SOAP 2025

Annual Meeting

APRIL 30 - MAY 4, 2025

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SOAP
Society for Obstetric Anesthesia and Perinatology

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SOAP 57th Annual Meeting

Leveraging Technology for Better Outcome: Improving Lives of Patients & Clinicians

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Wednesday, April 30

Thursday, May 1

Friday, May 2

Saturday, May 3

Sunday, May 4

Welcome to Portland!

On behalf of the SOAP Board of Directors and the 2024-2025 Annual Meeting and Live Events Committee, we are delighted to greet you in Portland for the 2025 SOAP 57th Annual Meeting.

This year's theme, **"Leveraging Technology for Better Outcomes: Improving Lives of Patients and Clinicians,"** promises an engaging and forward-thinking experience of what the future of obstetric anesthesia holds.

Prepare for an outstanding program featuring highly educational workshops, including sessions on the latest advancements in artificial intelligence, precision medicine, and digital health tools designed to enhance both patient and clinician outcomes. We are especially excited to announce a **Keynote Presentation by Ashley Duque Kienzle**, a renowned expert in AI and health technology, whose insights will undoubtedly inspire and challenge us. You will see usual favorites like the **Ostheimer Lecture** delivered by **Dr. Emily Sharpe**, offering groundbreaking perspectives on patient-centric healthcare innovations, and the **Fred Hehre Lecture** presented by **Dr. Medge Owen**, a global leader in advancing maternal and neonatal health through her work in *Kybele*. Additionally, the event will include perennial favorites such as the **Research Symposium, Gertie Marx Research Competition, Best Paper Competition, and Sol Shnider Clinical Talks**, ensuring a diverse array of topics to captivate every attendee.

When you're not immersed in the enriching conference sessions, Portland awaits! Renowned for its vibrant food scene, lush green spaces, and eclectic culture, the city offers something for everyone. Stroll through the iconic Powell's City of Books, explore the serene Japanese Garden, or enjoy the lively atmosphere of the Pearl District. For the adventurous, the nearby Columbia River Gorge and Mount Hood provide world-class hiking and stunning natural vistas.

The 2025 Annual Meeting is more than just an opportunity to learn and share knowledge; it's a chance to connect with peers and leaders from across the globe. Together, we'll explore how technology is transforming healthcare and fostering better outcomes for patients and clinicians alike.

We're excited to welcome you to Portland!

Sincerely,

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With special thanks to members of the following subcommittees who volunteered their time and expertise to the planning of the 57th Annual Meeting.
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*Special thanks are due to **Ruth Landau, MD,** chair of the Abstract Review Subcommittee, and the dedication of these volunteers who reviewed hundreds of abstracts to help in creating the educational program.*
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Program Information

ACCME Accreditation and Designation Statements

CEU

This program has been prior approved by the American Association of Nurse Anesthesiology for 33.00 Class A CE credits; Code Number 1045634; Expiration Date 5/4/2025.

Overall Accreditation Statement

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American Society of Anesthesiologists and the Society for Obstetric Anesthesia & Perinatology.

The American Society of Anesthesiologists is accredited by the ACCME to provide continuing medical education for physicians.

Workshops WEDNESDAY

Optional Workshops

1:00pm – 5:00pm **Workshop** (optional)

TTE-refresher (advanced-FATE) Half-Day Workshop

The American Society of Anesthesiologists designates this live activity for a maximum of *8.0 AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

1:00pm – 5:00pm **Workshop** (optional)

Point-of-Care Ultrasound (POCUS)

The American Society of Anesthesiologists designates this live activity for a maximum of *4.0 AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

1:00pm – 5:00pm **Concurrent - workshops** (optional)

Trauma Informed Care for Optimal Outcomes

The American Society of Anesthesiologists designates this live activity for a maximum of *4.0 AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

1:00pm – 5:00pm **Concurrent - workshops** (optional)

Educational Skills for the Busy Clinician

The American Society of Anesthesiologists designates this live activity for a maximum of *4.0 AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

2025 SOAP Annual Meeting

The American Society of Anesthesiologists designates this live activity for a maximum of *26.50 AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

About This Meeting

The use of novel technologies, including artificial intelligence (AI), ultrasound, wearable devices, and other advanced tools is rapidly expanding within medicine. While the regulatory framework for use of these technologies, particularly AI, within healthcare is evolving, it can barely keep pace with the emerging number of potential applications for these tools. As patients increasingly use AI and other devices to understand their own health, it is imperative that clinicians better understand the benefits as well as potential for harm of these tools. Furthermore, outside of the clinical care realm, these technologies have the potential to enhance clinician efficiency and wellness by streamlining administrative tasks and reducing workload. Within this rapidly changing landscape, the Society for Obstetric Anesthesia and Perinatology (SOAP) 2025 Annual Meeting aims to bring together experts to share research, best practices, and clinical pearls to ensure that novel technological advancements are better understood before they are integrated into clinical practice.

Target Audience

This meeting is intended for Anesthesiologists, Anesthesiologists Assistants, CRNAs, Nurses, Resident/Fellows, and Medical Students interested in the recent advances in obstetric anesthesia and the application of these advances to their practice.

Mission of the SOAP Annual Meeting and Live Events Committee

The mission of the AMLE Committee is to provide anesthesiologists, obstetricians, and other physicians and members of related allied health specialties with the knowledge that will reinforce past learning as well as disseminate new concepts, practices, and skills involving anesthesia and analgesia for the pregnant patient.

Participation in the SOAP 57th Annual Meeting

Attendance is open to all health practitioners, provided that they have registered for the meeting. CME credit will only be offered to those with an MD, DO or equivalent.

Educational Format

CME activities may include the following formats: plenary sessions, debates, lectures, poster discussions, oral abstracts, problem-based learning, and skill-set workshops.

Annual Meeting Objectives

At the completion of this conference the participants should be able to:

1. List and explain current and potential applications of artificial intelligence, wearable devices, ultrasound and other novel technologies within obstetric anesthesia.

2. Outline and discuss common pitfalls and risks associated with use of artificial intelligence and other advanced technologies within obstetric anesthesia.
3. Evaluate the potential risks and benefits of patient use of artificial intelligence, wearable devices and other technologies for health monitoring and decision making. Design strategies to guide patients on the appropriate use of these tools.
4. Describe a strategy to use advanced technologies to streamline administrative tasks, reduce clinician workload, and conduct research in an ethical manner.
5. Utilize an evidence-based approach when caring for the pregnant patient in the development of a peripartum plan that optimizes anesthetic care and patient safety.

Special Needs Statement

The American Society of Anesthesiologists and the Society for Obstetric Anesthesia and Perinatology are committed to making its activities accessible to all individuals and fully comply with the legal requirements of the Americans with Disabilities Act and the rules and regulations thereof. If you are in need of an accommodation, please do not hesitate to submit a description of your needs in writing to membership@soap.org.

Disclosure Policy

The American Society of Anesthesiologists remains strongly committed to providing the best available evidence-based clinical information to participants of this educational activity and requires an open disclosure of any potential conflict of interest identified by our faculty members. It is not the intent of the American Society of Anesthesiologists to eliminate all situations of potential conflict of interest, but rather to enable those who are working with the American Society of Anesthesiologists to recognize situations that may be subject to question by others. All disclosed conflicts of interest are reviewed by the educational activity course director/chair to ensure that such situations are properly evaluated and, if necessary, resolved. The American Society of Anesthesiologists educational standards pertaining to conflict of interest are intended to maintain the professional autonomy of the clinical experts inherent in promoting a balanced presentation of science. Through our review process, all American Society of Anesthesiologists CME activities are ensured of independent, objective, scientifically balanced presentations of information. Disclosure of any or no relationships will be made available for all educational activities.

How to Receive CME Credit

To receive credit, participants must access the ASA Education Center, review the meeting information, and complete the evaluation. Further instructions will be emailed to each participant immediately prior to and after the activity.

Disclaimer Statement

The information provided at this accredited activity is for continuing education purposes only and is not meant to substitute for the independent medical judgment of a healthcare provider relative to diagnostic and treatment options of a specific patient's medical condition.

Pre-Meeting Workshops

TTE-refresher (advanced-FATE) Half-Day Workshop

This hands-on workshop is for practitioners with some experience in basic TTE that wish to refresh their skills and learn doppler techniques useful to the non-cardiologist. Standard and advanced TTE-windows will be practiced on patient models including doppler applications relevant to the OB-anesthesiologist. Attendees will learn how to estimate cardiac output, SVR, differentiate states of shock, assess diastolic function, pulmonary artery pressures and review learned techniques in presented Obstetric related cases. Workshop and performed scans are recognized part of ASA-diagnostic POCUS certificate program.

Trauma Informed Care for Optimal Outcomes

This immersive and interactive workshop covers the basics of trauma-informed and collaborative care in the obstetric setting. This program utilizes various learning platforms to present the material: didactic lectures introduce psychological trauma and its relevance in the peripartum period in addition to communication strategies for optimal outcomes; case exploration in small groups will address perspective taking and management of acute stress responses; simulation exercises will allow participants to reinforce their new skills in a variety of challenging scenarios. Time will be allocated for final debriefing, questions, self-care, and reflection prior to completion of the workshop.

Point of Care Ultrasound (POCUS)

This workshop includes online FAST (Focused Assessment with Sonography for Trauma), Airway-, and Gastric-, precourse to be completed prior to attending this workshop. POCUS workshop covering Gastric-, Neuraxial-, Airway-, and FAST(abdominal) ultrasound. Focus of the workshop will be hands-on training on patient models with brief, 10-15 minutes lectures on each topic

Educational Skills for the Busy Clinician

This workshop will be focused on teaching high-yield, low-effort educational skills for the busy clinician. We'll go over how to frame a chalk talk, some techniques for procedural teaching, and how to deliver timely and effective feedback. These will all be discussed with the theme of making it easy - doing each of these things with relatively little added time or effort.

Sessions

Best Case Reports

This live presentation highlights some of the most well-written and interesting case reports submitted to the Annual Meeting. Cases were selected to represent a wide range of topics from various institutions and are sure to foster lively discussions among the panelists. There will be author and audience participation, via virtual chat function, to encourage interactive discussion. This engaging session will be moderated by Dr. Emily McQuaid-Hanson, and will feature panelists Dr. Marie-Louise Meng, Dr. Feyce Peralta, and Dr. Christine Warrick.

Best Paper Competition

This curated session includes presentations from the top rated and most impactful research abstracts submitted this year. Presenters compete for the title of SOAP Annual Meeting Best Paper via presentations and a question- and-answer session. This competition will be moderated by Ashraf Habib Research Committee Chair and distinguished researchers in the obstetric anesthesiology field.

Case Reports Sessions

These moderated sessions, scheduled for Friday, Saturday, and Sunday, are designed to highlight educationally valuable case reports submitted and presented by obstetric anesthesiology fellows and residents across the country. There will be opportunities to participate and ask questions regarding some of the most challenging clinical scenarios our presenters have encountered.

Research Abstracts Sessions

These moderated sessions, scheduled for Friday and Sunday, showcase the state-of- the-art research being conducted in obstetric anesthesia.

Oral Presentations

Oral presentations of diverse, high-quality and hand-selected peer-reviewed scientific research related to obstetric anesthesia will be presented in sessions on Friday and Sunday, followed by a moderated question-and-answer session. Friday's session will be moderated by Lisa Leffert, MD and Sunday's session moderators will be Michaela Farber, MD and Brandon Togioka, MD.

Gertie Marx Research Competition

Named in memory of obstetric anesthesia pioneer Gertie Marx, this research competition highlights the best quality research performed by our trainees (medical students, residents and fellows). Six presenters will compete in this judged competition, moderated by Dr. Ruth Landau and judged by Dr. Rich Smiley, Dr. Jill Myre, Dr. Feyce Peralta, Dr. David Berman, and Dr. Anton Chau.

Fred Hehre Lecture

This session offers reflections from a renowned member of the obstetric anesthesia community, which bring insights into scope of practice changes over time and focuses on what matters most to the art and science of obstetric anesthesia practice. This year's Fred Hehre lecturer will be obstetric anesthesia legend Dr. Medge Owens.

Gerard W. Ostheimer Lecture

Always a highlight and one of the most highly anticipated sessions of the meeting, the Gerard W. Ostheimer lecture is a review of important, relevant, and practice-changing literature related to obstetric anesthesia, obstetrics, perinatology, and allied medical disciplines that was published in the preceding calendar year (2024). This digestible synthesis of the literature analyzes the clinical impact of published works and latest evidence-based advances in the field of obstetric anesthesia. This year's Ostheimer lecturer will be Dr. Emily Sharpe.

SOAP Distinguished Service Award Presentation & Awards Ceremony

Join us as we honor Dr. Lawrence Tsen, 2025 recipient of SOAP's highest honor, the 2025 Distinguished Service Award. Dr. Tsen will be introduced by Dr. May Pian-Smith. This session will also include Dr. Heather Nixon, SOAP President, announcing recipients of the Gertie Marx and Best Paper Competitions, Teacher of the Year Awards, Research in Education, Frederick P. Zuspan Award, Patient Safety Award, and the Diversity and Inclusivity Award. Don't miss it!

Keynote – Empowering Clinicians: Leveraging AI to Enhance Outcomes while Upholding Ethics, Privacy, and Scientific Rigor

The keynote presentation is Ashley Duque Kienzle. Ashley Duque Kienzle is the founder of Almma Health and an expert in the application of Artificial Intelligence for Behavior Change. She has built and led international teams at Meta, Amazon, and Changing Health, where she's helped define, develop, and scale AI tech products across the globe. Ashley holds a degree in Behavioral Biology and Master in Communication focused on Behavior Change from Johns Hopkins University and serves as Chairperson of one of their boards.

President's Panel: AI: The Good, The Bad and The Ugly

The session will be moderated by Dr. Heather Nixon and including panelists Ashley Duque Kienzle, Sarah Armstrong, MD, Aswathi Jayaram, MD, and Mahesh Vaidyanathan, MD

OAA: Burnout, Resilience, and AI

Dr. Sarah Armstrong will provide an overview of the scale of burnout, and the moral distress and injury it can cause in obstetric anesthesia. She will provide an understanding of how traditional methods to prevent burnout are not working and how the use of AI may reduce the impact of burnout on physicians.

SMFM Session: AI in Obstetrics

This session will be presented by Dr. Melissa Wong and will provide information on the different uses of AI and how it can improve patient care.

SOAP/SOCCA Panel: Extending Knowledge Beyond the OR: What Happens to My Patients in the ICU?

The panel will include "Mental Health in Maternal Critical Illness" by Dr. Kaitlyn Brennan, "Sepsis Management in Pregnancy" by Dr. Benjamin Brakke, and "Peripartum Cardiomyopathy" by Monica Lupei.

ASRA/SOAP Panel - Spinal Pathology & Neuraxial Techniques

This joint panel moderated by Phil Rubin, MD will feature Dr. Jaime Daly and Dr. Jeanette Bauchat, representing SOAP.

ASA Update

SOAP is honored to host Dr. David Martin, Vice President for Scientific Affairs, American Society of Anesthesiologists, for an update on the work of the ASA. SOAP President Dr. Heather Nixon will provide the introduction.

Clinical Track

Sol Shnider Clinic Track – Session #1

The Sol Shnider clinical track session #1 will cover clinically relevant reviews and updates for important topics such as “The Role of AI in Medicine” moderated by Dr. Mike Burns and “Wrangling the Experts: OB Anesthesia Legends Debate Approaches to Controversial Cases and Topis” moderated by Dr. Brendan Carvalho and presenters Dr. Rich Smiley, Dr. Jill Mhyre, and Dr. Paloma Toledo.

Sol Shnider Clinic Track – Session #2

The Sol Shnider clinical track session #2 will cover clinically relevant reviews and updates for important topics including “Delivery Disasters! AFE, ECMO, Malignant Hyperthermia and the Lost Airway“ moderated by Dr. Adam Wendling and presenters Dr. David Arnolds, Dr. Emily Naoum, Dr. Dave Berman, and Dr. Mark Rollins, and “How to Leverage Point of Care Viscoelastic Testing Technology to Take Better Care of Your Patients” moderated by Dr. Michaela Farber and panelists Dr. Dennis Snegovskikh, Dr. Shubangi Singh, and Dr. John Kowalczyck.

Sol Snider Clinical Track – Session #3

The Sol Shnider clinical track session #3 will cover clinically relevant reviews and updates for important topics including “Trouble Shooting Tricky Epidurals” presentations by Dr. Ron George, Dr. C. LaToya Mason, and Dr. Michael Hoffkamp, “Updates from ASA Committee on OB Anesthesia” moderated by Dr. Mark Zakowski, and “Totally Epic Enhancements in the Electronic Medical Record” moderated by Dr. Thomas Klumpner and presenters Dr. Mahesh Vaidyanathan and Dr. Alice O’Brien.

SOAP Research Network Symposium

The second iteration of the SOAP Research Network Symposium provides the opportunity to present research proposals to SOAP’s network of research experts, who will provide constructive feedback on rigor, relevance, methodology, ethics, feasibility, and fundability of research ideas and discuss opportunities for potential project collaborators. This is an excellent opportunity to receive constructive feedback with the goal of everyone in the SOAP research community supporting everyone’s excellent research!

SOAP 2025 PROGRAM SCHEDULE

WEDNESDAY, APRIL 30

1:00pm – 5:00pm Focused Assessed Transthoratcic Echocardiography (FATE) Course
Broadway I & II (Plaza Level)
Faculty:

1. Ezeldeen Abuelkasem, MD
2. Jean Marie Carabuena, MD – Brigham and Women's Hospital
3. Raffaella Fantin, MD – Medical University of Innsbruck
4. Cedar Fowler, MD – Stanford University
5. James McAvoy, MD
6. Alexandra Nicholas, MD - UPMC
7. Clemens Ortner, MD – Stanford University
8. Cesar Padilla, MD – Stanford University
9. Ivan Velikovic, MD – SUNY Downstate Health Science University

1:00pm – 5:00pm Point-of-Care Ultrasound (POCUS)
Broadway III & IV (Plaza Level)
Faculty:

1. Cristian Arzola, MD – Mount Sinai Hospital, University of Toronto
2. Juliana Barrera, MD – University of British Columbia
3. Naida Cole, MD – University of Chicago
4. Jackie Galvan, MD – UTSW Medical Center
5. Brinda Kamdar, MND – MGH, Harvard
6. Sangeeta Kumaraswami, MD – Westchester Medical Center/New York Medical College
7. Ayumi Maeda, MD – Brigham and Women's Hospital
8. Carolina Rincon, MD - Clinica Unversitaria Bolivariana
9. Naveed Siddiqui, MD – Mount Sinai Hospital, University of Toronto
10. Evan Wild, MD – Mount Sinai Hospital, University of Toronto
11. Fabricio Zasso, MD – Mount Sinai Hospital, University of Toronto

1:00pm – 5:00pm Educational Skills for the Busy Clinician
Forum Suite (Level 3)
Faculty:

1. David Berman, MD – Johns Hopkins Hospital
2. Anna Gitterman, MD – Johns Hopkins Hospital
3. Monique Cheng, MD – Johns Hopkins Hospital
4. Giovanni Charles, MD – Johns Hopkins Hospital

1:00pm – 5:00pm Trauma Informed Care for Optimal Outcomes
Director's Suite (Level 3)
Faculty:

1. Anjum Anwar, MD – University of Washington Medical Center
2. Katie Seligman, MD – University of British Columbia
3. Andrea Traynor, MD – Stanford University
4. Tracey Vogel, MD – Allegheny Health Network

Wednesday, April 30 - Continued

1:00pm – 5:00pm Internation Symposium: China
Galleria North & South (Ballroom Level)
Jie Zhou, MD

1:00pm – 5:00pm Board of Directors Meeting
Skyline (23rd Floor)

5:00pm Educational Programming Adjourns for the Day

6:00pm -8:00pm Welcome Reception in Expo Hall
Pavillion (Plaza Level)

THURSDAY, MAY 1

7:00am – 9:00am Continental Breakfast in Expo Hall
Pavillion (Plaza Level)

7:00am – 7:45am Special Interest Group Roundtable Discussions
Atrium Ballroom (Plaza Level)

7:45 am – 8:00 am Opening Remarks
Ballroom (Ballroom Level)
Heather Nixon, MD – SOAP President

8:00am – 9:00am KEYNOTE LECTURE: Empowering Clinicians: Leveraging AI to Enhance Outcomes while Upholding Ethics, Privacy, and Scientific Rigor
Ballroom (Ballroom Level)
Ashley Duque Kienzle
Founder, Almmahealth
Advisor specializing in AI and Business Strategy – Kashmir Intelligence, CurbsideMD, KidneyBeam, Facebook, Amazon, Capital One and others

9:00am – 10:00am President's Panel: AI: The Good, The Bad and The Ugly
Ballroom (Ballroom Level)
Moderator: Heather Nixon, MD
Panelists: Ashley Duque Kienzle
Sarah Armstrong, MD
Aswathi Jayaram, MD
Mahesh Vaidyanathan, MD

10:00am – 10:10am 2025 Distinguished Service Award
Ballroom (Ballroom Level)
Introduction: May Pian-Smith, MD
Recipient: Lawrence Tsen, MD

10:10am – 10:55am BREAK IN THE EXPO HALL
Pavillion (Plaza Level)

10:55am – 11:05am Audience Transition

Thursday, May 1 - Continued

11:05am – 11:50am	OAA: Burnout, Resilience, and AI *Ballroom (Ballroom Level)* Sarah Armstrong, MD President, Obstetric Anesthetists' Association
11:50am – 1:00pm	LUNCH ON YOUR OWN
11:50am – 1:00pm	Sponsor Lunch (NO CME) – pre-registration required Cerus – *Atrium Ballroom (Plaza Level)*
1:00pm – 2:00pm	Best Paper Research Competition *Ballroom (Ballroom Level)* Moderator: Ashraf Habib, MD Panelists: Phil Hess, MD; Lisa Leffert, MD; Ron George, MD; Michaela Farber, MD; Allison Lee, MD 1. The TRPV4 channel could be part of the problem—and the solution—in uterine atony - Daiana Fornes, PhD 2. Single nuclear transcriptomics uncover downregulation of FSHR in the myometrium of patients with uterine atony - Jessica Ansari, MD, MS 3. Severe Perioperative Surgical Morbidity in Patients undergoing Cesarean Delivery in California 2016 - 2021 - Alexander Butwick, MBBS, FRCA, MS 4. Impact of the Kybele Program on Regional Anesthesia for Cesarean Delivery: A 13-Year Evaluation of Anesthesiologist Proficiency at UCCV - Borislava Pujic 5. Influence of pain psychological and sleep variables on acute to chronic postsurgical pain after cesarean delivery: a prospective observational study -Sarah Ciechanowicz, MA, BMBCh, FRCA, MRes 6. Medicaid expansion, Medicaid generosity, and severe maternal morbidity during delivery hospitalizations - Jean Guglielminotti (MD, PhD)
2:00pm – 2:45pm	SOAP/SOCCA Panel – Extending Knowledge Beyond the OR: What Happens to My Patients in the ICU? *Ballroom (Ballroom Level)* Moderator: Ioannis Angelidis, MD 1. Mental Health in Maternal Critical Illness - Kaitlyn Brennan, DO, MPH 2. Sepsis Management in Pregnancy - Benjamin Brakke, DO 3. Peripartum Cardiomyopathy - Monical Lupei, MD
2:45pm – 2:55pm	Audience Transition
2:55pm – 3:40pm	BREAK IN THE EXPO HALL *Pavillion (Plaza Level)*
3:40pm	EXPO HALL CLOSES FOR THE DAY
3:45pm – 3:50pm	Audience Transition
3:50pm – 4:50pm	SMFM Lecture: AI in Obstetrics *Ballroom (Ballroom Level)* Speaker: Melissa Wong, MD
4:50pm – 5:00pm	Audience Transition

Thursday, May 1 - Continued

5:00pm – 7:00pm Case Reports - Abstract Breakouts

Breakout Room 1: Airway - *Studio Suite (3rd Floor Conference level)*
Moderators: Baskar Rajala, MD and Jimin Kim, MD

1. Breathless After Birth: Flash Pulmonary Edema Following Cesarean Delivery - Bahaa Daoud, MD
2. A Case of Paradoxical Vocal Fold Motion in Pregnancy - Bryce, Marshall, MD
3. Combined Cesarean Delivery and Tracheal Dilation in Parturient with Subglottic Stenosis – Julia Epelbaum, MD
4. Difficult Airway and Neurofibromatosis Type 2: Anesthesia for Urgent Cesarean Section - Makenzie Cherveny, DO
5. Baby, You Take My Breath Away - Kimberly Mendoza, MD, PhD, MPH
6. Anesthetic Considerations of Anterior Mediastinal Mass in the Peripartum Period - James, Meisenheimer, MD
7. Large Plexiform Neurofibroma causing Supraglottic and Subglottic Tracheal Stenosis - Andrew Hackney, MD
8. Jet Ventilation in a Pregnant Patient during her Third Trimester - Walter Taylor, MD
9. Management of Cesarean Delivery in a Patient with Large Mediastinal Mass and Bronchovascular Compression – Jacob Weber, MD
10. Pregnancy in Goldenhar Syndrome: Potential for both difficult airway and difficult neuraxial anesthesia - Kaylea Gunn, MD
11. A Case of Tracheal Stenosis in the Second Trimester of Pregnancy - Talia Scott, MD
12. Choosing the Best Path: Difficult Airway Versus Challenging Neuraxial During Cesarean Delivery - Ezana Girmai, MD
13. An unconventional use of airway ultrasound in a difficult and traumatic obstetric airway - Max Schmideler, MD
14. Spinal Anesthesia for a Patient with Achondroplasia, Prior Lumbar Fusion, and Obesity: Development of a Novel Difficult Back Algorithm - Jordan Francke, MD MPH

Breakout Room 2: High Acuity/ Intensive Care - *Directors Suite (3rd Floor Conference level)*
Moderators: Ioannis Angelidis, MD and Jessica Sheeran, MD

1. Amniotic Fluid Embolism with Echocardiographic Evidence of Intracardiac Thrombus: Two Case Reports - Dan Mija, MD
2. Amniotic Fluid Embolism and Multisystem Organ Failure - Marcia Chen, MD
3. Successful resuscitation from amniotic fluid embolism with extracorporeal membrane oxygenation - Nichole Jordan-Lewis, CRNA, DNP
4. Seizure to Hysterectomy: Suspected Atypical Presentation of Amniotic Fluid Embolism – Loni Kreger, MD
5. Amniotic fluid embolism resulting in severe right heart failure: clues to a diagnosis - Haylee Bergstrom, MD
6. Suspected Anaphylaxis During Emergent Cesarean Section - Eric Krause, M.D.
7. Anaphylaxis and Regional Anesthesia: A Catastrophic Combination During Cesarean Delivery - Bhavani Shankar Kodali, MD
8. Cardiac Arrest and Resuscitation in a Parturient with Multiple Risk Factors - Caleb Bauman, DO
9. A Diagnostic Dilemma: Multi-System Collapse in Peripartum Cardiac Arrest - Claudia Sotillo, MD

Thursday, May 1 - Continued

10. Multi-system Collapse and Fatal Subscapular Liver Hematoma in a Patient with Intrauterine Fetal Demise - Kelsey De Silva, M.D.
11. Anaphylaxis to Corn and Its Implications On Anesthetic Management During Obstetrical Care - Navigating a Perioperative Maize of Derivatives - Maria Patrocinio, MD
12. Heat of the Moment: Managing Burn Trauma in Pregnancy, Briel, Lee, MD
13. Bezold-Jarisch Reflex with Elective C-Section Under Epidural Anesthesia - Maithili Khandekar, MD
14. Management of a Parturient with Mast Cell Activation System and History of Tethered Cord - Kayla Jardine, MD
15. Perinatal Sepsis: Anticipate and Act Early, Preventing Tube to Tracheostomy - Lukas Croner

Breakout Room 3: Hypertension - *Council Suite (3rd Floor Conference level)*
Moderators: Kelechi Anyaehie, MD and Erin Haggerty, MD

1. Spinal Anesthesia Challenges in Geriatric Pregnancy with Hypertension and Delayed Block Onset : Case report - Sooah Cho, MD
2. Management of a Patient with Moyamoya, Neurofibromatosis Type 1 Requiring Urgent Delivery for Pre-eclampsia with Severe Features – William Quach, MD
3. Management of Newly Diagnosed Adrenal Mass in the setting of Chronic Hypertension with Superimposed Pre-eclampsia with Severe Features - Amy Bingham, MD
4. Management of an Urgent Cesarean due to PRES - Dmytro Orel, MD
5. The Kidney Conundrum: Differentiating Lupus Nephritis Flare from Preeclampsia with Severe Features - Ashley Peotter, MD
6. Hemorrhagic Pericardial Effusion: An Atypical Presentation of Pre-Eclampsia – Shobana Bharadwaj, MD
7. HELLP Syndrome at 19 weeks Complicated by Delayed Care - Koran Sherman, BS
8. Intravenous Midazolam in the Treatment of Eclampsia-Induced Status Epilepticus: A Case Report - Thomas Quisenberry
9. Anesthetic management of a pregnant patient with coexisting ESRD and preeclampsia with severe features: a case report - Rishi Singhal, MD
10. Emergent Cesarean Delivery in the Setting of Severe Preeclampsia and Rapid Onset Pulmonary Edema - M. Chloe Slator, BS
11. Shoulder pain during labor epidural analgesia, subdural anesthesia, general anesthesia, and post-dural puncture headache in a patient with preeclampsia with severe features: a case report – Abdo Barakat, MD
12. Magnesium Toxicity during Cesarean Section - Kaitlin Bruneau, MD, MS
13. Multidisciplinary Management for Cesarean Delivery in a Patient with Fulminant Hepatic Failure – Yue Qiu, MD
14. Critical Care Obstetrics: A case of postpartum respiratory failure complicated by preeclampsia, acute kidney injury and hyponatremia - Paul Vozzo, MD
15. Presentation of Posterior Reversible Encephalopathy Syndrome in a Pregnant Patient with Preeclampsia with Severe Features - Mallory Hawksworth, MD

Breakout Room 4: Postdural Puncture Headache & Obesity - *Forum Suite (3rd Floor Conference level)*
Moderators: Katy Scharf, MD and Manuel Vallejo, MD

1. Utilizing the Existing Needle Track After Accidental Dural Puncture: Same-site Epidural as Innovation or Risk? - Rishabh Jindal, MBBS, MD

Thursday, May 1 - Continued

2. Seizures after epidural blood patch for post-dural puncture headache -Jessica Galey, MD
3. "I feel like a vessel burst in my head!": A case of pneumocephalus and pneumorrhachis from accidental dural puncture - Jennifer Tripi, MD
4. Persistent Headache After Combined Spinal Epidural - Olivia Lucas, MD
5. Sensorineural Hearing Loss After Labor Epidural Analgesia: A Diagnostic Dilemma - Kresimir Ukalovic, MD, FRCPC
6. Refractory Postdural Puncture Headache: The Role of Connective Tissue Disorder? - Katherine Taylor Fortson, MD
7. Intrathecal Catheter Insertion and Management after Unintended Dural Puncture in a Parturient with Fontan Physiology Undergoing Cesarean Delivery - Andrea Lorico, MD
8. Anesthetic Management in a Parturient with Symptomatic Chiari-1 Malformation - Mallory Hawksworth, MD
9. Arachnoiditis: A rare complication of an epidural blood patch - Bradley Skene, DO
10. Going with Flow: High-Flow Nasal Cannula in a Super Morbidly Obese Patient During Unscheduled Cesarean Delivery Under Neuraxial Anesthesia - Shruthimurthy Hassankrishnamurthy, MBBS
11. Complexities in Cesarean Section in patient with Super Morbid Obesity - Madelyn Rabideau
12. Beyond the Scale: Anesthetic Considerations for Super-Super Obese Obstetric Patients - Jennifer Tripi, MD
13. Spinal anaesthesia for cesarean section in obese parturient with surgically corrected scoliosis- The challenges and options - Shanti Medical Rajendra Kapoor, MD
14. Anesthetic Considerations for Parturient with BMI >100 kg/m2 – Maria Murzvyeva, MD
15. A Tale of Two General Anesthetics for Cesarean Section in Super Morbidly Obese Patient with BMI 104 kg/m2 - Paris Thompson

Breakout Room 5: Cardiac 1 - Congenital & Acquired - *Broadway I/II (Plaza level)*
Moderators: Jason White, MD and Stephanie Woodward, MD

1. Cesarean Delivery in a Parturient with Multiple Complex Congenital Cardiac Lesions - Donaldson Lee, MD
2. Management of pregnancy termination for a patient with Eisenmenger syndrome and Chiari I malformation with associated syringomyelia - Jacob Nieb, MD
3. Management of a Parturient with Unrepaired Tetralogy of Fallot - Alexander Meshel, MD
4. Obstetric Management of Cardiac Disease in Alagille Syndrome - Becky Mirsky, MD
5. Primary cesarean section versus induction of labor? The challenges of a complex cardiac case - Heidi Heyman, MD
6. Case Report: Anesthetic Care of a Patient with Partially Repaired, Anomalous, Cyanotic Congenital Heart Disease Undergoing Dilation and Curettage - Jonathan Petrillo, MD
7. Management of Hypertrophic Obstructive Cardiomyopathy During Cesarean Section - Rachel Pedreira, MD, MS
8. Obstetrics patient with left ventricular noncompaction cardiomyopathy undergoes elective cesarean section under general anesthesia - Feras Alhourani, MD

Thursday, May 1 - Continued

9. Anesthetic Management of Unrepaired Atrial Septal Defect with Pulmonary Hypertension: Hemodynamic Precision in High-Output Physiology of Pregnancy - Rishabh Jindal, MBBS, MD
10. Transpositon of the Great arteries in the obstetric patient - Kirsten Ponsart, DO
11. Multidisciplinary Approach for Managing a Patient with Fontan Circulation for Tricuspid Atresia and Placenta Accreta: A Case Report - Geoffrey Elder, MD
12. Management of Cesarean Delivery in a Patient with Fontan Circulation - Ashley Radee, MD
13. Atrial Switch: Delivering Now but Not Forever – Jessica Klein
14. Twin Gestation with Maternal History of Repaired Tetralogy of Fallot - Sydney Labat

Breakout Room 6: Postpartum Hemorrhage - *Broadway III/IV (Plaza level)*
Moderators: Tom Klumpner, MD and Phil Rubin, MD

1. Dysfibrinogenemia – A wild ride on the carousel of clotting - Nilang Shah, MD
2. Anesthetic Management with Continuous Spinal Anesthesia for Cesarean Section in a Pregnant Woman with a Giant Uterine Fibroid: A Case Reportv- Jian Xu, MD
3. Management of Postpartum Hemorrhage and Anaphylaxis in Teen Pregnancy: A Case Report - Nicholas Kraus, MD
4. REBOA to the Rescue: Management of Massive Hemorrhage following Catastrophic Uterine Rupture - Travis Cuddy, MD
5. Intraoperative Cell – Salvage during Cesarean Delivery: a case report - Borislava Pujic
6. A Race Against Time: Managing Uterine Rupture and Massive Hemorrhage in a case with Placenta Accreta Spectrum, Yasmine, Habli, MD
7. Pulse Oximetry Derangement After Intraoperative Blood Transfusion, Fallon, Babcock, MD
8. Left Broad Ligament Hematoma Following Cesarean Section in a Parturient with history of Aortic and Mitral Valve Replacements on Anticoagulant - Kasim Noorul Asyikeen
9. Massive Transfusion during Cesarean Hysterectomy in a patient with Placenta Accreta Spectrum under CSE Double-Segment Technique - Nicolas Muller, MD
10. Case report: inadvertent intramyometrial injection of ergotamine for post-partum hemorrhage - Amir Siddiqui
11. 2 Scars and A Little Lady: Managing a Cesarean Scar Pregnancy, Kimberly, Mendoza - MD, PhD, MPH
12. Shoulder Pain: An Atypical Presentation of Uterine Rupture - Casi Blanton
13. Successful regional anesthesia for management of uterine rupture, emergent cesarean delivery, and massive postpartum hemorrhage - Daniel An, MD, MS
14. Anesthesia considerations for twin c-section affected by maternal super-morbid obesity - Adetola Ojo
15. Back for Blood? Considerations for Safe Neuraxial Placement in a Parturient with Known Vertebral Hemangiomas - Natalie Campbell, MD
16. Neuraxial Anesthesia in a Postpartum Hemorrhage Patient with Cystic Fibrosis and Vitamin K Deficiency Coagulopathy - Tanvee Singh, MD

7:00pm Educational Programming Adjourns for the Day

Thursday, May 1 - Continued

5:00pm – 6:00pm International Attendee Meet Up
Senate (3rd Floor Conference Level)

7:00pm DINNER ON YOUR OWN

FRIDAY, MAY 2

6:30am – 8:30am Continental Breakfast in Expo Hall
Pavillion (Plaza Level)

6:30am – 7:30am Special Interest Group Roundtable Discussions in Expo Hall
Atrium Ballroom (Plaza Level)

7:00am – 10:00am Abstract Breakouts

Breakout Room 1: Cesarean Delivery - *Studio Suite (3rd Floor Conference level)*
Moderators: Greg Palleschi, MD; Katie Arendt, MD; Ayumi Maeda, MD

1. A case series of the anesthetic management of post-uterine transplant cesarean delivery - James Miranda, MD
2. Enhancing operating room efficiency and patient outcomes: The impact of preoperative neuraxial ultrasound in cesarean deliveries - Pamela Sarue, MD
3. PATIENT EXPERIENCE DURING ROUTINE CESAREAN DELIVERY - an interview study - Fernanda SL Oliveira, MD
4. Risk of Emergent Cesarean Delivery at the time of External Cephalic Version - Megan Howell, DO
5. Association of patient and clinical characteristics with regional anesthesia without additional medication administration among patients who underwent cesarean delivery: a single center study - Rachel Hoffman, BS
6. Association of patient and clinical characteristics with prolonged cesarean delivery operative time: a single center retrospective study - Manuel Jagan, BS
7. Association of patient characteristics with failed activation of labor epidural catheters for intrapartum cesarean deliveries: a retrospective single center study - Ritesh Dontula, BS
8. Association of patient demographic, physical, and clinical characteristics with prolonged bladder catheterization time following cesarean delivery: a single center study - Jacqueline Schuster, MD
9. Prenatal care and cervical insufficiency surveillance stratified by race: a single-center retrospective study - Marissa Rosa, BS
10. Labor epidural catheter administration of lidocaine for intrapartum cesarean delivery: incidence of exceeding recommended dosages based on ideal body weight at a single center - Taylor Hartshorne, BS
11. Survey on Post-Cesarean Section Analgesia in Mainland China: Clinical Database Project by the Chinese Medical Association Obstetric Anesthesia Group - NA ZHAO, MD
12. Validation of the Chinese Version of the ObsQoR-10 questionnaire for the evaluation of recovery after delivery: A Prospective Observational Study - NA ZHAO, MD
13. Toggling with the Tone: How does parity affect required MAC during fetoscopic myelomeningocele repairs? - Claire Naus, MD

Friday, May 2 - Continued

14. The Super Obese Parturient: Hemodynamic Risks And Cesarean Section Outcomes – A Retrospective Cohort Study - Sijules Abongwa, DO
15. A retrospective analysis of obstetric anesthesia for postpartum tubal ligation procedures - Syed Iqbal
16. The Effect of Sugammadex Administration During Cesarean Section on Lactation Success in Term or Near-Term Pregnant Patients - Shayna Levine, MD

Breakout Room 2: Neuraxial Labor Analgesia - *Directors Suite (3rd Floor Conference level)*

Moderators: Elizabeth Lange, MD; Yunping Li, MD; Adithya Bhat, MD

1. Comparison of Analgesia Efficacy between Single-Orifice and Multi-Orifice Wire-Reinforced Catheters for Labor Analgesia with the Dural Puncture Epidural Technique: A Randomized Controlled Trial - Weijia Du
2. PATIENT EXPERIENCE DURING NEURAXIAL LABOR ANALGESIA - an interview study - Fernanda SL Oliveira, MD
3. Timing and rate of conversion from nitrous oxide to neuraxial analgesia during labor - Jacob Nieb, MD
4. Mission Possible: Case Series of Successful Neuraxial Procedures for Parturients with Chronic Cerebrospinal Fluid Leaks - Youri Tan, MD
5. Patient Preferences and Satisfaction with Neuraxial Labor Analgesia for Vaginal Deliveries: A Cross-Sectional Survey in a Diverse Urban Population - Salwa Najmi, BA
6. Beyond Pain Relief: The Impact of Adverse Events on Satisfaction with Anesthesia in Cesarean Births – Salwa Najmi, BA
7. The informational needs of postpartum Spanish-speaking parturients undergoing obstetric anesthesia - Mariana Restrepo, BA
8. Making Labor Epidural Analgesia Better: A Quality Improvement Project - Soobin Song
9. Developing Interdisciplinary Medical Education for L&D Nurses on Labor Epidurals: A Quality Improvement Initiative - Brittany Duck
10. Which is Less Painful? Intradermal vs. Subcutaneous Lidocaine Injections for Tuohy Needle Insertion: A Pilot Double-Blind Randomized Trial - Lukas Croner
11. Success in Predicting Neuraxial Analgesia Failure: A Retrospective Model Development Study - Daniel Berenson, MD, PhD
12. A survey of patients regarding factors impacting their decision to choose labor epidural analgesia - Jessica Stockinger, MD
13. A survey of provider factors that may affect receipt of labor epidural analgesia at a large, tertiary-care center - Jessica Stockinger, MD
14. The Assessment of the Pain with Local Anesthetic Infiltration and Its Predictive Value of Pain During the Labor Course, a Retrospective Analysis - Payton Marshall
15. “Ready, Set, Huddle”: Implementation of Perioperative Huddles on Labor and Delivery - Lauren Blake, MD, MHS

Friday, May 2 - Continued

18. The Angle Labor Pain Questionnaire demonstrates good to excellent test-retest reliability and performance for pain measurement during preterm labor Pamela Angle, MD, FRCPC, MSc (oxon)

Breakout Room 3: Teams & Tech - *Council Suite (3rd Floor Conference level)*
Moderators: Paloma Toledo, MD; Jill Mhyre, MD; Anton Chau, MD

1. High-Risk Obstetric Anesthesiology Consultations: A Retrospective Single-Center Study at a Quaternary Academic Medical Center in the United States - Laura Nerb, MD
2. Building Electronic Health Record Infrastructure to Optimize Antenatal Anesthesia Planning Consults Across a Municipal Hospital System: A Quality Improvement Initiative - Nita Wong, BS
3. Strategies for disaster preparedness and planning for peripartum healthcare delivery: a scoping review - Cassandra Poirier, MDCM
4. Obstetric Anesthesiologist Involvement on State Maternal Mortality Review Committees (MMRC): A Survey of Society for Obstetric Anesthesia and Perinatology State Representatives and MMRC - Stratton Dangerfield, MD
5. Assessment of Knowledge Acquisition during a Novel, Intensive Obstetric Anesthesia Simulation Curriculum: A Pilot Study in Vietnam - Jordan Francke, MD, MPH
6. Automating Anesthesiology Anetnatal Consultation Notes for Postpartum Hemorrhage Risk: A Feasibility Study Using Large Language Models -Domenic Pedulla, MD
7. Development of a Novel Obstetric Anesthesia Simulation Curriculum in Vietnam: A Model for Improving Maternal Care in Low- and Middle-income Countries - Jordan Francke, MD, MPH
8. Obstetric Anesthesia for Parturients with Acquired or Congenital Heart Disease: A Comparison of Management and Outcomes between Thailand and United States Tertiary Hospitals - Saranya Lertkovit, MD
9. Defining a Critical Care Obstetrics (CCOB) Population: From Risk Stratification to Patient Outcomes - James Conwell, DO
10. Personalized AI-Powered Precision Medical Education App - Patrick Pham, BS
11. Spanish-language patient education materials for obstetric anesthesia: a comparison of readability and quality of online Spanish-language resources - Mariana Restrepo, BA
12. Accuracy and readability of ChatGPT and Gemini responses to obstetric anesthesia questions: effect of time, query level, and hallucinations - Christine Chen, MD
13. Standardizing Patient Handoffs between Anesthesia Trainees on Labor & Delivery - Christine Chen, MD
14. Can Large Language Model tools provide useful information for learners? - Maria Patrocinio, MD
15. 3D printing, A Novel Approach to Clinical Teaching in Pursuit to Enhance Patient Safety - Bhavani Kodali, MBBS, MD, FASA
16. Quality Assessment: A Novel Interdisciplinary Patient Safety and Quality Care Simulation Program in Labor and Delivery - Dillon Froass

Friday, May 2 - Continued

Breakout Room 4: Blues, PDPH + BP - *Forum Suite (3rd Floor Conference level)*
Moderators: Mary Yurashevich, MD; Scott Segal, MD; Mark Norris, MD

1. Prevalence of Inpatient Postpartum Anxiety and Post-Traumatic Stress Symptoms: A Quality Improvement Initiative - Claudia Sotillo, MD
2. Prevalence and risk factors for postpartum anxiety among insured patients in the United States - Phillip Callihan, MD, PhD
3. Refinement of a Single-Session, Exposure-Based Intervention for Reducing Anxiety in High-Risk Pregnancies Through a Participatory Research Design - Cristina Wood, MD, MS
4. Procedural Anxiety in High-Risk Pregnancies with Scheduled Cesarean Deliveries - Cristina Wood, MD, MS
5. Comparison of Models Estimating Six-Week Edinburgh Postnatal Depression Scores Based on Ante-Natal Anxiety and Depression Assessments and ObsQoR-10 at Discharge. - Feyce Peralta, MD, MS
6. Reducing psychological trauma in women undergoing urgent or emergency cesarean sections: A qualitative study of stressors and possible solutions related to obstetrical care - Pamela Angle, MD, FRCPC, MSc (oxon)
7. Association between Injectate Volume and Epidural Blood Patch Success: A Retrospective Cohort Study - Amnon Berger, MD, PhD
8. QIPS: Improving Post Dural Puncture Headache Accountability Via a Universal Electronic Health Record. - Jackson Prestwood, MD
9. Preventive Efforts for Post-Dural Puncture Headaches in High-Risk Obstetric Patients with Unintentional Dural Punctures - Cristian Betancourt Perez, MD
10. Improving Compliance in Documenting Unintended Dural Punctures Through Automated EHR Tools in the Context of Analyzing Obstetric Anesthesia Complications Database and Epidural Blood Patch Practices - Shalonda Cook, MD
11. Prophylactic treatment of Neostigmine and Atropine to Postdural Puncture Headache in obstetrics a randomized controlled trial - Mingpin Hu
12. Association between systolic blood pressure and lung water in patients with preeclampsia – a point-of-care USG-based observational study - Shreya Goswami, MD
13. A neonatal outcome-based definition of maternal hypotension during cesarean delivery- a pilot study - Liz James, MD
14. Blood Pressure Trajectories at Delivery Hospitalization by Cardiovascular Health: Evaluating Blood Pressure for Postpartum Maternal Morbidity Prediction - Marie-Louise Meng, MD
15. B-line Scores on Lung Ultrasound before and after Magnesium Treatment among Patients with Severe Preeclampsia - Ayumi Maeda, MD
16. Safety of Deep Sedation for Advanced Second Trimester Uterine Dilation and Evacuation in Medically Complex Patients: A Retrospective Analysis at an Urban Center - Hannah Nguyen
17. Intravenous dexamethasone does not acutely upregulate inflammatory mediators in the placenta at term - Kathy Lee, BS
18. Stretching the limits: Anesthetic considerations in pregnant patients with Ehlers-Danlos Syndrome Shakthi - Jayanthy Venkatachalam, MBBS
19. Obstetric Anesthesia Outcomes in Pregnant Patients with Spine Surgery and Hardware: A Retrospective Cohort Study - Tyler Guidugli, DO

Friday, May 2 - Continued

Breakout Room 5: Blood & Co - *Broadway I/II (Plaza level)*

Moderators: Maria Sheikh, MD; David Arnolds, MD; Holly Ende, MD

1. Amniotic Fluid Embolism: A Retrospective Single-Center Observational Description of Anesthetic Management and Outcomes - Leila Katabi, MD
2. Evaluating the Ability of Fibrinogen, ROTEM And SEER-Derived Parameters to Predict Severe Obstetric Hemorrhage. - Marc Ghabach, MD
3. Prophylactic Strategies for Prevention of Postpartum Hemorrhage in Cesarean Delivery: A Bayesian Network Meta-analysis of 167 Randomized Controlled Trials - Jessica Stockinger, MD
4. A pilot study evaluating the correlation of SEER Sonorheometry with ROTEM in Obstetric Hemorrhage - Marc Ghabach, MD
5. Association of Antepartum Anemia and Red Blood Cell Mass with Racial and Ethnic Disparities in Transfusion Rates after Cesarean Delivery: A Retrospective Cohort Study - Hisako Okada, MD, PhD
6. The Relationship between the High Frequency Heart Rate Variability Index (HFVI) and Epidural Analgesia in the Laboring Parturient - Genevieve Monanian, MD
7. Randomized Double-Blinded Clinical Trial of Oxytocin Bolus versus Infusion in Elective Cesarean (INBOX trial) - Tiffany Angelo, DO, FASA
8. Longitudinal Analysis of Viscoelastic Testing Utilization in Postpartum Hemorrhage Management: Trends Over Time - Emily Kim, MS
9. Perioperative and anesthetic management of placenta accreta spectrum at an academic center: a 11-year retrospective cohort study. - Nicolas Muller, MD
10. High-Dose Heparin in Pregnant Women: Implications for Neuraxial Analgesia Safety - Kelly Li
11. Evaluating Blood Hemostasis in Pregnant Women using the Thromboelastograph 6s System – A Prospective Observational Study. - Teshi Kaushik, MD
12. 'Is being awake the way forward?' for the anaesthetic management of Placenta Accreta Spectrum-a cohort study of 53 women in a UK tertiary centre. - Christine James
13. Risk Factors and Development of a Prediction Model for Postpartum Hemorrhage in Cesarean Delivery - Brittany Burton, MD
14. Prophylactic Tranexamic Acid for Reduction of Intraoperative Blood Loss during Cesarean Delivery: A Retrospective Analysis - Haley Mullins
15. Plasma Transfusion in Obstetric Hemorrhage: A Single-Center Quality Audit of Dosing Practices and Outcomes - Kelly Fedoruk, MD, FRCPC
16. Association between pre- and post- delivery anemia and severe maternal morbidity among pregnant patients of different racial, ethnic, and socioeconomic groups determined by Area Deprivation Index - Amy Krepps, MD, MSPH
17. Prevalence and trends of anemia, iron deficiency, and iron-deficiency anemia in non-pregnant US women of reproductive age: NHANES 1999-2023 – Alexander Butwick, MBBS, FRCAm MS
18. Factors and Outcomes Associated with Blood Product Transfusion Ratios During Massive Postpartum Hemorrhage: A Multicenter Regression Analysis - Michael Furdyna, MD
19. Fresh Frozen Plasma Utilization and Factor Deficiency Coagulopathy in Severe Postpartum Hemorrhage from 2016 to 2024: A Retrospective Cohort Study - Lillian Liao, MD, MS

Friday, May 2 - Continued

20. Incidence of Postpartum Hemorrhage in Parturients Evaluated by an Antenatal Anesthesiology Consultation - Domenic Pedulla, MD

Breakout Room 6: ERAC, Opioids, Pain - *Broadway III/IV (Plaza level)*
Moderators: Phil Hess, MD; Dave Berman, MD; Nicole Higgins, MD

1. Is cesarean delivery during the second stage of labor associated with increased requirements for sedation and intravenous analgesia? - Cristina Hajjar, MD
2. Comparing Dexmedetomidine to Opioids as Neuraxial Adjuvants to Local Anesthetics for Perioperative Pain Management During C-sections: A Systematic Review of Randomized Controlled Trials - Christopher Evans, BS
3. Is Neuraxial Dexmedetomidine Administration Safe? - Samantha Armstrong, BS
4. Spinal Anesthesia for Obstetric Fistula Repair in Rwanda - Richard Smiley, MD, PhD
5. Intrathecal dexmedetomidine as an adjuvant for cesarean delivery: a scoping review - Paul Vozzo, MD
6. Factors associated with no in-hospital opioid use after cesarean delivery and relationship between in-hospital opioid use and opioid use after discharge - RUTH LANDAU, MD
7. Anesthesia outcomes and peripartum opioid use in patients with a diagnosis of opioid use disorder: a retrospective cohort study (2020-2024) - Brian Waldman, MD
8. Maternal and Neonatal Outcome Effects of Substance Use Disorder in Pregnancy: A Quality Assurance/Improvement Study - Manuel Vallejo, MD, DMD
9. Enhanced Recovery After Cesarean Delivery Impacts Foley Removal Times and Urinary Retention - Grace Kim
10. Effectiveness of Neuraxial Morphine Re-dose for Patients with Placenta Accreta Spectrum Undergoing Cesarean Hysterectomy. - Sabrina Antonio, MD
11. Pain Management and Opioid Requirements Following Perineal Lacerations: A Retrospective Cohort Study - Kelly Fedoruk, MD, FRCPC
12. Postpartum Recovery Profiles: a multicenter assessment of postpartum recovery using the STanford Obstetric Recovery checKlist (STORK) - Phillip Callihan, MD, PhD
13. The Effectiveness of Abdominal Wall Blocks on Post Cesarean Section Pain : A Retrospective Analysis - Haley Mullins
14. Ilioinguinal-Iliohypogastric Nerve Block for Post-Cesarean Delivery Pain Control: A Systematic Review – Adi Alduayji, MD
15. Implementation of an opioid-sparing clinical pathway reduces inpatient administration and favors multimodal pain control in post-Cesareans - Simon Dang
16. Developing a conceptual model for acute to chronic postsurgical pain after cesarean delivery: a qualitative study - Sarah Ciechanowicz, MA, BMBCh, FRCA, MRes
17. Investigating analgesia adequacy and intraoperative pain during caesarean delivery: single-centre pilot and feasibility study Ning - Lynn Chen, MBBChir
18. The Effect of Neuraxial Anesthesia on Urinary Catheter Removal After Caesarean Delivery – A Comparison Between Spinal and Epidural Anesthesia: A Systematic Review" - Summaiya Ali

Friday, May 2 - Continued

10:00am – 10:10am Audience Transition

10:10am – 10:45am BREAK IN THE EXPO HALL
Pavillion (Plaza Level)

10:45am – 10:55am Audience Transition

10:55 am – 11:00 am Opening Remarks
Ballroom (Ballroom Level)

11:00am – 12:30pm Gertie Marx Research Competition
Ballroom (Ballroom Level)
Moderator: Ruth Landau, MD
Judges: Rich Smiley, MD; Jill Mhyre, MD; Feyce Peralta,MD; Caitlin Sutton, MD; David Berman,MD; Anton Chau, MD

1. Adjuvant Analgesic, Anxiolytic, and Sedative Medications Administered During Cesarean Delivery: A Retrospective Report from the Multicenter Perioperative Outcomes Group Research Consortium - Eric Chen, MD
2. Frequency of Adherence to Obstetric Anesthesia Best Practices for Cesarean Delivery: A Multicenter Retrospective Cohort Analysis – Jordan Francke, MD, MPH
3. Efficacy and Safety of Dexmedetomidine or Sufentanil in Combination With Ropivacaine With Dural Puncture Epidural Technique For Labor Analgesia: A Randomized Controlled Trial - Yongxin Liang
4. Rac1 Facilitates YAP1 mediated Piezo1 overexpression in the uterus contributes to myometrium contraction and inflammation-associated preterm birth – Yanmei Bi
5. Comparison of Dexamethasone vs Ondansetron as the First-Line Antiemetic to Prevent Postoperative Nausea and Vomiting after Cesarean Delivery – A Double-Blinded Randomized Controlled Trial -Maria Patrocinio, MD
6. The Effect of Sufentanil for Combined Spinal-Epidural Anesthesia on Fetal Heart Rate During Labor Analgesia - JIAN XU

12:30pm – 1:30pm LUNCH ON YOUR OWN

12:30pm – 1:30pm SPONSORED LUNCH (NO-CME) – pre-registration required
Rivanna – *Atrium Ballroom (Plaza Level)*

CONCURRENT SESSIONS

1:30pm – 2:15pm Oral Presentations #1 - Main stage *Ballroom (Ballroom Level)*
Moderator: Lisa Leffert, MD

1. A randomized controlled trial using programmed intermittent epidural bolus with 0.15% versus 0.075% ropivacaine in labor epidural analgesia: effect on analgesic requirement and obstetric outcomes – Tao Han, MD
2. Incidence of new onset of persistent pain after cesarean delivery and associated risk factors – Mary Yurashevich, MD, MPH
3. A multicenter assessment of postpartum recovery using the STanford Obstetric Recovery checKlist (STORK) – Moe Takenoshita, BSc, MBBChir, MRCS

Friday, May 2 - Continued

4. Post-Cesarean Opioid Use and Pain Scores Among Opioid Dependent Patients before and after Implementation of a Modified Enhanced Recovery Protocol – Lindsey Gleason, BA

1:30pm – 2:15pm Breakout – *Galleria North & South (Ballroom Level)*
Tech-Enhanced Teaching: Leveraging New Technologies for Better Patient Outcomes
1. C8 App: Handheld Learning Can Improve Patient Care – Dan Katz, MD
2. Painless Push: Teaching Patients Improves Outcomes – Allison Lee, MD
3. POCUS: What Every OB Anesthesiologist Should Know – Clemens Ortner, MD
4. Podcasts: New Ways to Learn in 2025 – Antonio Gonzalez-Fiol, MD

2:15pm – 3:15pm Fred Hehre Lecture – Leadership Lessons and Clinical Pearls
Ballroom (Ballroom Level)
Intro: Yemi Olufolabi, MD
Speaker: Medge Owens, MD

3:15pm – 3:25pm Audience Transition

3:25pm – 4:00pm BREAK IN THE EXPO HALL
Pavillion (Plaza Level)

4:00pm EXPO HALL CLOSES FOR THE DAY

4:00pm – 4:10pm Audience Transition

4:15pm – 6:15pm Sol Shnider Track #1
Ballroom (Ballroom Level)

1. The Role of AI in Medicine
   Speaker: Mike Burns, MD

2. Wrangling the Experts: OB Anesthesia Legends Debate Approaches to Controversial Cases and Topics
   Moderator: Brendan Carvalho, MD
   Panelists: Rich Smiley, MD
   Jill Myhre, MD
   Paloma Toledo, MD

6:15pm Educational Programming Adjourns for the Day

6:30pm – 7:30pm Sponsored Happy Hour – BD
Atrium Ballrooom (Plaza Level)

7:30pm – 10:00pm SOAP EF Fundraising Event – Ticket Required
Exchange Ballroom
123 NE 3rd Ave, Portland, OR 97232

SATURDAY, MAY 3

7:00am – 9:00am Continental Breakfast in Expo Hall – *Pavillion (Plaza Level)*

7:00am – 7:30am Special Interest Group Roundtable Discussion
Atrium Ballroom (Plaza Level)

7:30am – 10:30am Research Network Symposium
North & South Galleria (Ballroom Level)

7:50 am – 8:00 am Opening Remarks
Ballroom (Ballroom Level)

8:00am – 10:00am Sol Shnider Clinical Track #2
Ballroom (Ballroom Level

1. Delivery Disasters! AFE, ECMO, Malignant Hyperthermia and the Lost Airway
   Moderator: Adam Wendling, MD
   Presenters: AFE – David Arnolds, MD
   ECMO – Emily Naoum, MD
   MH – Dave Berman, MD
   Lost Airway – Mark Rollins, MD
2. How to Leverage Point of Care Viscoelastic Testing Technology to Take Better Care of Your Patients
   Moderator: Michaela Farber, MD

   Panelists: How to Advocate for POCVT in Obstetric Anesthesia: Cost Analysis, Outcomes – Denis Snegobskikh, MD
   How to Use POCVT during Postpartum Hemorrhage – Shubangi Singh, MD
   It's Not Only for PPH! POCVT in Non-PPH Settings: Uses and Limitations – John Kowalczyk, MD

10:00am – 10:10am Audience Transition

10:10am – 10:45am BREAK IN EXPO HALL
Pavillion (Plaza Level)

10:45am – 10:55am Audience Transition

CONCURRENT SESSIONS

10:30am – 12:15pm BREAKOUT - IARS Workshop: How to be a Great Peer Reviewer (pre-registration required)
Galleria North & South (Ballroom Level)
Panelists: Asraf Habib, MD
Jill Mhyre, MD
Cynthia Wong, MD
Thomas Vetter, MD

10:55am – 12:15pm Best Case Reports
Main Stage *Ballroom (Ballroom Level)*
Moderator: Emily McQuaid-Hanson, MD
Panelists: Marie-Louise Meng, MD
Feyce Peralta, MD
Christine Warrick, MD

1. Medical Management of Congenital Heart block: A Multi-Disciplinary Approach –

Saturday, May 3 - Continued

Jordan Abrams, MD
2. Easing the Tension: A Multidisciplinary Approach to Pulmonary Hypertension in Pregnancy – Emily Eruysal, MDA
3. A Narrowing Case of Subglottic Stenosis in Pregnancy: Multidisciplinary Approach for Optimal Maternal and Fetal Outcomes - Nikke Bowerman, MD
4. Anesthesia for Maternal-Assisted Cesarean: A Patient-Centered Approach – Rebecca Boothe
5. Cesarean Section in an Impella Dependent Patient Sierra Trost, MD
6. Sensorineural Hearing Loss After Labor Epidural Analgesia: A Diagnostic Dilemma – Kresimir Ukalovic, MD, FRCPC
7. Management considerations for the obstetric patient with Takayasu's arteritis – Jasmine Kim, MD
8. Management of pregnancy termination for a patient with Eisenmenger syndrome and Chiari I malformation with associated syringomyelia – Jacob Nieb, MD
9. Varicella zoster meningitis: A rare case of disseminated reactivation – Paul Francois, MD
10. REBOA to the Rescue: Management of Massive Hemorrhage following Catastrophic Uterine Rupture – Travis Cuddy, MD

12:15pm – 1:15pm LUNCH ON YOUR OWN

12:15pm – 1:15pm Sponsored Lunch – Octapharma
Atrium Ballroom (Plaza Level)

1:15pm – 1:45pm ASA Update
Ballroom (Ballroom Level)
David Martin, MD, PhD, FASA, Vice President for Scientific Affairs, ASA

1:45pm -2:45pm Gerard W. Ostheimer Lecture
Ballroom (Ballroom Level)
Intro: Katie Arendt, MD
Speaker: Emily Sharpe, MD

2:45pm – 2:55pm Audience Transition

2:55pm – 3:30pm BREAK IN EXPO HALL
Pavillion (Plaza Level)

2:55pm – 3:30pm The Power of Participation: SOAP Committee Showcase
Atrium Ballroom (Plaza Level)

3:30pm – 3:40pm Audience Transition

3:30pm – 3:40pm 2025 SOAP/FAER MRTG Recipient Presentation
Ballroom (Ballroom Level)

3:40pm – 4:30pm SOAP Awards – *Ballroom (Ballroom Level)*
- Best Research Paper
- Gertie Marx
- Teacher of the Year
- Best Case Report
- Diversity & Inclusivity Award

Saturday, May 3 - Continued

- Patient Safety Award/APSF
- Research in Education Award
- Frederick P. Zuspan Award
- Mentoring Excellence Award
- Center of Excellence
- SOAP/Kybele International Outreach Grant
- SOAP Diversity & Inclusivity Mentored Grant

4:30pm – 4:40pm Audience Transition

4:40pm – 5:10pm BREAK IN EXPO HALL
Pavillion (Plaza Level)

5:10pm EXPO HALL CLOSES/EXPO MOVES OUT

5:10pm – 5:20pm Audience Transition

5:20pm – 7:20pm Abstract Breakout Sessions

Breakout Room 1: Musculoskeletal & Connective Tissue - *Studio Suite (3rd Floor Conference level)*
Moderators: Jarna Shah, MD and Manju Prasad, MD

1. Anesthetic Management of a Pregnant Patient with Spinal Muscular Atrophy Type II Undergoing Cesarean Section - Yasmine Habli, MD
2. Anesthetic management of a parturient with Ehler-Danlos syndrome complicated by known difficult airway and local anesthesia resistance undergoing Cesarean section - Jerry Lee, MD
3. Neuraxial anesthesia for cesarean section in a patient with achondroplasia and lumbar spinal fusion - Daniella Goni, MD
4. Care for the Epidermolysis Bullosa Patient Undergoing Cesarean Section - Megan Gauthier, DO, MBA, FASA
5. Not all Ehlers Danlos Syndrome (EDS) is equal: a case series of 2 parturients with vascular EDS - Lauren Blake, MD, MHS
6. Labor Analgesia for Parturient with Hereditary Multiple Osteochondromas - Case Report - Joshua Fink, MD
7. Labor analgesia for a parturient with neurofibromatosis type 1 involving the lumbosacral spine - Lauren Crosby Zawierucha, MD
8. Anesthetic Considerations in Spinal Muscular Atrophy Type II for Cesarean Delivery - Courtney Cleary, MD
9. We've Got a Bone to Prevent: Cesarean Delivery in a Unique Fibrodysplasia Ossificans Progressiva Patient - Angelica Pinninti, MD, MBA
10. Anesthetic Delivery Management of Multi-organ Systemic Scleroderma - Man Kuan Lei, MD
11. Anesthetic management for emergent cesarean in a parturient with skeletal dysplasia, spinal fusion, and history of failed airway, who presented as a level 1 trauma - Blake Benner, MD
12. Anesthetic Management of a Patient with Diastrophic Dysplasia Requiring Cesarean Delivery - Amber Reitz, DO
13. Acute Postpartum Disc Herniation resulting in Foot Drop - Emily Kershaw, MD

Saturday, May 3 - Continued

Breakout Room 2: Placental Concerns - *Directors Suite (3rd Floor Conference level)*
Moderators: Ling-Qun Hu, MD and Kaitlyn Newmann, MD

1. Intraoperative Visual Diagnosis of Missed Placenta Accreta - Pearl Huynh
2. Placenta Percreta and PEA - Mohammad Nawaz, MD
3. Anesthetic Management of a Parturient with Undiagnosed Acute Cocaine Intoxication - Brittany Hatter, MD
4. Massive Transfusion After Midnight: A Case of Placenta Accreta Spectrum, Hemorrhage and Resource Limitations - Meaghan Reaney, DO
5. Abdominal Pregnancy Case Report - Rafael De Souza, MD
6. Placenta accreta spectrum disorder in patient with history of mullerian agenesis - Ashley Vincent, MD
7. IR Embolization for Delayed Hysterectomy after Classical Cesarean - Brandi Sun, MD
8. The right place at the right time: antepartum hemorrhage in the operating suite for a scheduled cesarean hysterectomy - Precious Ichite, MD
9. Anesthetic Management of Massive Hemorrhage During Planned Cesarean Hysterectomy for Placenta Accreta - Jacqueline Labins, MD
10. Utility of ROTEM for Management of Patient with Suspected Concealed Abruption in DIC - Joanna Sanchez, MD
11. ECV Abruption Leading to DIC – Desby Cheribin, MD
12. Anesthetic Management of the Reduction of an Incarcerated Gravid Uterus Through a Ventral Hernia - Shanee Navon, MD
13. Liver Transplant in a Pregnant Patient Complicated by Intraopertive Placental Abruption - Sydney Tran
14. Unknown Placenta Accreta During Elective C-Section - Emilie Cohn, MD
15. Couvelaire Uterus in a Nulliparous Parturient - Lindsay Tremper

Breakout Room 3: Cardiac 2 - Pulmonary Hypertension & Valves - *Council Suite (3rd Floor Conference level)*
Moderators: Arran Siler, MD and Bryan Mahoney, MD

1. Epidural Analgesia: Delivering with Aortic Stenosis - Vered Schwell, MD
2. Late Second Trimester Dilation and Evacuation in a Morbidly Obese Patient with Newly Diagnosed Severe Pulmonary Arterial Hypertension - Catharine Keim, MD
3. Easing the Tension: A Multidisciplinary Approach to Pulmonary Hypertension in Pregnancy - Emily Eruysal, MD
4. Peripartum Anesthetic Considerations for Patients with Pulmonary

Saturday, May 3 - Continued

Hypertension from Fibrosing Mediastinitis Undergoing Surgical Pregnancy Termination - Braydon Bak, MBBCh,BAO
6. Between A (Harrington) Rod and a Hard Place, Madison, Kohl, DO
7. Pulmonary Hypertension: Enemy of Pregnancy, Madison, Kohl, DO
8. Anesthetic Management of Urgent Cesarean Delivery in a Patient with Sub-aortic Stenosis and Severe Pulmonary Hypertension: A Case Report - Lev Botea, MD
9. Mechanical Aortic Valve Thrombosis in Pregnancy- Anticoagulation Considerations - Taylor Leathers, MD
10. Anesthetic Management for Cesarean Delivery in a Patient with Congenital Truncus Arteriosus and Severe Valvular Disease: A Case Report - Khader Zimmo, MD FRCPC
11. Anesthetic Management for Cesarean Delivery in a Parturient with Multiple Comorbidities Including Severe Pulmonary Hypertension, Sarcoidosis, and Severe Rheumatic Mitral Stenosis - Yue Qiu, MD
12. Mechanical Valve Thrombosis with Critical Aortic Stenosis in a Twin Pregnancy - Zachary Lerner, MD
13. Antepartum Valve-Sparing Aortic Root Replacement - Afif Kraitem, MD

Breakout Room 4: Cardiac 3 - Arrhythmia & Acuity - *Forum Suite (3rd Floor Conference level)*
Moderators: Erin Haggerty, MD and Bahaa Daoud, MD

1. SCAD and Stroke: To Anticoagulate or Not? - Madison, Kohl, DO
2. Delivery venue dilemma: A case of maternal arrhythmia requiring continuous telemetry - Jil Decker, MD
3. Medical Management of Congenital Heart block: A Multi-Disciplinary Approach - Jordan Abrams, MD
4. Progressive Maternal Heart Block in Pregnancy - Emily, Bliss, MD
5. Anesthetic Management of Paroxysmal Supraventricular Tachycardia and Thromboembolic Risk in a Pregnant Patient with Complex Congenital Heart Disease - Lauren Nguyen, MSc
6. Neuraxial Anesthesia for Vaginal Delivery in Congenital Complete Heart Block - Harvy Freitag, MD
7. Complete Heart Block in Pregnancy - Keionne Green
8. Anesthetic Management of a Patient with Micra Leadless Pacemaker Undergoing Cesarean Delivery: A Case Report - Rishabh Jindal, MBBS, MD
9. Brugada Syndrome in Pregnancy: A Multidisciplinary Approach - Corey, Meehan, MD
10. Cesarean Delivery in the Setting of Chest Pain Due to Spontaneous Coronary Artery Dissection – Mikayla Troughton, MD
11. Anesthetic Management of a Parturient with Aortic Aneurysm - Caitlin, McCusker
12. Rhythm and Risk: Cesarean Delivery in Brugada Syndrome – Mohammad Nawaz, MD
13. Misattributed Agitation: Delayed Recognition of Neurological Deterioration in Preeclampsia due to Preexisting Bipolar Disorder - Jace Battrell, MD
14. A Perfect Storm: Coexisting Septic Shock and Post-Dural Puncture Headache - Diksha Verma, MD

Saturday, May 3 - Continued

Breakout Room 5: Coagulation & Vascular - *Broadway I/II (Plaza level)*
Moderators: Brad Bavaro, MD and Jeremy Juang, MD

1. Balancing the Clot: Management of Disseminated Intravascular Coagulation with Thromboelastography during Intrapartum Cesarean Delivery - Rosalyn Chen, MD
2. The Utility of Rotational Thromboelastometry (ROTEM) in Guiding Anesthetic Management for High-Risk Obstetric Patients - Oluwakemi Adesina
3. Von Willebrand Disease Type To Be or Not 2B, Madison, Kohl, DO
4. Neuraxial Anesthesia in Von Willebrand Disease Type 2A – Daniel Heinze, DO
5. Anesthetic Management of Comorbid Hydatid Cysts and VWD Type 2b in Pregnancy: A Case Report - Lauren Nguyen, MSc
6. Neuraxial Analgesia in Type 2N Von Willebrand's Disease: A Case Report - Kelly Li
7. Management considerations for the obstetric patient with Takayasu's arteritis - Jasmine Kim, MD
8. Urgent C-section for a patient with Moyamoya Disease - a challenging anesthetic management - Allen Le, MD
9. Intracranial Bullet Near the Circle of Willis, Is Neuraxial Safe? - Saheb Dhillon, MD
10. Simultaneous Diagnoses of Cerebral Arteriovenous Malformation and Multiple Sclerosis in Pregnancy- Lucas Steele, MD
11. Subarachnoid Hemorrhage: Do Not Manage Alone! - Meaghan Reaney, DO
12. Peripartum Anesthetic Considerations and Management in a Patient with Hereditary Neuropathy with Liability to Pressure Palsies (HNPP) - Michael Goulet, MD
13. No Pressure: Labor Management of Patient with Hereditary Neuropathy with Pressure Palsy (HNPP) - Andrea Fritz, MD, MPH
14. Neuraxial Anesthesia in a Parturient with a History of Intracranial Arachnoid Cyst – Michelle Yanik, MD
15. Obstetric Anesthesia Management in a Patient with Wallenberg Syndrome: A Case Report - Rishabh Jindal, MBBS, MD

Breakout Room 6: Patient-Centered Care, Ethics, Fetal Surgery - *Broadway III/IV (Plaza level)*
Moderators: Sharon Abamowitz, MD and Amy Penwarden, MD

1. Anesthesia for Maternal-Assisted Cesarean: A Patient-Centered Approach - Rebecca Boothe
2. Intraoperative Akathisia and Anxiety During Cesarean Delivery with Rapid Improvement after Dexmedetomidine IV, Leonard, Soloniuk, n/a
3. Implementation of the Ulysses Contract in a Patient with Severe Needle Phobia - Samar Ayoub, MD
4. Ethical and Clinical Challenges in Managing Pregnancy in a Critically Ill Patient with Tuberculous Meningoencephalitis: A Case Report and Review of Guidelines - Rishabh Jindal, MBBS MD
5. Neuraxial anesthesia for ex utero intrapartum treatment of a patient with twin gestation and blood product refusal - Claire Rhee, MD
6. Anesthetic Management of the First EXIT Procedure at Our Facility for a Fetus with Congenital Neck Teratoma, Casi, Blanton, Medical Doctor

Saturday, May 3 - Continued

7. The Use of Novel Drug Remimazolam for Labor Epidural Anxiolysis - James Parry
8. Reversing Back to our Roots; Avoiding Sugammadex in the Pregnant Patient - Joe Bryant-Huppert, MD
9. Conjoined Parapagus Dithoracic Twins - Susan Stanley, MD
10. The Coincidentia Oppositorum - Bridging Obstetric Anesthesia and Palliative Care - Kimberly Mendoza, MD, PhD, MPH
11. Paravertebral Block for Post-Cesarean Section Analgesia - Rima Abhyankar
12. Anesthesia-employed FHR Monitoring During Neurosurgery in Third Trimester - Christian-Michael Gopichand
13. Postpartum Conversion Disorder After Epidural - Robert Bloom, MD

7:20pm Educational Programming Adjourns for the Day

7:35pm DINNER ON YOUR OWN

SUNDAY, MAY 4

7:00am – 9:00am Coffee Service
Grand Ballroom Foyer (Ballroom Level)

7:00am – 7:45am Special Interest Group Roundtable Discussions
Grand Ballroom Foyer (Ballroom Level)

7:45 am – 8:00am Opening Remarks
Grand Ballroom Foyer (Ballroom Level)

8:00am – 9:00am SOAP/ASRA Panel: Spinal Pathology & Neuraxial Techniques
Grand Ballroom Foyer (Ballroom Level)
Moderator: Phil Rubin, MD
Panelists: Hans Sviggum, MD
Pamela Flood, MD
Jeanette Bauchat, MD
Jaime Daly, MD

9:00 am – 9:15 am BREAK
Grand Ballroom Foyer (Ballroom Level)

CONCURRENT SESSIONS

9:15am – 11:15am Sol Shnider Track #3 *(General Session)* – MAIN STAGE
Grand Ballroom (Ballroom Level)

1. Troubleshooting Tricky Epidurals
   1. Troubleshooting Epidurals in Labor
   2. Troubleshooting Epidurals for Intrapartum Cesarean
   3. #Hot Take – Every Intrapartum Cesarean Gets a Spinal

Presenters: Ron George, MD
C. LaToya Mason, MD
Michael Hoffkamp, MD

Saturday, May 3 - Continued

2. Updates from ASA Committee of OB Anesthesia
Speaker: Mark Zakowski, MD

3. Totally *Epic* Enhancements in the Electronic Medical Record
    1. Building an Interactive Dashboard for the OB Anesthesiologist
    2. New and Improved Epic Workflows for OB Anesthesiology

Moderator: Thomas Klumper, MD
Presenters: Mahesh Vaidyanathan, MD
Alice O'Brien

9:15am - 11:15am — Oral Poster Presentations #2 – BREAKOUT
Galleria North & South (Ballroom Level)
Moderator: Michaela Farber, MD and Brandon Togioka, MD

1. Reduction of Emergency Release Blood Product Ordering on Labor and Delivery: A Quality Improvement Initiative – Chloe Stanwyck, MD, MS
2. Antepartum point-of-care gastric ultrasound in fasted obstetric patients undergoing non-delivery surgical procedures -Saranya Lertkovit, MD
3. Comparative Thromboelastography on Peripheral vs Uterine Blood as an Early Marker of Postpartum Coagulation Changes – Tyler Guidugli, DO
4. Improving Postpartum Hemorrhage Risk Prediction by Integrating Time-Based Anesthesia Factors with Traditional Confounders – Kelly Li
5. A Retrospective Study of Associations between Antepartum Psychiatric Medications and Hypertensive Disorders of Pregnancy in Patients with Mood and Anxiety Disorders - Heather Acuff, MD, PhD
6. Duration of Urinary Catheterization and Barriers to Early Catheter Removal After Cesarean Deliveries - A Mixed-Methods Study – Aislynn Sharrock, BA (Hons)
7. Leveraging a 3D-Printed Spine Model to Study Medication Spread in Spinal Anesthesia – Jaber Hanhan, MD
8. How Do Abortion Laws Affect Where Residents and Fellows Accept Their First Post-Training Jobs? – Rachel Douglas, DO
9. The effect of sugammadex administration on fetal outcomes in pregnant patients who underwent non-obstetric surgery under general anesthesia – Jacob Nieb, MD
10. Machine Learning Analysis of Arterial Stiffness Trends throughout Pregnancy to Predict the Development of Preterm, Term and Postpartum Preeclampsia - Allison Engo
11. Expert Consensus on Minimum Anesthesia Requirements for Cesarean (MARC) Delivery: A Delphi Study - Ronald George, MD, FRCPC
12. Measuring Changes In Cardiac Output During Cesarean Section Using Left Ventricular Outflow Tract Velocity Time Integral - Julia Morrison, MD

11:15am – 11:25am — Audience Transition

11:55am -1:25pm — Abstract Breakout Session

Breakout Room 1: Endocrine & Autonomic - *Studio Suite (3rd Floor Conference level)*
Moderators: Brandon Togioka, MD and Shobana Bharadwaj, MD

1. Cesarean Section in a Parturient with SCI and Autonomic Dysreflexia: A Case Report - Emily Sun, MD

Sunday, May 4 - Continued

2. Pregnant Patient with Grave's Disease Requiring Total Thyroidectomy - Elizabeth Cifuentes, MD
3. Dearth of Dopamine: Management of Dystonia in the Parturient - Christopher, Kerr, MD
4. Anesthetic considerations for pregnant patients with osteogenesis imperfecta - Valeryia Pratasava, MD
5. Severe Symptomatic Postural Orthostatic Tachycardia Syndrome in a Pregnant Patient - Hayley Holbrook, DO
6. My patient's freezing and she doesn't even know it! Altered thermoregulatory response to spinal morphine: a teaching moment - Paris Thompson
7. Hyperemesis Gravidarum Leading to Fetal Demise and Wernicke's Encephalopathy – Mikayla Troughton, MD
8. Anesthetic Considerations in a Parturient with Pseudocholinesterase Deficiency - Paul Lee, DO
9. Emergency Cesarean in a Parturient with Unrecognized Gestational Diabetes Insipidus Complicated by Heart Failure - Frank Slykas, MD
10. Anesthetic Management of a Parturient with Carnitine Palmitoyltransferase II Deficiency - Hunter Calvert, DO
11. Management of cesarean delivery in a patient with Fanconi syndrome - Jessica Galey, MD
12. Preoperative gastric ultrasound to facilitate anesthetic management of cyclic vomiting syndrome during early pregnancy - Saranya Lertkovit, MD
13. Autoimmune Catatonia: An interesting case of Hashimoto's encephalitis in a term parturient - Maria Patrocinio, MD
14. Perioperative Management of a Patient with Paroxysmal Nocturnal Hemoglobinuria for Cesarean Delivery: A Case Report - Hanshin Lee
15. Navigating Anesthetic Challenges in a Pregnant Patient with Goiter, Preeclampsia, and Anticipated Difficult Airway: A Case Report - Maria Patrocinio, MD

Breakout Room 2: Cancer - *Directors Suite (3rd Floor Conference level)*
Moderators: Adam Wendling, MD and Maria Gutierrez, MD

1. Missing the point: Failed labor epidural analgesia in a childhood cancer survivor who received intrathecal chemotherapy - Jordan Francke, MD, MPH
2. Recurrent Metastatic Breast Cancer in Pregnancy Complicated by Uncontrolled Pain - Lauren Chapman, BS, MPH
3. Management of Primary Pulmonary Synovial Sarcoma in a Pregnant Patient: A Case Report - Shayna Levine, MD
4. On the Tip of the Tongue: Anesthetic Dilemmas for C-Section with Metastatic Cancer - Theresa Nguyen, BS.
5. Anesthetic Management for Cesarean Delivery in a Patient with Acute Promyelocytic Leukemia - Yue Qiu, MD
6. Ethical and Anesthetic Considerations of a Parturient who Presents with Interval Progression of Glioblastoma and Midline Shift - Nikke Bowerman, MD
7. Management of elective pre-term cesarean delivery in a patient with a recently resected grade III astrocytoma - Jessica Galey, MD
8. Cesarean Delivery for a Patient with Von Hippel-Lindau Syndrome - Margaret Lund, MD

Sunday, May 4 - Continued

9. Epidural in Neurofibromatosis Type I: Proceed With Caution! - Maria Istafanos, DO
10. Intraoperative Management of Undiagnosed Metanephrine-Secreting Tumor during Cesarean Delivery – Kathleen Simons, MD
11. Cesarean Delivery in a Parturient with Neurofibromatosis Type 1 - Kathryn Kim, MD
12. Clinical Manifestation, Disease Course, and Peri-delivery Planning of Rectal Cancer During Pregnancy - Sabrina Antonio, MD
13. Anterior Mediastinal Mass on a Laboring Patient - Diana Valencia Morales, MD
14. Cesarean Section in Acutely Progressive Amyotrophic Lateral Sclerosis - Daniel Olix, MD
15. Over, Under, Around, or Through? Navigating Neuraxial Anesthesia in a Parturient with a Large Lumbar Lipoma – Hannah Jennings-Davis, MD

Breakout Room 3: HEME General - *Council Suite (3rd Floor Conference level)*
Moderators: Kristen Fardelmann, MD, Kazou Ando, MD

1. Platelet Storage Pool Disorder in a Parturient - Sunny Patel, BS, MD
2. Obstetric Management of a Female Hemophilia A Carrier - Elizabeth Day, MD, MPH
3. The Development of Guidelines for Fondaparinux Use and Neuraxial Anesthesia - Jennifer Tripi, MD
4. A Factor of Uncertainty: Navigating Factor VII Deficiency in Obstetric Care - Jordan Horstman, DO
5. A Case of Factor V Deficiency Complicated By Fresh Frozen Plasma Allergy -- Emily Boyd, MD
6. Severe Thrombocytopenia After RSV Vaccination in a Parturient - Cristina Hajjar, MD
7. Intravenous Iron: Ironically Not Always Benign – Lucy Xu, MD
8. Postpartum Cerebral Venous Sinus Thrombosis in a Patient with Aplastic Anemia, Preeclampsia, and HELLP Syndrome - Ani Chilingirian, MD
9. Anesthetic Management of Parturients with Severe Factor XI Deficiency: Two Cases - Ashley Zimmermann, MD
10. A Rare Blood Phenotype and Isoimmunization: Proceeding to Cesarean Delivery Without Compatible Blood - Joanna Zhang, MD
11. Coagulopathy may be not a contraindication to neuraxial anesthesia- a case report in a patient with acute fatty liver of pregnancy - Ejaz Khan
12. Born to Bleed: Navigating Pregnancy and Delivery in a Rare Coagulopathy - Yasmine Habli, MD
13. Cesarean Delivery in a Patient with Chronic Inflammatory Demyelinating Polyneuropathy - Marisela Sandoval, MS

Breakout Room 4: Pulmonary & Infection - *Forum Suite (3rd Floor Conference level)*
Moderators: Emily Dinges, MD, Michelle Simon, MD

1. Anesthetic Management of a Parturient with Severe Pulmonary Hypertension and Right Ventricular Failure - Christopher Lee, MD
2. Breathing Through a Straw: Airway Compression from a Thyroid Mass in Pregnancy - Patrick Hesketh, MD
3. Cesarean Section on a Patient with a Large Mediastinal Mass - Samuel Hutcheson, MD

Sunday, May 4 - Continued

4. Pressure's On: Cesarean Delivery in Severe Pulmonary Hypertension: A Case Report - Catherine Gao, MD
5. Lessons of Severe Pulmonary Arterial Hypertension in the Parturient - Vikasini, Mahalingam, MD
6. A cervical conundrum: New diagnosis of thyroid goiter and dural venous fistula in pregnancy - Syed Saad Iqbal, CRNA, DNP
7. Intraoperative Pulmonary Embolus During Cesarean Delivery - Jacob Weber, MD
8. The Clot Thickens: Bilateral Pulmonary Embolism in the Pregnant Patient with Antithrombin III Deficiency - Christine Chen, MD
9. Substance Abuse and Fulminant Withdrawal in a Pregnant Patient with Severe Pulmonary Hypertension - Ryan Ford
10. Decision Between General vs. Neuraxial Anesthesia for Cesarean Section in a Patient with Alpha-1 Antitrypsin Deficiency - Ian Lambert, MD
11. Varicella zoster meningitis: A rare case of disseminated reactivation, -Paul Francois, MD
12. Disseminated Spinal Coccidioidomycosis in Pregnancy - Eden Patton, MD
13. Anesthetic Management for Cesarean Section in a Parturient with Valerian Root-induced Liver Injury and Coxsackie Sepsis - Lauren Langman
14. Neuraxial Anesthesia in Late-Onset Pompe Disease: A Case Presentation and Literature Review - Rishabh Jindal, MBBS, MD
15. Management of parturient with malaria and severe preeclampsia requiring cesarean delivery and emergent ECMO - Jessica Galey, MD

Breakout Room 5: Cardiac 4 - Cardiomyopathy, VADS, Non-Obstetric Surgery - *Broadway I/II (Plaza level)*

Moderators: Chad Dean, MD, Lisa Leffert, MD

1. Successful management of patient with ischemic cardiomyopathy undergoing c-section through a multi-disciplinary approach - Jessica Galey, MD
2. Peripartum Temporary Left Ventricular Assist Device for Ischemic Cardiomyopathy Complicated by Refractory Cardiogenic Shock – Liliane Ernst, MD
3. Cesarean Section in an Impella Dependent Patient - Sierra Trost, MD
4. General anesthesia for cesarean delivery in a patient with a stented coarctation of the aorta with signs of restenosis: a case report - Marco Antoni Carneiro, MD, TSA, EDAIC
5. Successful Obstetric Outcome in Situs Inversus with Fontan Physiology - Samuel Rafla, MD
6. Successful Vaginal Delivery in the Patient with Acute Decompensated Cardiomyopathy - Christine Chen, MD
7. Womb with a View: Turning the Tables on Uterine Inversion & Takotsubo Cardiomyopathy - Jordan Abrams, MD
8. Peripheral veno-arterial extracorporeal membrane oxygenation to facilitate cesarean delivery for a parturient in profound cardiogenic shock - Christopher Taylor, MD
9. Emergent Intrapartum Cesarean Delivery in a Grand Multiparous Parturient Supported by a Left Ventricular Assist Device - Tyler Guidugli, DO
10. Management of Acute Decompensated Heart Failure in a Patient with Repaired Congenital Heart Disease - Yue Qiu, MD

Sunday, May 4 - Continued

11. Preservation of Uterus after Cesarean Section in Uterine Transplant Patient - Andrew Hackney, MD
12. Gravid Uterus Contained Within an Abdominal Hernia: A Case Report - Shubham Mangla
13. Combined Urgent Cesarean Section and Open Appendectomy Under Neuraxial Anesthesia - Nicholas Miller, MD
14. The Use of Cangrelor to Prevent Coronary Stent Thrombosis in the Setting of a Scheduled Caesarean Section - Liz James, MD
15. Anesthetic Management: Emergent Craniotomy and Cesarean Delivery - Lindsey Lang, MD

Breakout Room 6: Epidural Complications- not PDPH - *Broadway III/IV (Plaza level)*

Moderators: Pedram Aleshi, MD and Hilary MacCormick, MD

1. A case of sheared epidural catheter: Where is the piece of plastic? - Jennifer Tripi, MD
2. Gluteal Augmentation Injections as an Emerging Risk in Neuraxial Anesthesia: Early Identification, Evaluation, and Communication as Mitigation Strategies for a Safe Delivery - Kylie Shukur, DO
3. Labor Epidural in Patient with Migrating Biopolymer from Buttock Implants: A Case Report – Rachel A. Achu-Lopes, MD
4. Knot My Best Epidural - Stratton, Dangerfield, MD
5. Too Close for Comfort: Epidural Placement in a Patient with a Gluteal Abscess - Patrick Hesketh, MD
6. CSF Fistula Following Neuraxial Anesthesia for Labor: A Case Report - Usman Hyder, MBBS, MD
7. Functional Neurologic Disorder following Neuraxial Anesthesia during Cesarean Section - Eric Krause, MD
8. Management of Retained Epidural Catheter Fragment After Combined Spinal Epidural during Routine External Cephalic Version - Casey Spell,
9. Clinical Diagnosis: A Case of Subdural Catheter Placement - Casi Blanton, MD
10. The DEX Best Thing: A Case of Dexmedetomidine as an Epidural Adjunct in a Patient with Anaphylactic Allergy to Fentanyl - Sara Jones, MD
11. Inadvertent Subdural Catheter Placement during Urgent Cesarean Section Delivery - Venkat Tummala
12. Unilateral Horner's Syndrome Following Epidural Catheter Placement in a Laboring Patient - Loni Kreger, MD
13. Case Report: Suspected Inadvertent Subdural Catheter Placement Leading to Maternal Cardiac Arrest - Sagar Patel, MD
14. Acute Ptosis, Headache, and Facial Neurologic Deficits in Labor: What Could it Be? - Joseph Israeli, MD
15. Grand Mal Seizure Following Standard Test Dose - Maria Istafanos, DO

1:25pm SOAP 2025 ANNUAL MEETING ADJOURNS

Speaker Disclosures

The following speakers and/or planning committee members have indicated that they have relationships with ineligible companies to disclose.

Name	Type of Relationship	Ineligible Company
David Arnolds	Grant/Contract	BioIntelliSense
Brendan Carvalho	Other Professional Activities - Consultant	Rivanna Medical, LLC
Brendan Carvalho	Other Professional Activities - Consultant	Vertex Pharmaceuticals
Brendan Carvalho	Stock	Flat Medical
Anton Chau		
Michaela Farber	Other Professional Activities – Consultant	HemoSonics LLC
Michaela Farber	Other Professional Activities – Consultant	Octapharma USA, Inc.
Michaela Farber	Grant / Contract	Flat Medical
Kristen Fardelmann	Other Professional Activities – Other	Stipend for role as Co-Editor in Chief of Obstetric Anesthesia Digest
Antonio Gonzalez-Fiol	Other	Butterfly Network, Inc.
Ashraf Habib	Grant / Contract	Haisco USA
Ashraf Habib	Other Professional Activities – Other	Merck
Ashraf Habib	Consultant	Orion Corporation
Ashraf Habib	Grant / Contract	Pacira Pharmaceuticals Incorporated
Ashraf Habib	Consultant	Vertex Pharmaceuticals
Brinda Kimdar	Consultant	Peter Angelos Law
Brinda Kimdar	Consultant	Wolters Kluwer Health, Inc.
Tom Klumpner	Grant / Contract	University of Michigan
Tom Klumpner	Grant / Contact	BioIntellisense
Sangeeta Kumaraswami	Stock	Berkshire Hathaway
Sangeeta Kumaraswami	Stock	Eli Lilly
Sangeeta Kumaraswami	Stock	Johnson and Johnson
Sangeeta Kumaraswami	Stock	Proctor and Gamble
Ruth Landau	Other Professional Activities – Other	American Society of Regional Anesthesia and Pain Medicine
Ruth Landau	Other Professional Activities – Other	Elsevier Publishing
Allison Lee	Other Professional Activities – Consultant	Covidien, LP
Chawla Mason	Other Professional Activities – Consultant	Medtronic
Jill Mhyre	Other Professional Activities – Other	ACGME
Jill Mhyre	Grant / Contract	Elsevier
Jill Mhyre	Gift	Wolters Kluwer Health, Inc.
Rebecca Minehart	Other Professional Activities – Consultant	Rivanna Medical, LLC
Alice O'Brien	Gift	Edwards Lifesciences Corporation

Name	Type of Relationship	Ineligible Company
Clemens Ortner	Other Professional Activities – Consultant	Sonologi Inc.
Richard Smiley	Grant / Contract	Ionis Pharmaceuticals
David Stahl	Other Professional Activities – Consultant	CurbsideMD
Brandon Togioka	Grant / Contract	GuideStar Medical Devices
Brandon Togioka	Grant / Contract	Haisco Pharmaceutical Group
Brandon Togioka	Grant / Contract	Merck
Brandon Togioka	Grant / Contract	Georgia-Pacific
Paloma Toledo	Other Professional Activities – Other	Pacira Pharmaceuticals Incorporated
Tracey Vogel	Other Professional Activities – Consultant	NOMA.AI
Carolyn Weiniger	Gift	Elsevier
Cynthia Wong	Other Professional Activities – Other	Elsevier
Cynthia Wong	Other Professional Activities – Other	Wolters Kluwer
Mark Zakowski	Other Business Ownership	Quantum Birthing LLC

All relevant financial relationships for this activity have been mitigated.

All other planners, faculty, and staff have reported no relevant financial relationships with ineligible companies to disclose.

Program Material
Wednesday, April 30, 2025

Focused Assessed Transthoratcic Echocardiography (FATE) Course
Faculty: Ezeldeen Abuelkasem, MD; Jean Marie Carabuena, MD; Raffaella Fantin; Cedar Fowler, MD; James McAvoy, MD; Alexandra Nicholas, MD; Clemens Ortner, MD; Cesar Padilla, MD; Ivan Velikovic, MD

Point-of-Care (POCUS) Ultrasound
Faculty: Christian Arzola, MD; Juliana Barrera, MD; Naida Cole, MD; Jackie Galvan, MD; Brinda Kamdar, MD; Sangeeta Kumaraswami, MD; Ayumi Maeda, MD; Carolina Rincon, MD; Naveed Siddiqui, MD; Evan Wild, MD; Fabricio Zasso, MD

Educational Skills for the Busy Clinician
Moderator: David Berman, MD
Panelists: Anna Gitterman, MD; Monique Cheng, MD; Giovanni Charles, MD

Trauma Informed Care for Optimal Outcomes
Moderator: Tracey Vogel, MD
Panelists: Anjum Anwar, MD; Katie Seligman, MD; Andrea Traynor, MD

Program Material
Thursday, May 1, 2025

Opening Remarks
Speaker: Heather Nixon, MD – SOAP President

Opening Keynote – Empowering Clinicians: Leveraging AI to Enhance Outcomes while Upholding Ethics, Privacy, and Scientific Rigor
Speaker: Ashley Duque Kienzle
Founder, Almmahealth
Advisor specializing in AI and Business Strategy – Kashmir Intelligence, CurbsideMD, Kidney Beam, Facebook, Amazon, CapitalOne, and others

President's Panel: AI: The Good, The Bad and The Ugly
Moderator: Heather Nixon, MD
Panelists: Ashley Duque Kienzle; Sarah Armstrong, MD; Aswathi Jayaram, MD; Mahesh Vaidyanathan, MD

Distinguished Service Award
Introduction: May Pian-Smith, MD, MS
Recipient: Lawrence Tsen, MD

OAA: Burnout, Resilience, and AI
Speaker: Sarah Armstrong, MD – President, Obstetric Anesthetists' Association

Best Paper Research Competition
Moderator: Ashraf Habib, MD
Judges: Phil Hess, MD; Lisa Leffert, MD; Ron George, MD; Michaela Farber, MD; Allison Lee, MD

1. The TRPV4 channel could be part of the problem—and the solution—in uterine atony – Daiana Fornes, PhD
2. Single nuclear transcriptomics uncover downregulation of FSHR in the myometrium of patients with uterine atony – Jessica Ansari, MD, MS
3. Severe Perioperative Surgical Morbidity in Patients undergoing Cesarean Delivery in California, 2016 – 2021 – Alexander Butwick, MBBS, FRCA, MS
4. Impact of the Kybele Program on Regional Anesthesia for Cesarean Delivery: A 13-Year Evaluation of Anesthesiologist Proficiency at UCCV – Borislava Pujic, MD
5. Influence of pain, psychological and sleep variables on acute to chronic postsurgical pain after cesarean delivery: a prospective observational study – Sarah Ciechanowicz, MA, BMBCh, FRCA, MRes
6. Medicaid expansion, Medicaid generosity, and severe maternal morbidity during delivery hospitalizations - Jean Guglielminotti MD, PhD

SOAP/SOCCA Panel – Extending Knowledge Beyond the OR: What Happens to my Patients in the ICU?
Moderator: Ioannis Angelidis, MD

- Mental Health in Maternal Critical Illness
  Kaitlyn Brennan, DO, MPH
- Sepsis Management in Pregnancy
  Benjamin Brakke, DO
- Peripartum Cardiomyopathy
  Monical Lupei, MD

SMFM Lecture: AI in Obstetrics
Speaker: Melissa Wong, MD

Abstract Breakout Session #1 (Breakout Rooms)
Room 1: Airway
Room 2: High Acuity/ Intensive Care
Room 3: Hypertension
Room 4: Postdural Puncture Headache & Obesity
Room 5: Cardiac 1 – Congenital & Acquired
Room 6: Postpartum Hemorrhage

EMPOWERING CLINICIANS: LEVERAGING AI TO ENHANCE OUTCOMES WHILE UPHOLDING ETHICS, PRIVACY AND SCIENTIFIC RIGOR

Ashley Duqué Kienzle
AI Advisor

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Artificial intelligence (AI) is playing a vital role in improving healthcare but what is AI exactly?

AI is the umbrella term meaning systems performing tasks that usually require human cognitive functions. It includes Machine Learning, Natural Language Processing, Computer Vision and Deep Learning.

- **Ethics**
- **Privacy**
- **Scientific Rigor**

ENHANCING OUTCOMES USING AI

- **Predictive Care**
- **Personalization**
- **Improved Efficiency**

AI IN PREDICTIVE AND PROACTIVE CARE

AI is helping shift from reactive to proactive care using prediction and forecasting risk by analyzing historical and real-time data.

- **Identifying risk factors**
- **Predicting postoperative complications**
- **Providing prevention strategies**

PERSONALIZATION

Tailored pharmaceutical and behavioral intervetions, surgery simulation with digital twin and 3D printed organ replicas, and interpreting complex monitoring are all enabled by AI advances.

- **Early Warning Signs**
- **Digital Twins**
- **Personlaized Medicine and Behavior Change**

IMPROVED EFFICIENCY THROUGH AUTOMATION

AI with Clinical Oversight can free up clinican time, reduce errors and stream line workflows by automating data collection, analysis and completing some logistical tasks.

01 **Documentation**
02 **Scheduling and Resource Allocation**
03 **Robotics**
04 **Image Interpretation**

ETHICAL CONSIDERATIONS IN USING AI IN HEALTHCARE

Proactively addresing ethical considerations is imperativel to ensuring AI works for eveyone. Healthcare providers must prioritize human care, provide transparency/explainability and mitigate biases to improve outcomes for all patients.

- Maintaining a Human Element
- Transparencyand Explainability
- Addressing Bias

OPTIONS FOR PROTECTING PATIENT PRIVACY

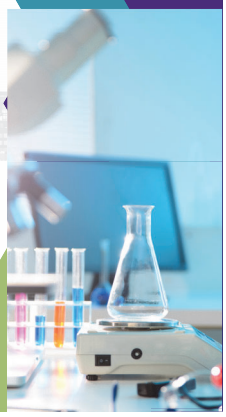
Developing artificial intelligence models in healthcare requires vast amounts of sensitive data and therefore robust privacy protection.

- Annonymiztion.De-identification
- Differential Privacy
- Federated Learning
- Secure Computing

ENSURING SCIENTIFIC RIGOR

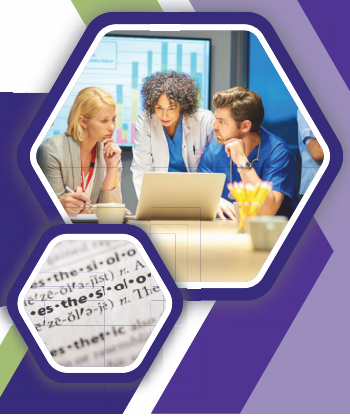
AI models need clinical validation, monitoring and retrainning to ensure they are working as intended and in partnership with clinicians and patients.

- Internal and External Validation
- Training and Simulation
- Randomized Control Trials
- Continuous Improvement



EMPOWERING CLINICIANS WHILE MOVING INTO THE AI FUTURE WITH ENHANCED OUTCOMES

THANK YOU FOR YOUR ATTENTION

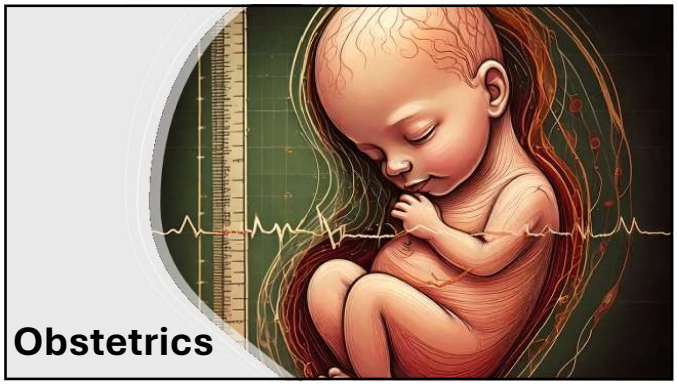



Artificial Intelligence

1


Health Care

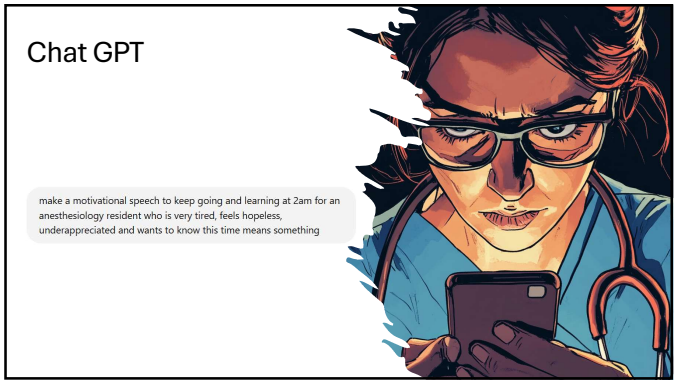
2


Obstetrics

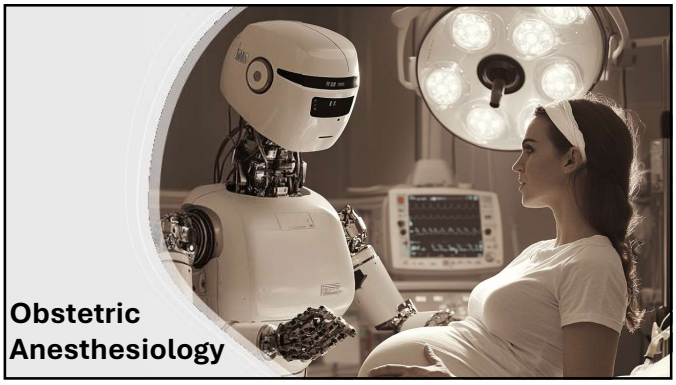
3


Provider Wellness

4


Chat GPT
make a motivational speech to keep going and learning at 2am for an anesthesiology resident who is very tired, feels hopeless, underappreciated and wants to know this time means something

5


Obstetric Anesthesiology

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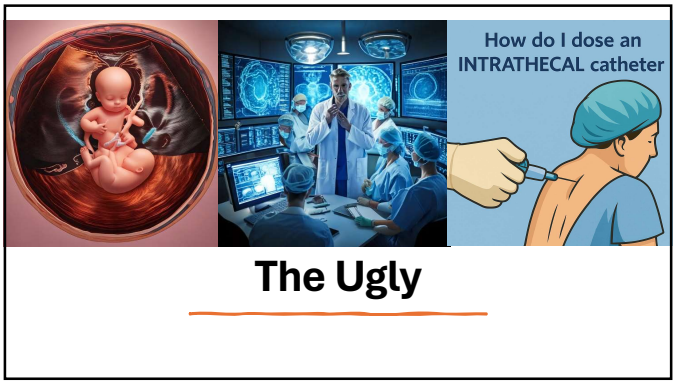
AI Failures

7


How do I dose an INTRATHECAL catheter
The Ugly

8


AI Successes

9


Where Do We GO?

10

Running out of Gas: Burnout, resilience and AI in OB Anaesthesia

Dr Sarah Armstrong
Lead for Obstetric Anaesthesia, Frimley Park Hospital, UK
Honorary Secretary, Obstetric Anaesthetists' Association

1

Who am I?

- Lead for obstetric anaesthesia - education and research
- Elected Honorary Secretary of the Obstetric Anaesthetists' Association
- Honorary Senior Lecturer
  - St George's University London Medical School
  - Southampton University Medical School
  - Brunel University London Medical School
- Day job at a busy DGH - 6000+ deliveries pa

2

I have no conflicts of interest to disclose

3

"Burnout is what happens when you try to avoid being human for too long"

Brene Brown, Sociologist

4

"The best part of my day is when I'm in the room with the patient that I'm caring for. The worst parts of my day are the bits that come before it and after it."

Anonymous physician

5

Burnout

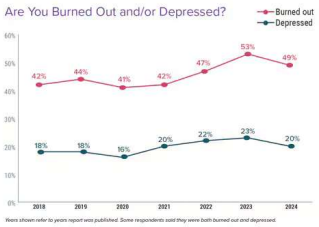
World Health Organization (ICD-11):
"A syndrome resulting from chronic workplace stress that has not been successfully managed"

- Emotional exhaustion
- Depersonalisation - feeling detached, cynical or negative about work or patients
- Reduced personal accomplishment

6

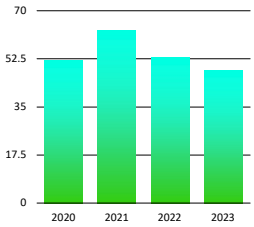
Medscape Physician Burnout & Depression Report 2024: 'We Have Much Work to Do'

Are You Burned Out and/or Depressed?



Years shown refer to years report was published. Some respondents said they were both burned out and depressed.

Percentage of US physicians experiencing burnout



7

"The problem with burnout in medicine is that we have a culture that rewards being overworked"

Dr Kate Granger, MBE

8

Job Stress as the Biggest Culprit

"It takes 12 hours a day at work just to keep my head above water, plus working 3-4 hours each day on weekends."

"My job expects me to complete modules in my off time and be on call via the phone without pay or allowed time off the next morning."

"My department lacks leadership and continues to deteriorate in many ways. Seemingly, no one in authority chooses to do anything about it."

"I am held hostage to patient satisfaction scores that involve hospital care outside of my control."

"I have reached my limit for the BS I can take from the hospital administration, insurance companies, and demanding patients."

9

Which Specialties Have the Greatest Burnout Rates?

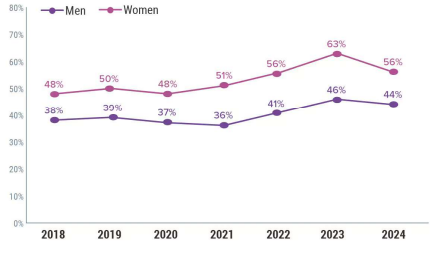
Emergency Medicine	63%
Ob/Gyn	53%
Oncology	53%
Pediatrics	51%
Family Medicine	51%
Radiology	51%
Pulmonary Medicine	50%
Anesthesiology	50%
Gastroenterology	50%
Internal Medicine	50%
Urology	49%
Cardiology	47%
Nephrology	46%
Physical Medicine & Rehabilitation	46%
Dermatology	46%
Critical Care	45%
Surgery, General	45%
Diabetes & Endocrinology	44%
Neurology	44%
Orthopedics	44%
Otolaryngology	43%
Pathology	41%
Psychiatry	39%
Ophthalmology	39%
Plastic Surgery	37%

Not all specialties are shown.

10

Medscape Physician Burnout & Depression Report 2024: 'We Have Much Work to Do'

Are More Female or Male Physicians Burned Out?



Years shown refer to years report was published.

11

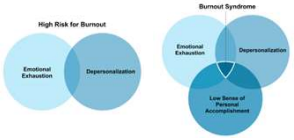
ANESTHESIOLOGY

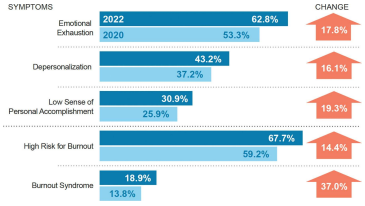
U.S. Attending Anesthesiologist Burnout in the Postpandemic Era

Anoushka M. Afonso, M.D., Joshua B. Cadwell, M.D., M.B.A., Steven J. Staffa, M.S., Jina L. Straley, M.D., Amy E. Vinson, M.D.

Anesthesiology 2024; 140:38–51

- Voluntary survey sent to all attending anesthesiologist ASA members in the United States
- n = 2,698 survey respondents
- 67.7% were at high risk for burnout
- 18/9% of respondents had burnout syndrome





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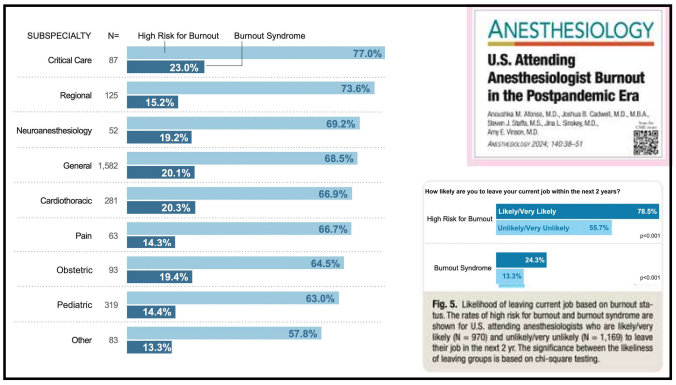

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OB anaesthesia as a cause of burnout

- Work overload and long working hours
- Critical decision making in high pressure environments
- Emotional strain of dealing with patients and families
- Lack of work-life balance
- Lack of recognition and support from colleagues and supervisors
- Financial stress
- "Physician heal thyself"

14

OB anaesthesia as a cause of burnout

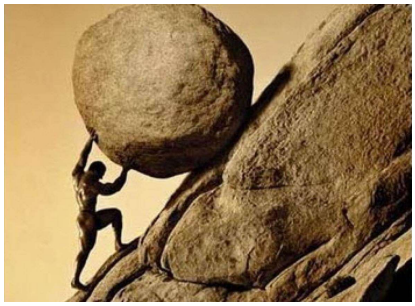
- Work overload and long working hours
- Critical decision making in high pressure environments
- Emotional strain of dealing with patients and families
- Lack of work-life balance
- Lack of recognition and support from colleagues and supervisors
- Financial stress
- "Physician heal thyself"

15

- Non clinical-workloads are too high without allocated time
- Exhaustion due to multiple commitments
- The "Love-hate" relationship with work
- Feeling "on edge", even unsafe on the job
- The changing way in which society views doctors

16

17



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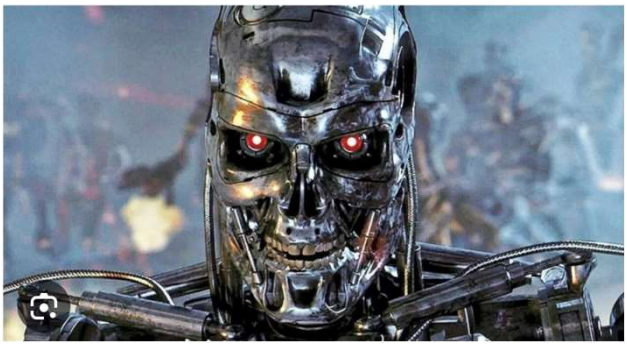

21

Moral distress

Moral distress - psychological unease generated where professionals identify an ethically correct action but are constrained in their ability to take that action

- Lack of power or agency
- Structural limitations
  - Staff,
  - Resources
  - Training
  - Time

Moral distress and moral injury
Recognising and tackling it for UK doctors
BMA

22

Quick Reference Handbook for Obstetric Emergencies

Action card guidance for medical and resuscitation emergencies in hospital

To ensure you have the most up to date version refer to contents page and www.oaa-anaes.ac.uk/qrh

Do not add or remove documents
Do not alter the order of the documents

The guidance in this handbook is not intended to be standards of medical care.
The ultimate judgement with regard to a particular clinical procedure or treatment plan must be made by the clinician in light of the clinical data presented, the diagnostic and treatment options available.

23

2-4a Anaphylaxis v.1

Anaphylaxis is a life-threatening hypersensitivity reaction featuring rapidly developing hypotension and tachycardia, and potentially life threating airway obstruction or bronchospasm. **Common causative agents**: antibiotics, anaesthetic agents, IV colloids, blood products. Latex: catheters, dressings, gloves. Chlorhexidine: skin preparation, impregnated lubricants, or catheters

START

1. **Call for help** (obstetrician, midwife, anaesthetist +/- neonatal team +/- cardiac arrest team)
   - **Ask**: "who will be the team leader?"
   - **Team leader assigns** checklist reader and scribe
   - **Note time**
2. **Assess clinical status using the ABCDE approach**
   - Position woman appropriately (**Box A**)
   - Check airway –*then*– give high flow oxygen
   - If airway involvement → call anaesthetics/ICU
   - Start continuous monitoring: SpO_2, respiratory rate, 3-lead ECG and blood pressure
3. **Treat anaphylaxis**
   - Give adrenaline 500 mcg IM. If no improvement → repeat at 5 minute intervals (**Box B**)
   - Give rapid IV crystalloid bolus
   - Remove any suspected causative agents
4. **Assess response**
   - If no improvement in cardiac or respiratory symptoms after two doses of IM adrenaline state 'refractory anaphylaxis' –*then*– → **2-4b**
5. **Take mast-cell tryptase sample**
   - 5-10 mL clotted blood drawn as soon as feasible following initial resuscitation
6. **Consider transfer of the woman to critical care setting**
7. **Start post event action (Box C)**

Box A: Position
If cardiovascular compromise, Lie flat, tilt bed head down
Avoid aortocaval compression:
- Place in full left lateral position; **or**
- Supine with manual uterine displacement; or
- 15° lateral tilt (if bed/operating table permits)

If respiratory problems without cardiovascular compromise:
- Place in sitting position

Box B: Drug doses and treatments
- **Adrenaline bolus** *500 micrograms IM (0.5 mL of 1:1000 adrenaline) to anterolateral aspect of mid-thigh –or– [specialist use] 50 micrograms IO/IV with appropriate monitoring.
**IM generally preferred; IV/IO adrenaline ONLY to be given by experienced specialists*
- **Oxygen** 15 L/min via reservoir mask –*then*– titrate to SpO_2 94-98%
- **Crystalloid bolus** e.g., 500-1000 ml Hartmann's titrate to response **(reduce to 250-500 ml if pre-eclamptic)**

Box C: Post event actions
- Stop suspected triggers currently prescribed
- Take 2nd tryptase sample at 1-2 hrs, and 3rd after 24 hrs
- Consider cetirizine (10-20 mg PO) for cutaneous symptoms
- Make referral to a specialist allergy clinic or immunology centre to identify the causative agent (see www.bsaci.org)
- Report anaphylactic drug reactions (www.mhra.gov.uk)
- Inform the woman and her GP

Box D: Critical changes
Refractory anaphylaxis → 2-4b
Cardiac arrest → **1-1**

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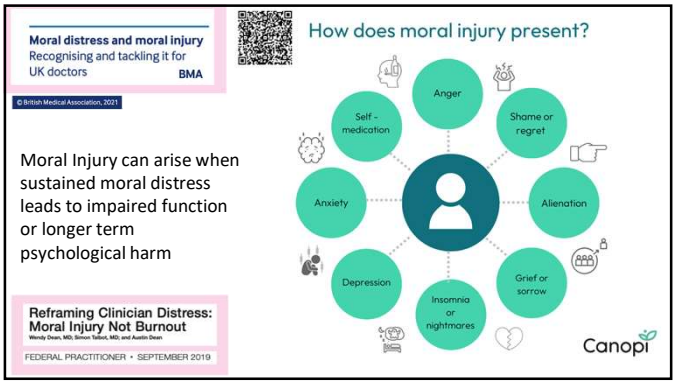

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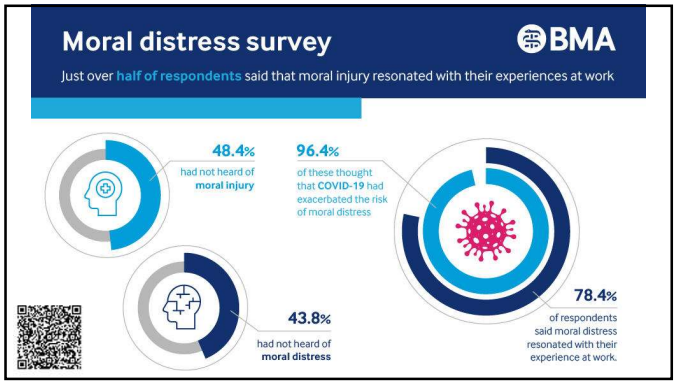

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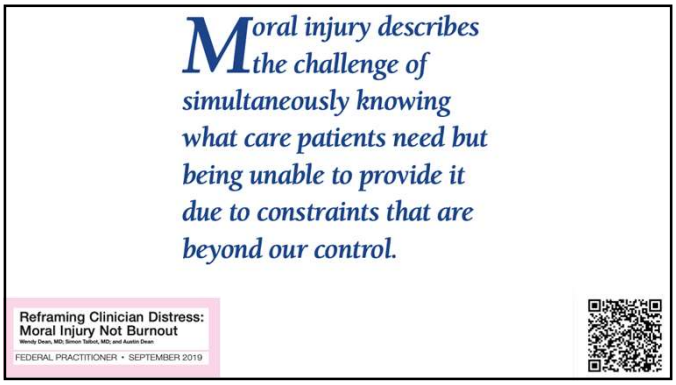

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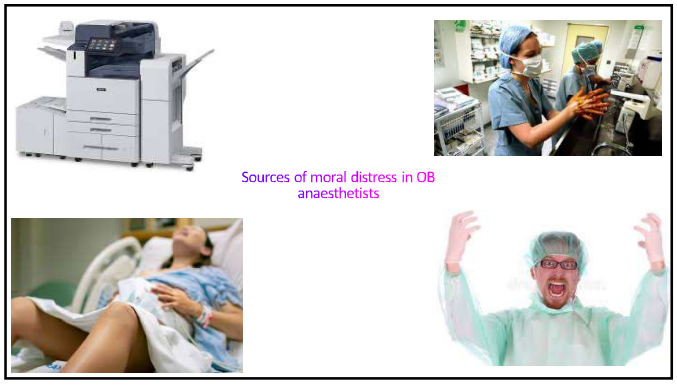

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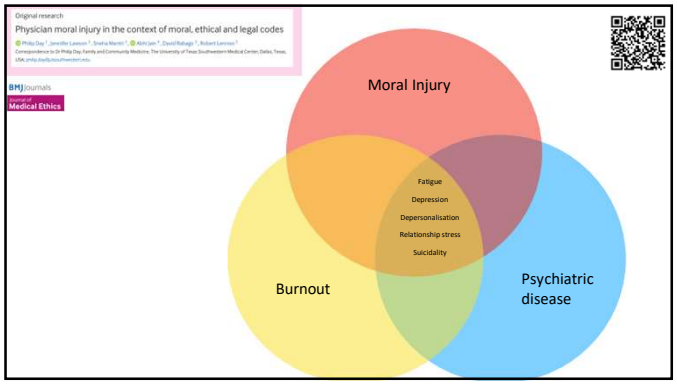

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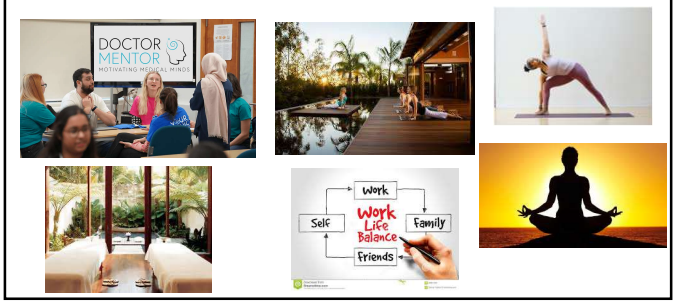
Traditional solutions for physician burnout



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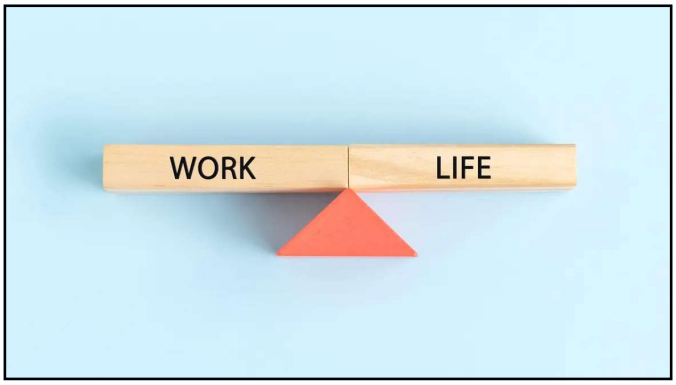
Limitations of current strategies

- Lack of systemic change
- High workload continues to outpace personal coping mechanisms
- Mental health stigma remains a barrier to seeking help

33



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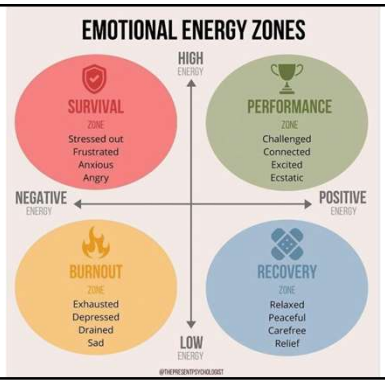

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Strategies to Combat Burnout in OB Anesthesiologists

Individual Strategies

- Manage on-call fatigue
- Develop stress management techniques
- Set professional boundaries
- Foster peer support
- Take advantage of downtime
- Rotate between roles
- Debrief after difficult cases
- Engage in non-clinical interests

Organizational Strategies

- Optimize staffing & scheduling
- Encourage rest breaks
- Improve crisis support systems
- Streamline documentation
- Enhance team communication
- Create a wellness culture
- Recognize & reward contributions
- Support career flexibility

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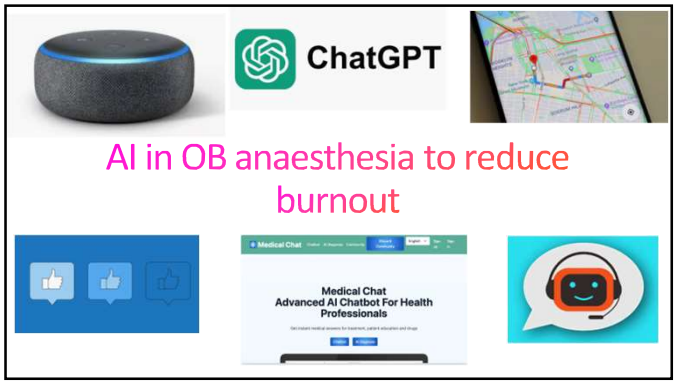

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1. Automating administrative tasks

1. **EMR management**
   - Data entry, billing, appointment scheduling
2. **Speech recognition software**
   - Natural Language Processing and Machine learning algorithms can extract key data from clinical notes and automate documentation processes
3. **Smart scheduling of rotas**

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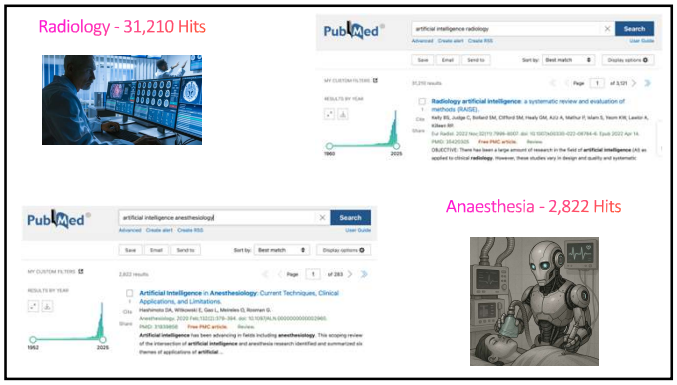

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2. Enhancing clinical decision making

- Predictive risk models integrated with AI and the EMR could make risk calculation more accessible, specific and actionable:
  - Physical status scoring
  - Airway assessment
  - Prediction of:
    - Post-op delirium
    - Introperative blood products
    - Post-op ICU

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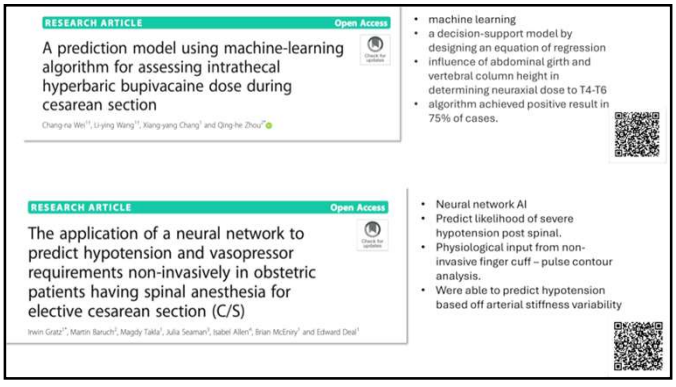
- BMI 64.5 kg/m2
- Unable to identify landmarks on palpation
- Standard US could not identify interspinous spaces
- AI-US successfully identified desired intervertebral space and depth to epidural space (8cm)

41



- machine learning
- a decision-support model by designing an equation of regression
- influence of abdominal girth and vertebral column height in determining neuraxial dose to T4-T6
- algorithm achieved positive result in 75% of cases.

- Neural network AI
- Predict likelihood of severe hypotension post spinal.
- Physiological input from non-invasive finger cuff – pulse contour analysis.
- Were able to predict hypotension based off arterial stiffness variability

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3. Reducing cognitive load

- Prioritising, organising and summarising complex data from multiple sources
- Can integrate patient data with clinical guidelines:
  - Summarises key issues
  - Provides actionable insights for doctors in real time
  - Smart checklists for emergencies
  - Forecasting
- Reduces pajama time

43

3. Streamlining communication

Automating Responses to Patient Portal Messages Using Generative AI

Amarpreet Kaur, Alex Budko, Katrina Liu, Eric Eaton, Bryan Steitz, Kevin B. Johnson

doi: https://doi.org/10.1101/2024.04.25.24306183

medRxiv BMJ Yale

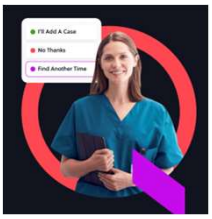
Posted April 25, 2024.

EDITORIAL Cited in Scopus: 0

Effectiveness of artificial intelligence (AI) chatbots in providing labor epidural analgesia information: are we there yet?

International Journal of Obstetric Anesthesia, Vol. 62, Published online: March 24, 2025

Paige M Keasler, Joel Chee Yee Chan, Ban Leong Sng



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4. Supporting mental health and wellbeing

- AI wearable technologies can potentially
  - Enhance early detection of mental health issue
  - Provide personalised suggestions for intervention
  - Offer support through innovative platforms

Enhancing mental health with Artificial Intelligence: Current trends and future prospects

David B. Olawade [a], Ojima Z. Wada [b], Aderonke Odetayo [c], Aanuoluwapo Clement David-Olawade [d], Fiyinfoluwa Asaolu [e], Judith Eberhardt [f]

Journal of Medicine, Surgery, and Public Health

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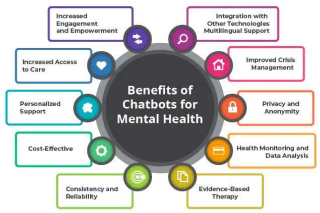

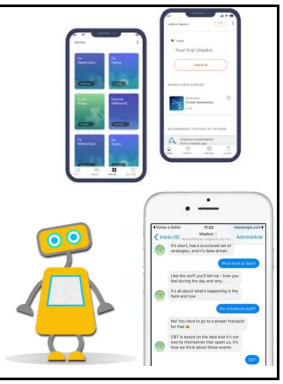

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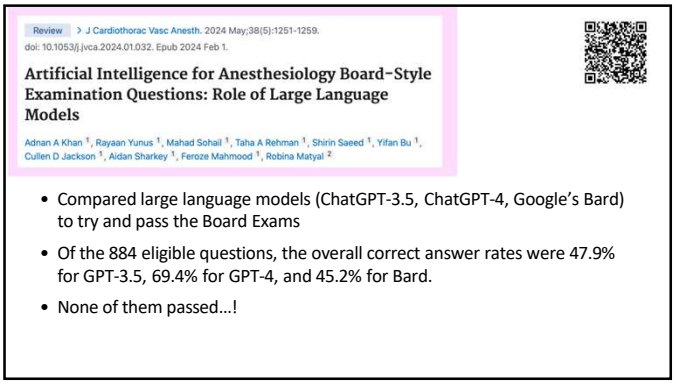
5. Personalised learning and training

- Chatbots (assist in the understanding of complex clinical scenarios)
- Virtual patients
- Intelligent tutoring systems (one to one human teaching)
- Gamification
- Adaptive learning systems

48



- Compared large language models (ChatGPT-3.5, ChatGPT-4, Google's Bard) to try and pass the Board Exams
- Of the 884 eligible questions, the overall correct answer rates were 47.9% for GPT-3.5, 69.4% for GPT-4, and 45.2% for Bard.
- None of them passed…!

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Could AI exacerbate burnout?

- Potential deskilling and overreliance on AI
- Changing cognitive demands
- Patient-doctor alienation
- Job displacement concerns
- Equity concerns in AI integration
- "Black box"

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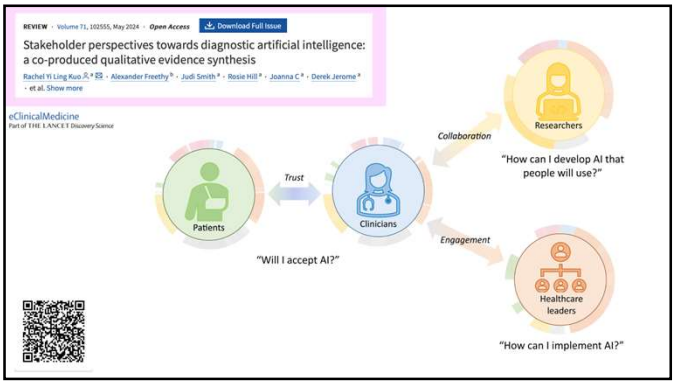

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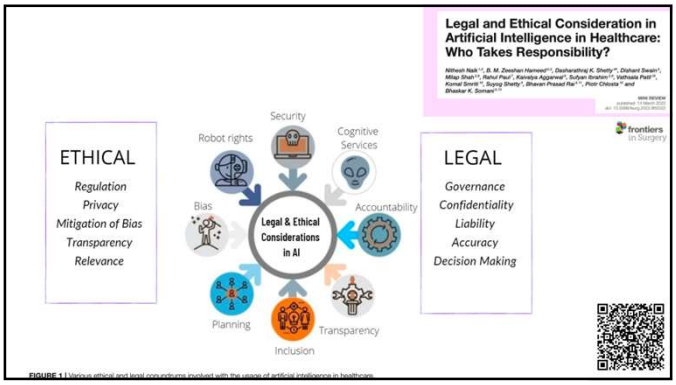

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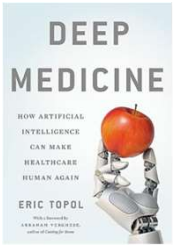
"AI won't replace doctors, but doctors who use AI will replace those who don't"



Eric Topol
Cardiologist and Author of "Deep Medicine"

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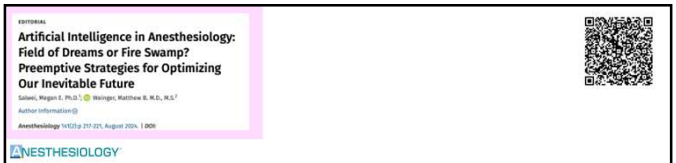

For better or for worse, AI will be embedded in our electronic health records, our medical devices, and in hospital systems with the goal of optimizing cost, production, and quality. However, this "field of dreams" will quickly become a "fire swamp" if AI is not designed and implemented with a human-centered approach.

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Summary

- Burnout and moral injury locate the source of distress in a broken system, not a broken individual
- AI has significant potential in reducing burnout in OB anesthesia:
  - Automatic routine tasks
  - Enhancing clinical decision making
  - Improving communication
  - Reducing cognitive load
- We need strong medical leadership to ensure the needs of doctors are not sidelined
- We need a framework to incorporate AI topics into our training programmes to adequately equip our residents for a future practice augmented by AI applications

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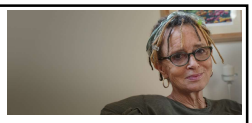

"Almost everything will work again if you unplug it for a few minutes, including you."
— *Anne Lamott*

Thank you
saraharmstrong1@nhs.net

56

Stanford MEDICINE

The TRPV4 channel could be part of the problem—and the solution—in uterine atony

Daiana D. Fornes, PhD; Guillermina Michel, BS; David N. Cornfield, MD; Jessica R. Ansari, MD, MS

Stanford University School of Medicine

SOAP 2025 Annual Meeting

APRIL 30 - MAY 4, 2025

HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

SOAP Society for Obstetric Anesthesia and Perinatology

1

SPEAKER DISCLOSURE

I have nothing to disclose.

SOAP 2025 Annual Meeting

APRIL 30 - MAY 4, 2025

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2

Clinical Problem & Knowledge Gap

Uterine atony

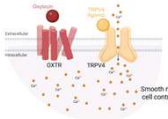
- Failure of the uterus to contract firmly after delivery to stop bleeding from the placental bed (~500ml/min)
- Causes 80% of maternal hemorrhage cases
- Impacts 1 in 12 deliveries
- #1 cause of maternal death worldwide

Oxytocin Treatment Gaps

- Oxytocin is a first-line treatment for uterine atony
- Mechanism of action (and failure in atony) remain incompletely understood

Hypothesis

TRPV4 is required for oxytocin to induce contraction in human uterine smooth muscle, and that its dysfunction contributes to uterine atony.



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Methods

Human Myometrial Samples

- Term, non-laboring cesarean deliveries (≥37 weeks)
- Biopsies collected from the upper margin of the lower uterine segment incision, post-placenta delivery.

Control
Uterine tone score ≥ 8
one dose oxytocin
QBL < 1000 mL

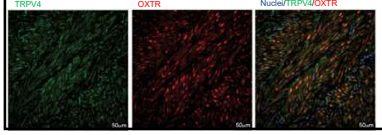
Atony
Uterine tone score < 6
2nd line uterotonic
QBL > 1000 mL

Assays
- Calcium imaging
- Collagen gel contraction
- Proximity Ligation Assay (PLA)

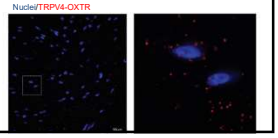
TRPV4 modulation
- Pharmacologic
  - GSK1016790A (agonist)
  - GSK2798745 (antagonist)
- Genetic
  - siRNA-mediated TRPV4 knockdown

Results: TRPV4 and OXTR interact in the gravid human myometrium

TRPV4 and OXTR colocalize in uterine smooth muscle



TRPV4 and OXTR interact in term myometrium (PLA)



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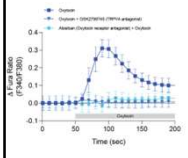
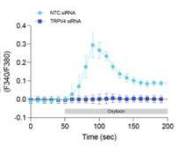
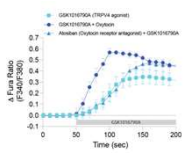
Results: *TRPV4 is Required for Oxytocin Response*

Intracellular Calcium

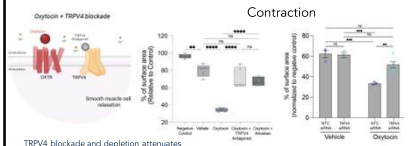




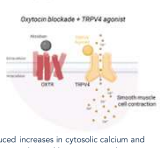
Intracellular Calcium



Contraction



TRPV4 blockade and depletion attenuates oxytocin-induced responses in cytosolic calcium and contractility

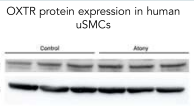


TRPV4-induced increases in cytosolic calcium and contractility are enhanced by oxytocin and remain unaffected by OXTR blockade

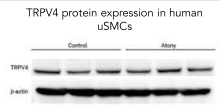
5

Results: In uterine atony TRPV4-OXTR interaction is reduced

OXTR protein expression in human uSMCs

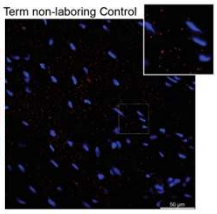


TRPV4 protein expression in human uSMCs

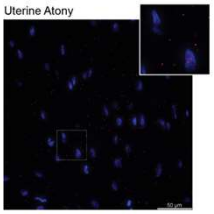


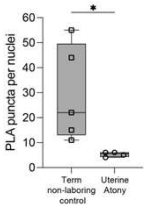
Reduced TRPV4–OXTR interaction may contribute to oxytocin resistance in uterine atony

Term non-laboring Control



Uterine Atony





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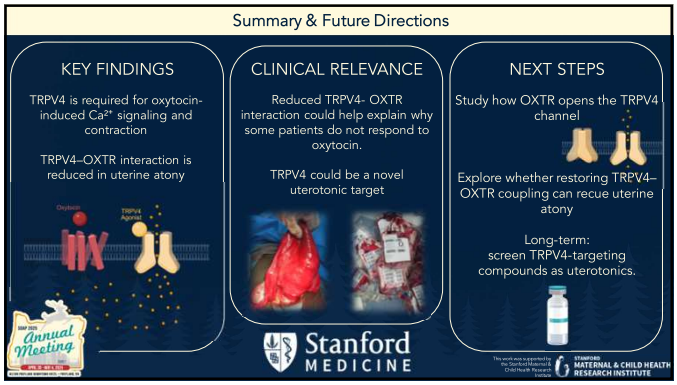

Summary & Future Directions
KEY FINDINGS
TRPV4 is required for oxytocin-induced Ca²⁺ signaling and contraction
TRPV4–OXTR interaction is reduced in uterine atony
CLINICAL RELEVANCE
Reduced TRPV4- OXTR interaction could help explain why some patients do not respond to oxytocin.
TRPV4 could be a novel uterotonic target
NEXT STEPS
Study how OXTR opens the TRPV4 channel
Explore whether restoring TRPV4–OXTR coupling can recue uterine atony
Long-term:
screen TRPV4-targeting compounds as uterotonics.
Annual Meeting
Stanford MEDICINE
STANFORD MATERNAL & CHILD HEALTH RESEARCH INSTITUTE

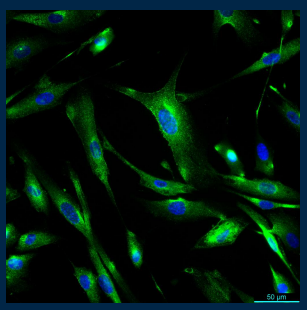
7

SINGLE NUCLEAR TRANSCRIPTOMICS UNCOVER DOWNREGULATION OF FSHR IN THE MYOMETRIUM OF PATIENTS WITH UTERINE ATONY

Jessica Ansari, Daiana Fornes, Carsten Knutsen, Guillermina Michel, Alexander Kum, Virginia Winn, David Cornfield

Stanford MEDICINE
School of Medicine

1



SPEAKER DISCLOSURE

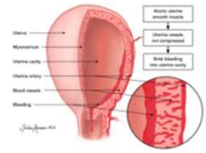
I have nothing to disclose.

2

BACKGROUND

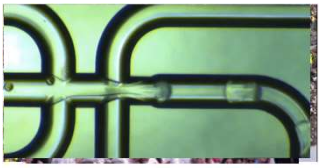
Uterine atony

- Causes 80% of PPH
- More than half of cases occur in low-risk patients
- We need to figure out the *why* on a cellular and molecular level to:
  - Predict (biomarkers)
  - Treat (develop new uterotonics)



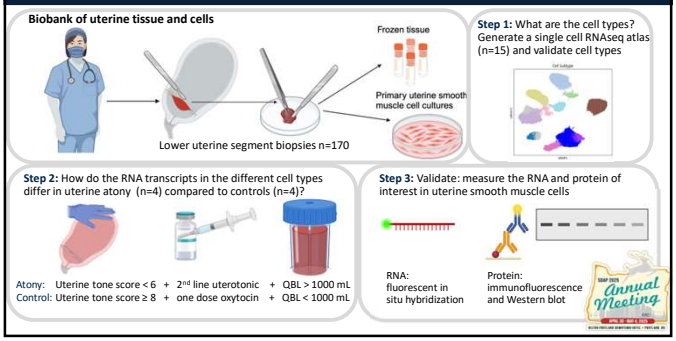
Single cell transcriptomics

- Count all the RNA transcripts in each cell of a tissue sample
- Can look at each different cell type for differences, for example between uterine atony and control patients



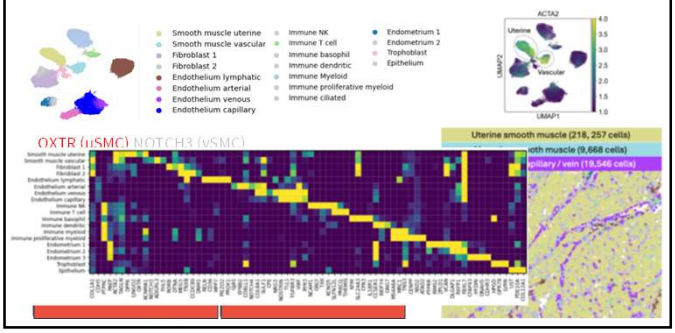
3

METHODS



4

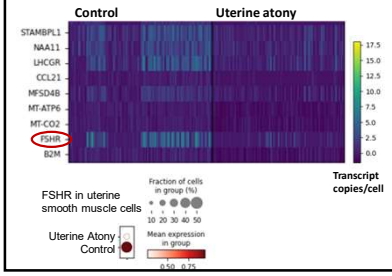
RESULTS STEP 1: a snRNAseq atlas (n=15)



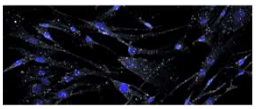
5

RESULTS STEP 2-3: Less FSHR in uSMC in uterine atony

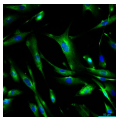
Gonadotropin and reproductive endocrinology signaling pathway genes in uterine smooth muscle cells

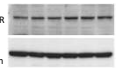


Validation: Do we actually have FSHR in our uterine smooth muscle cells?



RNA *in situ* hybridization: yes! N=6

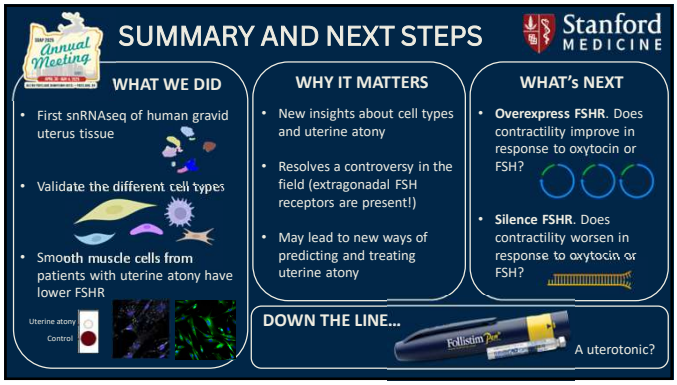




Protein Western blot: yes! N=6

Protein IF: yes! N=6

6


SUMMARY AND NEXT STEPS
Stanford MEDICINE
WHAT WE DID
First snRNAseq of human gravid uterus tissue
Validate the different cell types
Smooth muscle cells from patients with uterine atony have lower FSHR
Uterine atony
Control
WHY IT MATTERS
New insights about cell types and uterine atony
Resolves a controversy in the field (extragonadal FSH receptors are present!)
May lead to new ways of predicting and treating uterine atony
WHAT's NEXT
Overexpress FSHR. Does contractility improve in response to oxytocin or FSH?
Silence FSHR. Does contractility worsen in response to oxytocin or FSH?
DOWN THE LINE...
Follistim AQ
A uterotonic?

7

UCSF Department of Anesthesia and Perioperative Care

SOAP Society for Obstetric Anesthesia and Perinatology

Severe Perioperative Surgical Morbidity in Patients Undergoing Cesarean Delivery In California, 2016 - 2021

Authors: A.J. Butwick MBBS, FRCA, MS [1]; R.J. Baer PhD [2,3]; N. Farooqi FACOG [4]; O Stephansson MD PhD [5]; L. Jelliffe-Pawlowski PhD MS [3,6]

Institutions: [1]Department of Anesthesia & Perioperative Care, UCSF; [2]Department of Pediatrics, UCSD; [3]California Preterm Birth Initiative, UCSF; [4]Department of Obstetrics and Gynecology, UCSF; [5]Department of Obstetrics, Karolinska University Hospital; [6]NYU Rory Meyers College of Nursing

1

INTRODUCTION

- **Cesarean Delivery (CD): Most common surgical procedure**
  - **>1.1 million; 32% all births – US (2023) [1]**
- **Limited data – CD surgical-related morbidity**
  - **CDC severe maternal morbidity index: not CD specific; only 1 surgical morbidity indicator [2]**
  - **Few epidemiologic studies [3,4]**

1. Hamilton BE. Vital Statistics Rapid Release (CDC); no 35. April 2024
2. National Center for Chronic Disease Prevention and Health Promotion
3. Larsson. PLoS ONE 2021; 16: e0258222
4. Sheikh. Am J Obstet Gynecol MFM 2020;2:100071

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2

Primary Aim:

- Quantify the prevalence of severe perioperative surgical morbidity (SPSM) in patients undergoing cesarean delivery

Secondary Aims:

I. Quantify the SPSM prevalence in patients undergoing prelabor (elective) and intrapartum cesarean delivery

II. Identify potential risk factors for SPSM

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3

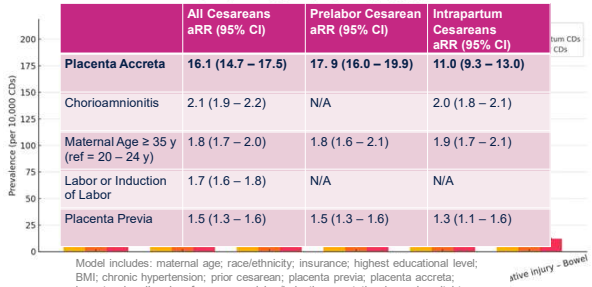
METHODS

- **Study Design:** Population-based cross-sectional study - linked California Birth Certificate – Maternal Discharge records
- **Study Cohort:** Singleton pregnancies; CDs; 2016 – 2021 (n=594,655)
- **Primary Outcome:** Composite measure of surgical morbidity (ICD-10 codes):
  - Bowel, bladder, genitourinary/pelvic, uterine injury; broad ligament hematoma; pelvic/retroperitoneal hematoma; hysterectomy; vascular injury; wound complication; ileus/bowel obstruction; acute peritonitis; shock
- **Statistical Analyses:**
  - Proportions – overall; prelabor vs intrapartum cesarean delivery; individual morbidities
  - Poisson log-linear regression - Associations between potential predictors (patient and hospital characteristics) and SPSM

4

RESULTS

	All Cesareans aRR (95% CI)	Prelabor Cesarean aRR (95% CI)	Intrapartum Cesareans aRR (95% CI)
Placenta Accreta	**16.1 (14.7 – 17.5)**	**17. 9 (16.0 – 19.9)**	**11.0 (9.3 – 13.0)**
Chorioamnionitis	2.1 (1.9 – 2.2)	N/A	2.0 (1.8 – 2.1)
Maternal Age ≥ 35 y (ref = 20 – 24 y)	1.8 (1.7 – 2.0)	1.8 (1.6 – 2.1)	1.9 (1.7 – 2.1)
Labor or Induction of Labor	1.7 (1.6 – 1.8)	N/A	N/A
Placenta Previa	1.5 (1.3 – 1.6)	1.5 (1.3 – 1.6)	1.3 (1.1 – 1.6)



Model includes: maternal age; race/ethnicity; insurance; highest educational level; BMI; chronic hypertension; prior cesarean; placenta previa; placenta accreta; hypertensive disorder of pregnancy; labor/induction; gestational age; hospital type (teaching/non-teaching); hospital location (urban/rural); annualized CD volume

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5

CONCLUSION

- **Main findings:**
  - 1st study –severe surgical morbidity index in CD
  - SPSM prevalence: 1.7% (1 in 59 CDs)
  - Higher prevalence: intrapartum vs prelabor CD (2.0% vs 1.5%)
  - Placenta accreta – very strong risk factor - SPSM (aRR 16)
- **Study Strengths:** Large contemporary population; generalizability
- **Limitations:** ICD-10 codes – morbidity; no timestamps for morbidity events; no data on long-term outcomes
- **Further study:** Validate measure; Assess ~ potential metric for surgical quality of care

Email: alexander.butwick@ucsf.edu

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6

Impact of the Kybele Program on Regional Anesthesia for Cesarean Delivery: A 13-Year Evaluation of Anesthesiologist Proficiency at UCCV

Borislava Pujic[1] MD, PhD, **Slavica Krusic**[2] MD, **Aleksandra Vejnovic**[3,4] MD, PhD, **Ivan Velickovic**[5] MD, **Nada Pejcic**[6] MD, **Medge Owen**[7] MD
[1] UCCV, Clinic of Anesthesia, Intensive Care and Pain Therapy, Gynecology and Obstetrics Hospital, Department of Anesthesia, Novi Sad, Serbia
[2] Gynecology and Obstetrics Clinic Narodni Front, Department of Anesthesiology, Belgrade, Serbia
[3] UCCV, Gynecology and Obstetrics Hospital, Novi Sad, Serbia
[4] University of Novi Sad, Faculty of Medicine, Novi Sad, Serbia
[5] Yale School of Medicine, New Haven, CT, USA
[6] UCC Nis, Clinic of Anesthesia and Intensive Care, Nis, Serbia
[7] Wake Forest School of Medicine, Department of Anesthesiology, Winston Salem, NC, USA



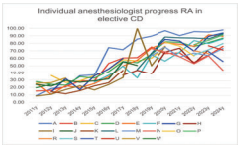
Introduction

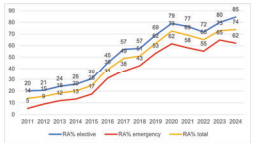
- Thirteen years ago, the use of regional anesthesia (RA) for cesarean delivery (CD) and labor analgesia in Serbia was still remarkably low
- General anesthesia (GA) was the predominant choice in nearly all hospitals across the country
- In 2012, UCCV started a long-term collaboration with the Kybele program to improve maternal outcomes through education
- Annual visits by the Kybele team provided innovative, hands-on training
- The most valuable component was the immersive training during the Schools of Obstetric Anesthesia

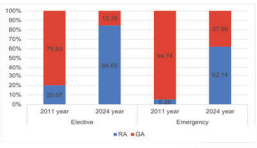
Methods

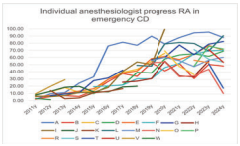
- Data from the UCCV delivery database (2011–2024) were analyzed for GA and RA use in elective and non-elective CDs
- Individual anesthesiologist data were reviewed to assess trends in RA utilization over time

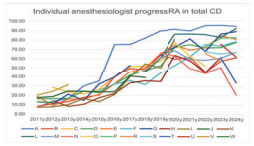
Results











Discussion

- The Kybele program began in Turkey, later expanding to countries including Croatia, Armenia, Georgia, Romania, Ghana
- Ongoing programs exist in Ghana, Serbia, Bosnia and Herzegovina, Republic of Srpska, and North Macedonia
- Each program is adapted to local cultural and healthcare systems

Conclusion

- The greater increase in RA use for non-elective cases was expected, as faculty had already expanded RA use in elective CDs
- More education is needed for providers who use RA less often
- Continued practice and training are crucial for improving RA use in many hospitals

Literature:
- Curr Anesthesiol Rep. 2023;13;76–82
- Front Public Health. 2017;5:134

Influence of Pain, Psychological and Sleep Variables on Acute to Chronic Postsurgical Pain After Cesarean Delivery: a Prospective Observational Study

Ciechanowicz S, Michel G, Panigrahy N, Guo N, Carvalho B, Sultan P

Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine, California, USA

Background and Aims

- Chronic postsurgical pain (CPSP) affects 15% of patients following cesarean delivery (CD).[1]
- Despite this, its impact on maternal quality of life remains underexplored.
- This study investigates key psychosocial contributors to CPSP:
  - ➢ mental health symptoms
  - ➢ pain-related cognitions
  - ➢ postpartum sleep disturbance
- Addresses a critical gap in understanding the biopsychosocial mechanisms underlying the development of chronic pain after childbirth.[2]

1. Wang LZ, et al.. Anaesthesia. 2025 Mar 11. doi: 10.1111/anae.16596.
2. Sluka KA et al. Pain. 2023 Sep 1;164(9):1912-1926

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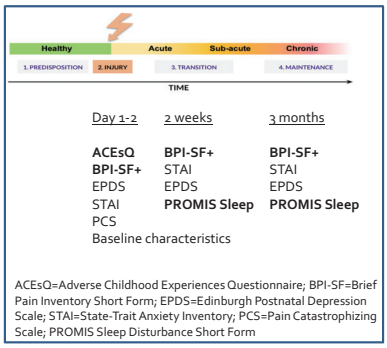
Study Design and Methods

- Single-center prospective study.
- We recruited adult patients after CD:
  - Intra-partum or planned
  - ≥37/40 gestation
  - English or Spanish speaking.
- Follow up via REDCap, text and telephone.
- CPSP: Pain at >3 months (Yes or No).



ACEsQ=Adverse Childhood Experiences Questionnaire; BPI-SF=Brief Pain Inventory Short Form; EPDS=Edinburgh Postnatal Depression Scale; STAI=State-Trait Anxiety Inventory; PCS=Pain Catastrophizing Scale; PROMIS Sleep Disturbance Short Form

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Results

- 143 participants enrolled (Feb–Sep 2024);
  - ✓ 105 (73%) completed 2-week follow-up
  - ✓ 100 (70%) completed 3-month follow-up
- CPSP at 3 months: 40% (40/100)
- Adverse Childhood Experiences (ACEs):
  - ➢ Not associated with pain outcomes
  - ➢ 24 h state anxiety ($\rho = 0.20$, $p = 0.020$) depressive symptoms ($\rho = 0.18$, $p = 0.035$)
- Pain Catastrophizing:
  - ➢ 24 h state anxiety ($\rho = 0.62$, $p < 0.001$) depressive symptoms ($\rho = 0.54$, $p < 0.001$)
  - ➢ Sleep disruption 2 weeks ($\rho = 0.27$, $p = 0.007$)

Variable	Median [IQR] – No Chronic Pain	Median [IQR] – Yes Chronic Pain	P-value	Sig.
Demographics				
Age	33.5 [28, 37]	34 [30, 37]	0.624	
Parity	0 [0, 1]	0.5 [0, 1]	0.778	
Education level	2 [1, 3]	2 [1, 2]	0.423	
BMI	30.9 [27, 34.8]	28.3 [25.6, 33.2]	0.176	
Pain Catastrophizing				
Pain Catastrophizing Score	5 [0.8, 16.5]	5 [1, 12]	0.862	
Acute Pain (24 to 48 hours)				
Worst Acute Pain (NRS 0-10)	6 [4, 8]	7 [6, 8]	0.025	*
Duration of Time Severe Pain (%)	20 [0, 40]	30 [20, 50]	0.011	*
Chronic Pain (3 to 4 months)				
Worst Pain (NRS 0-10)	0 [0, 1]	5 [4, 7]	<0.001	***
Pain Interference (BPI-SF)				
Sleep (24 to 48 hours)	4 [1, 7]	5 [3, 8]	0.041	*
Feeling in Control (24 to 48 hours)	3.5 [0.8, 5.2]	5 [1.5, 8.5]	0.065	.
Sleep Disturbance (PROMIS)				
2 weeks	13.5 [0, 22]	19 [11, 24.5]	0.042	*
3 to 4 months	16 [9.8, 22]	19 [12, 25.5]	0.110	
Anxiety (STAI)				
24 to 48 hours	44 [41, 46]	44 [43, 46]	0.235	
2 weeks	46.5 [0, 49]	47 [42.2, 49]	0.378	
3 to 4 months	47 [46, 49]	46.5 [44, 49]	0.053	.
Depression (EPDS)				
EPDS (24 to 48 hours)	4 [1, 8]	3 [0, 9]	0.534	
EPDS (2 weeks)	2 [0, 7]	0 [0, 8.2]	0.738	
EPDS (3 to 4 months)	1 [0, 5.2]	3.5 [0, 8]	0.045	*

Table 1. Median [IQR] variable comparisons by pain group (pain present at 3 to 4 months Yes or No). Values are presented as Median [Interquartile Range]. P-values calculated using Mann–Whitney U test. * p < .05, ** p < .01, *** p < .001, . = trend (p < .10). Abbreviations: BPI-SF= Brief Pain Inventory Short Form; EPDS = Edinburgh Postnatal Depression Scale; STAI = State-Trait Anxiety Inventory; PROMIS = Patient-Reported Outcomes Measurement Information System.

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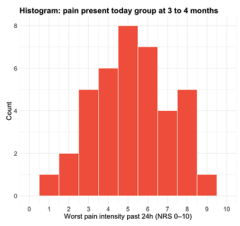
Results: Chronic Pain Group

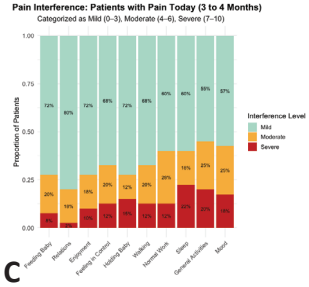


A

Interference Domain	Median [IQR]
General Activities	3 [0.8, 6]
Mood	3 [0, 6]
Normal Work	2 [0, 5]
Sleep	2 [0, 6]
Enjoyment	1 [0, 5]
Feeling in Control	1 [0, 5]
Holding Baby	1 [0, 4.2]
Walking	1 [0, 6]
Feeding Baby	0 [0, 4]
Relations	0 [0, 1.2]

Table: Pain interference scores (Median [IQR]) of patients with pain present today (3 to 4 months postpartum)

B



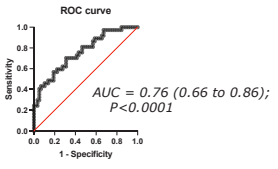
C

SOAP 2025 ANNUAL MEETING

Results: Predictors of Chronic Pain

Variable	OR (95% C.I.)	P value
Inpatient variables		
BPI Worst pain over the past 24 h	1.25 (1.03 to 1.52)	**0.020**
Duration of time in severe pain in past 24 h	1.21 (1.03 to 1.4)	**0.020**
BPI Pain interference with sleep	1.14 (1.00 to 1.3)	**0.044**
Pain interference with ability to feel in control	1.13 (1.00 to 1.28)	0.055
BPI Pain interference with general activities	1.12 (0.98 to 1.27)	0.088
BPI Current pain (24 to 48 h)	1.10 (0.93 to 1.3)	0.275
2 week variables		
BPI Pain interference with general activities	1.24 (1.02 to 1.5)	**0.028**
BPI Pain interference with sleep	1.20 (0.99 to 1.45)	0.057
PROMIS Sleep Disturbance Short Form	1.08 (1.01 to 1.15)	**0.030**
3 month variables		
PROMIS Sleep Disturbance Short Form	1.05 (1.00 to 1.10)	**0.049**
STAI score	1.04 (1.00 to 1.08)	**0.038**

Table. Variables and association with the odds of chronic pain presence; OR= Odds ratio; p-values in **bold** are statistically significant. BPI= Brief Pain Inventory; STAI= State Trait Anxiety Inventory



Antenatal	Postoperative day 1-2
BMI	Worst pain past 24 h (BPI-SF)
	Duration of time in severe pain past 24 h
	Pain interference with sleep (BPI-SF)
	Pain interference with ability to feel in control

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Discussion and Conclusion

- CPSP was common at 3 months, highlighting the need for early identification.
- Sleep disturbance emerged as a consistent factor and may represent a modifiable risk.
- Pain interference with sleep and activity improved prediction
  - value of functional pain metrics.
- Pain catastrophizing strongly linked to mood, supporting biopsychosocial screening.
- ACEs may influence emotional wellbeing more than pain outcomes in this population.
- Our study supports personalized postpartum pain care
  - targeting sleep and psychosocial risk
  - potential for future digital tools.

2025 SOAP ANNUAL MEETING
Leveraging Technology for Better Outcomes
Improving Lives of Patients & Clinicians

Medicaid Expansion, Medicaid Generosity, and Severe Maternal Morbidity During Delivery Hospitalizations

Jean Guglielminotti & Guohua Li

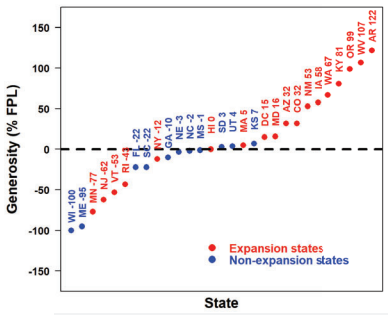
COLUMBIA | COLUMBIA UNIVERSITY DEPARTMENT OF ANESTHESIOLOGY

The 2014 Affordable Care Act Medicaid Expansion

- **For low-income adults**
  → Give states the option to expand Medicaid coverage to adults with incomes up to 138% of the Federal Poverty Level ($14,580 per year in 2024)
- **In states that implemented the Medicaid expansion**
  → Increase in perinatal healthcare access and utilization (e.g., number of prenatal visits)
- **Maternal health outcomes** (e.g. severe maternal morbidity)
  → Conflicting results on the impact of the expansion

Limitation of previous research

- Did not account for the variations across states in the change in the Medicaid eligibility income associated with the expansion (i.e., generosity)
- **Generosity → Absolute difference in Medicaid eligibility income between 2015 and 2013**

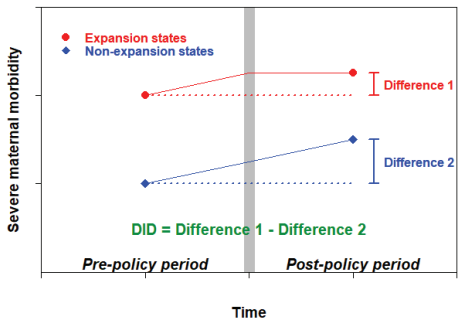


Median in expansion states = +24% (range: -77, + 122)
Median in non-expansion states = -3% (range: -100, +7)

Aims

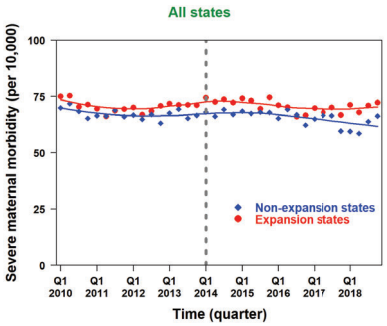
- **To assess the change in SMM associated with the Medicaid expansion in expansion states compared to non-expansion states**
  - **Difference-in-differences method (2-way interaction)**
  - **SMM**: CDC definition, exclusive of blood transfusion only
  - **HCUP data from 2010 to 2018**
    - 18 states that expanded Medicaid in January 2014
    - 11 states that did not expand Medicaid
  - **Data for 15 million delivery hospitalizations**
- **To assess whether the change in SMM associated with the expansion depends on whether people live in a generous state or in a non generous states**
  - **Difference-in-differences-in-differences method (3-way interaction)**
  - **Generous state: Change in Medicaid eligibility income > 0% FPL**

Difference-in-Differences Method



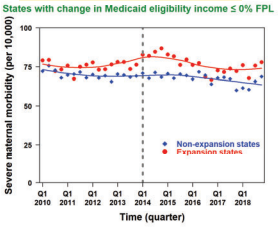
- Regression coefficient β3 of the 2-way interaction term
- $Logit\ (Y_i) = \beta 0 + \beta 1\ Exposure_i + \beta 2\ Intervention_i + \beta 3\ Exposure \times Intervention_i + \beta 4\ M_i$
- Percent change = $100 \times (e^{\beta 3} - 1)$

Results: Difference-in-Differences Method

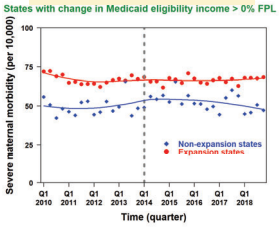


ALL STATES
Adjusted percent change
+4.7% (95% CI: 1.8, 7.6)

NON-GENEROUS STATES
Adjusted percent change
+8.8% (95% CI: 5.1, 12.6)



GENEROUS STATES
Adjusted percent change
-8.9% (95% CI:-15.4, -1.8)



Difference-in-differences-in-differences method
-15.1% (95% CI: 7.9, 21.8) relative decrease
in SMM rate in generous states compared to non-generous states

Subgroup Analyses for the Comparison of Generous and Non-generous States

No information on household income in HCUP data
→ Analyses of subgroups of people likely to be low-income

	DIDD adjusted percent change (95% CI)
Quartile of ZIP code median household income	
Quartile 1 (poorest neighborhood)	**-28.5% (-39.3, -15.5)**
Quartile 2	**-23.2% (-34.4, -10.1)**
Quartile 3	-10.7% (-23.5, 4.3)
Quartile 4 (richest neighborhood)	14.2% (-6.3, 39.2)
Health insurance	
Medicaid	**-25.6% (-34.8, -15.1)**
Private	-5.4% (-15.7, 6.0)

Conclusions

- **The impact of Medicaid expansion on maternal health outcomes depends on the state Medicaid generosity**
- **State efforts to improve the health of low-income birthing people could focus on policies increasing Medicaid generosity**

Acknowledgements

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- Jamie Daw (Health Policy and Management)

Abstract #: THUR-BP-01

The TRPV4 channel could be part of the problem—and the solution—in uterine atony

Presenting Author: Daiana D. Fornes

Presenting Author's Institution: Stanford University School of Medicine - Palo Alto, California

Co-Authors: David Cornfield, MD - Stanford University School of Medicine
Guillermina Michel, BS - Stanford University School of Medicine

Abstract :

Background

In patients with uterine atony—the leading cause of postpartum hemorrhage (PPH)—the uterus fails to contract in response to oxytocin [1]. In many cases, especially when low risk, non-laboring patients have uterine atony, the reason for oxytocin failure remains unknown. Part of the problem is lack of knowledge about how exactly oxytocin normally causes uterine contractility. In this study, we investigate the role of the transient receptor potential 4 (TRPV4) calcium channel in uterine atony and how it impacts the effects of oxytocin.

Methods

Myometrial tissue was collected from the hysterotomy site from term non-laboring patients undergoing cesarean delivery. Uterine smooth muscle cells (USMC) were cultured from the myometrial samples for calcium imaging and collagen contraction assays [2]. Using these assays, we assessed oxytocin (10^{-6}M) effects +/- the following: TRPV4 pharmacologic blockade with GSK2728745 (1nM), TRPV4 pharmacologic activation with GSK1016790A (10^{-6}M), siRNA mediated TRPV4 knockdown, or OXTR antagonism with atosiban (100nM). In fixed uterine tissue, a proximity ligation assay (PLA) [3] was used to assess protein-protein interaction between TRPV4 and the oxytocin receptor (OXTR) in patients with PPH from uterine atony (n=4) compared to control patients without PPH (n=5). PLA puncta per nucleus were averaged and compared by a t-test.

Results

In USMC, TRPV4 blockade or knockdown via siRNA completely inhibited oxytocin-induced cytosolic calcium influx ($p < 0.001$) and collagen gel contraction ($p < 0.01$). In contrast, OXTR blockade with atosiban did not affect calcium influx or contraction when the TRPV4 agonist GSK1016790A was applied.

Co-stimulation with oxytocin and GSK1016790A showed a synergistic effect, significantly reducing the collagen gel surface area by 26.6% ± 0.86%, compared to 33.8% ± 2.79% with oxytocin alone and 43.9% ± 1.15% with GSK1016790A alone ($p < 0.0001$).

Additionally, colocalization of OXTR and TRPV4 proteins was observed in tissue from control patients, but was markedly reduced in patients with PPH and uterine atony (34.0 ± 7.2 vs. 5.3 ± 0.4 puncta per nucleus, $p < 0.01$, Figure 1).

Conclusion

Together, these findings demonstrate a critical functional association between OXTR and TRPV4, revealing that oxytocin induces uterine contraction through TRPV4 channel activation. Moreover, uterine tissue from patients with oxytocin-resistant uterine atony showed significantly reduced OXTR-TRPV4 protein-protein interaction compared to tissue from patients with optimal postpartum contractility. These results provide a strong scientific basis for exploring TRPV4-targeting compounds as a novel therapeutic strategy to manage uterine atony.

References:

[1] B. Bt et al., *Anesth Analg*, vol. 110, no. 5, 2010, doi: 10.1213/ANE.0b013e3181d74898.
[2] L. Ying et al., *Sci Transl Med*, vol. 7, no. 319, 2015, doi: 10.1126/scitranslmed.aad0376.
[3] M. Hegazy et al., *Curr Protoc Cell Biol*, vol. 89, no. 1, 2020, doi: 10.1002/cpcb.115.

The TRPV4 channel could be part of the problem—and the solution—in uterine atony.pdf

Abstract #: THUR-BP-02

Single nuclear transcriptomics uncover downregulation of FSHR in the myometrium of patients with uterine atony

Presenting Author: Jessica R. Ansari, MD, MS

Presenting Author's Institution: Stanford University School of Medicine - Palo Alto, California

Co-Authors: Daiana D. Fornes - Stanford University School of Medicine
Carsten Knutsen, MS - University of California, San Francisco
Alexander Kum, BS - Stanford University School of Medicine
Guillermina Michel, BS - Stanford University School of Medicine
Virginia Winn, MD, PhD - Stanford University School of Medicine

Abstract :

Introduction: Uterine atony is the leading cause of postpartum hemorrhage (PPH) yet remains poorly understood. Many cases of atonic PPH lack clinical risk factors to explain impaired uterine contractility [1]. Single cell RNA sequencing (scRNAseq) has transformed understanding of *other* diseases by enabling gene expression analysis at the individual cell level. However, applying the method to the gravid human uterus has been challenging because myometrial smooth muscle cells (SMC) hypertrophy during pregnancy, exceeding the assay size limit. Single-nuclear RNA sequencing (snRNAseq) overcomes this limitation by analyzing RNA from nuclei instead of cells. We created the first snRNAseq atlas of the gravid human uterus to test the hypothesis that we would find differential gene expression (DEG) in SMC from patients with and without uterine atony.

Methods: Myometrial biopsies (1 cm^2) were collected from the hysterotomy during cesarean delivery from 150 consenting patients and flash-frozen in liquid nitrogen. 15 samples representing patients of various race/ethnicity, age, and gestational age were selected. Nuclei were isolated, cDNA libraries prepared, RNA sequenced, and cell types determined by established methodology [2]. To validate SMC type-differentiating marker genes, we performed in situ hybridization (ISH) to visualize RNA transcripts in fixed uterine tissue. To apply snRNAseq to uterine atony, samples from 4 term nonlaboring patients with uterine atony requiring methylergonovine or carboprost were compared to samples from 4 term nonlaboring controls without uterine atony, matched by delivery indication, age, and race. Cell type-specific DEGs were compared with pathways analysis, and individual DEGs were tested by Wilcoxon methods (p adjusted for multiple comparisons) with DESeq2 software [2].

Results: From 15 patients, we defined 19 cell types (Fig 1A). There were 2 distinct SMC populations: uterine (uSMCs) and vascular (vSMCs) validated by ISH (Fig 1B). In uSMC from patients with uterine atony, gonadotropin signaling pathway genes were downregulated compared to controls (Fig 1C). In particular, the follicle stimulating hormone receptor (FSHR) had 5.15-fold higher expression in uSMCs from controls than patients with uterine atony (p adjusted < 0.0001, Fig 1D).

Discussion: Using snRNAseq, we were able to generate a comprehensive transcriptomic atlas of the gravid human uterus. We identified DEGs in uSMC from uterine atony compared to control patients, uncovering a novel potential mechanism of impaired contractility. Reduced FSHR expression in uSMCs has biologic plausibility as a cause of uterine atony, as FSH stimulates uterine SMC contraction during

pregnancy [3]. These results also suggest a potential novel role for the use of FSH, an injectable medication already used in reproductive endocrinology, as a uterotonic treatment.

References: PMIDs 1. 33417319 2. 38263350 3. 30395176

SOAP Figure 1.28.pdf

Abstract #: THUR-BP-03

Severe Perioperative Surgical Morbidity in Patients undergoing Cesarean Delivery in California, 2016 - 2021

Presenting Author: Alexander Butwick, MBBS, FRCA, MS

Presenting Author's Institution: University of California, San Francisco - San Francisco, California

Co-Authors: Rebecca J. Baer, MPH - University of California San Francisco
Naghma A. Farooqi, FACOG - UCSF
Olof Stephansson, n/a - Karolinska Institutet and University Hospital

Abstract : Introduction:
Cesarean delivery (CD) is the most common inpatient surgery in the United States.(1) However, current indicators of severe maternal morbidity primarily focus on medical complications, with limited epidemiological studies reporting severe surgical complications affecting patients undergoing CD.(2)

Methods:
We performed a retrospective cross-sectional study of patients with singleton pregnancies who underwent CD in California between 2016 and 2021 using linked birth certificate data and ICD-10 codes. We developed a composite index for Severe Perioperative Surgical Morbidity (SPSM) which included intraabdominal or pelvic visceral and vascular injuries, hysterectomy, pelvic or retroperitoneal hematoma, wound complications, ileus or bowel obstruction, acute peritonitis, and shock. Hysterectomy was excluded from the SPSM index for patients with placenta accreta spectrum (PAS) disorder. We calculated the prevalence of SPSM overall and stratified it by those requiring intrapartum vs. prelabor CD. Adjusted relative risks (aRR) and 95% confidence intervals (CI) were calculated from multivariate Poisson log-linear regression modeling to evaluate patient and hospital predictors of SPSM.

Results:
Our study cohort comprised 594,655 patients, of whom 10,182 (1.7%) experienced SPSM. The rate of SPSM was higher for patients undergoing intrapartum CD than prelabor CD (2.0% vs. 1.5%). The most common perioperative morbidities were wound complications (n=3,489; 59 per 10,000 CDs); bladder, genitourinary or pelvic injury (n=2,671; 45 per 10,000 CDs); and ileus or bowel obstruction (n=1,983; 33 per 10,000 CDs) (Table). Event rates for each category of surgical complication were higher among patients undergoing intrapartum CD compared to prelabor CD. The strongest risk factors for SPSM were PAS disorder (aRR: 15.8; 95% CI: 14.5 – 17.3) and chorioamnionitis (aRR: 2.0; 95% CI: 1.9 – 2.2).

Conclusion:
SPSM impacts 1 in 59 patients undergoing CD in California, serving as a potentially important indicator of perioperative quality at the population level. PAS disorder was the strongest overall risk factor for SPSM. Additionally, the risk of each surgical complication was higher for patients undergoing intrapartum CDs than prelabor CD. Future studies and quality improvement efforts should focus on optimizing surgical strategies to mitigate the SPSM risk among patients undergoing CD.

References:

(1) Nat Vital Stat Rep 2024; 73: 1056 (2) Am J Obstet Gynecol MFM 2020; 2: 100071.

Table_SPSM_SOAPAbstract2025.pdf

Abstract #: THUR-BP-04

Impact of the Kybele Program on Regional Anesthesia for Cesarean Delivery: A 13-Year Evaluation of Anesthesiologist Proficiency at UCCV

Presenting Author: Borislava Pujic, Anesthesiologist

Presenting Author's Institution: UCCV, OBSTETRICS AND GYNAECOLOGY HOSPITAL - Novi Sad, Vojvodina

Co-Authors: Slavica Krusic, Anesthesiologist - Ob & Gyn Hospital Narodni Front, Belgrade
Nada Pejcic, Anesthesiologist - UKC Nis
Aleksandra Vejnovic, obstetrician - UCCV, OBSTETRICS AND GYNAECOLOGY HOSPITAL
Ivan Velickovic, Anesthesiologist - Yale School of Medicine

Abstract :

Introduction: A decade ago, the use of regional anesthesia (RA) for cesarean delivery (CD) and labor analgesia in Serbia was historically low, with general anesthesia (GA) being the predominant choice in nearly all hospitals across the country. However, in 2012, anesthesiologists at the University Clinical Center Vojvodina (UCCV) started a multi-year collaboration with the Kybele program, a partnership focused on improving maternal and neonatal health through education and training, which would revolutionize Serbian anesthesiology. The goal was to increase the adoption of RA for CD and labor analgesia. This program, which included annual visits from the Kybele team and innovative, hands-on training, became a beacon of hope for the future of obstetric anesthesia in Serbia. The most valuable component of these Schools of Obstetric Anesthesia was the intensive workshops, which provided a unique hands-on experience in obstetric anesthesia.

During the years of collaboration, UCCV has been recognized as a leading teaching hospital in Serbia and the surrounding countries (former Yugoslavia). The hands-on training sessions, a key part of the collaboration, attracted participants from Serbian hospitals at both secondary and tertiary levels, as well as Croatia, Bosnia and Herzegovina, Romania, North Macedonia, Montenegro, and Slovenia. This collaborative effort has united us in our goal of improving obstetric anesthesia practices.

Methods: Data were collected from the UCCV delivery database covering 2011 to 2024, focusing on using GA and RA for elective and non-elective CD. Additionally, data on each anesthesiologist within the department were gathered, and the trend of their RA use was compared between 2011 and 2024.

Results: During the Kybele program, the number of RA for CD significantly increased, from 13.81% in 2011 to 73.85% in 2024 (CHISQ: $p < 0.001$). A more prominent increase was observed in RA for emergency CD (5.26% in 2011 – 62.14% in 2024) than elective CD (20.07% in 2011 – 84.64% in 2024). All 13 anesthesiologists in the department improved their skills. In 2024, only 2/13 had RA rates below 50%, whereas in 2011, none had RA rate greater than 50%. In 2024, 84.61% of anesthesiologists had an RA rates above 50% (60-94%), with 38.46% having RA in more than 80% of all CDs.

Conclusion:
The more significant increase in RA use among non-elective cases is an unsurprising result because all faculty already increased the number of elective CDs, suggesting that more effort should be placed into the education of anesthesiologists on the benefits/risks of RA among those with lower usage of RA and

trend for use over time. The need for continued education and skill improvement in this area is crucial for further enhancing RA adoption across diverse clinical settings.

References:

< !1. Curr Anesthesiol Rep 2023;13, 76–82.

< !2. Front Public Health. 2017;5:134.

Abstract #: THUR-BP-05

Influence of pain, psychological and sleep variables on acute to chronic postsurgical pain after cesarean delivery: a prospective observational study

Presenting Author: Sarah Ciechanowicz, MA BMBCh FRCA MRes

Presenting Author's Institution: Stanford University School of Medicine - London, England

Co-Authors: Brendan Carvalho, MBBCh, FRCA - Stanford University
Nan Guo, Ph.D. - Stanford University
Guillermina Michel, BS - Stanford University School of Medicine
Nisha Panigrahy, BSc - University of Minnesota

Abstract : **Background:** The transition from acute to chronic postsurgical pain (CPSP) after cesarean delivery (CD) is poorly understood and predictive tools are lacking (1). Pain characteristics, psychological factors and sleep experiences may help predict this complication (2). This study aimed to investigate the impact of these variables on the acute to chronic pain transition.

Methods: A single-center, prospective study was conducted from February 2024 to January 2025. Following ethical approval, we recruited adult patients after CD (intra-partum or planned), who delivered at gestational age ≥37/40, English or Spanish speaking. Patients were contacted at 2 weeks and 3 months to complete REDCap surveys, with text and telephone reminders up to 3 attempts. Inpatient surveys at 24-48 h post-delivery included: Adverse Childhood Experiences (ACEs), Brief Pain Inventory (BPI) modified, Edinburgh Postnatal Depression Scale (EPDS), State-Trait Anxiety Inventory (STAI), and Pain Catastrophizing Scale (PCS). Surveys at 2-3 weeks and 3-4 months were: BPI-modified, EPDS, STAI and PROMIS Sleep disturbance. CPSP was defined according to the BPI as pain at >3 months post-surgery. Descriptive statistics, multiple logistic regression and correlation analysis were performed with R or Graphpad Prism.

Results: 143 participants were enrolled; 105 (73%) completed 2-week and 100 (70%) completed 3-month outcomes. The incidence of chronic pain was 40% (40/100). Multiple variables were associated with development of CPSP (Table). Worst inpatient pain was 5.9±2.5 and 7.0±2.1 in the no CPSP and CPSP groups, respectively. Five inpatient outcomes: past 24 h worst pain, duration of time in severe pain, interference with sleep, general activities and ability to feel in control, resulted in a receiver operating characteristic AUC=0.76 [95% CI 0.66 to 0.86] ($p< 0.0001$) for CPSP (moderate discrimination), which improved to AUC =0.81 [0.72 to 0.91] ($p< 0.0001$) with addition of two subacute pain variables (interference with general activities and sleep at 2 weeks). ACEs were not associated with acute, 2 week or 3 month pain. ACEs were associated with STAI at 24 h ($\rho=0.20$, $p=0.020$) and EPDS at 24 h ($\rho=0.18$, $p=0.035$). PCS was associated with STAI at 24 h ($\rho=0.62$; $p< 0.001$); EPDS at 24 h ($\rho=0.54$; $p< 0.001$), and sleep disruption at 2 weeks ($\rho=0.27$; $p=0.007$).

Conclusions: The AUC is higher than previous studies (3) and could represent clinical utility but further validation is required. Sleep was disrupted with acute, subacute and CPSP and could be an important predictive and modifiable factor in postpartum pain chronification. ACEs were associated with mood outcomes but not pain. Emphasis on pain severity, interference and sleep could improve CPSP prediction, encouraging follow-up utilizing digital health technologies.

References: 1. Sun et al. International Journal of Obstetric Anesthesia. 2019 Nov 1;40:78–90.

2. Bussières et al. Eur J Psychotraumatol. 2023;14(2):2284025.
3. Jin et al. 2016 Oct 18;16(1):99.

TableSOAP.pdf

Abstract #: THUR-BP-06

Medicaid expansion, Medicaid generosity, and severe maternal morbidity during delivery hospitalizations.

Presenting Author: JEAN R. GUGLIELMINOTTI, MD, PhD

Presenting Author's Institution: COLUMBIA UNIVERSITY IRVING MEDICAL CENTER - New York, New York

Co-Authors: GUOHUA LI, MD, DrPH - COLUMBIA UNIVERSITY IRVING MEDICAL CENTER

Abstract :

Background: The 2014 *Affordable Care Act* Medicaid expansion has given states the option to expand Medicaid coverage to non-elderly adults with incomes up to 138% of the Federal Poverty Level (FPL). During the perinatal period, its implementation has led to a significant reduction in insurance discontinuity and to an increase in healthcare access and utilization.**(1)** Previous research reports conflicting results on its impact on maternal health outcomes, such as severe maternal morbidity (SMM).**(2, 3)** However, previous research did not take into consideration the magnitude of the change in the state Medicaid eligibility income associated with the expansion (i.e., Medicaid generosity), which displays very marked variations across states. To address this gap, we assessed the association of Medicaid expansion and Medicaid generosity with SMM during delivery hospitalizations.

Methods: HCUP data for delivery hospitalizations from 2010 to 2018 in 18 states that expanded Medicaid in January 2014 and 11 states that did not were analyzed (**Table**). The outcome was SMM with the exclusion of blood transfusion, as defined by the CDC. The 2 exposure variables of interest were: **1)** the state Medicaid expansion status (expansion or non-expansion state), and **2)** the state Medicaid generosity, defined as the difference between 2015 and 2013 in the Medicaid eligibility income for adults (generous state if difference > 0% FPL or non-generous if difference ≤ 0% FPL). The intervention was the Medicaid expansion. The association of the Medicaid expansion and Medicaid generosity with SMM was estimated using the difference-in-differences and difference-in-differences-in-differences methods.**(4)**

Results: Of 14,910,244 delivery hospitalizations included, 58% were in expansion states, 39% in generous states, and 56% after the expansion. The overall SMM rate was 68.7 per 10,000 delivery hospitalizations. Among expansion states, the median change in Medicaid eligibility income (i.e., generosity) was +24% FPL, ranging from -77% in Minnesota to 122% in Arkansas; among non-expansion states, it was -3% FPL, ranging from -100% in Wisconsin to +7% in Kansas. Compared to non-expansion states, Medicaid expansion was associated with an 8.8% (95% CI: 5.1, 12.6) increase in the SMM rate in non-generous states and an 8.9% (95% CI: 1.8, 15.4) decrease in the SMM rate in generous states, yielding a relative decrease in SMM of 15.1% (95% CI: 7.9, 21.8) in generous states compared to non-generous states.

Conclusions: Our findings indicate that the impact of Medicaid expansion on maternal health outcomes depends on state Medicaid generosity. State efforts to improve the health of low-income birthing people should focus on policies increasing Medicaid generosity.

References:

(1) Obstet Gynecol 2022;139:269

(2) Anesth Analg 2021;133:340

(3) Health Economics 2023;32:2334

(4) Anesthesiology 2023;139:274

01bis_TABLE_EXPANSION_SMM.pdf

Mental Health in Critically Ill Parturients

Kait Brennan DO MPH
Director of Maternal Critical Care
Assistant Professor, Obstetric Anesthesiology & Critical Care Medicine
Vanderbilt University, Nashville TN

1

I have nothing to disclose

2

ICU Pearls: maternal mental health

- Postpartum PTSD complicates 4% of all births
  - There is an association between severe preeclampsia and PP PTSD
  - There may be an association between PPH and peripartum hysterectomy and PP PTSD
  - ICU admission is a de novo risk factor for PTSD, but it is not known if maternal ICU admission puts parturients at an increased risk

Vogel TM, Homitsky S. Antepartum and intrapartum risk factors and the impact of PTSD on mother and child. BIA Educ. 2020 Mar;20(3):89-95.
Lewkowitz AK, Roseet al. Association Between Severe Maternal Morbidity and Psychiatric Illness Within 1 Year of Hospital Discharge After Delivery. Obstet Gynecol. 2019 Oct;134(4):695-707.

3

ICU Pearls: maternal mental health

- Severe maternal morbidity confers an increased risk of admission for psychiatric disorders
  - Highest w/in first 4 months PP
  - Risk persists for 13 years PP!
  - Also confers 2x increased risk of SUD

Iackman A, et al. Severe maternal morbidity and mental mealth hospitalizations or emergency department visits. *JAMA Netw Open*. 2024;7(4):e247983

4

ICU Pearls: therapy in the ICU

- Therapy in the ICU
  - Consider offering therapy as part of a maternal ICU bundle
  - Helpful if introduced prior to admission in patients with expected ICU recovery
  - In person therapy or telehealth may be possible
  - Consider an outside therapy group specializing in birth trauma if not available institutionally

5

ICU Pearls: Lactation in the ICU

Don't pump and dump!

- Initiate pumping early in patients who may wish to breastfeed
  - Pumping can be accomplished in intubated patients
    - Critically ill parturients may have decreased milk supply
  - Delay in initiation of pumping may impair milk supply
- Patients with an established milk supply may produce 400cc-1200cc of milk per day
  - Intensivists must be cognizant of increased fluid needs, especially if NPO
- Provide hospital grade pumps to parturients admitted to the ICU
- Keep breastfeeding mothers and infants together
  - Evaluate policies that may prohibit otherwise well neonates from being in the ICU
  - Other patients present in the ICU do not confer additional infectious risk to a neonate

Bartick Met al. ABM Clinical Protocol #35: Supporting Breastfeeding During Maternal or Child Hospitalization. Breastfeed Med. 2021 Sep;16(9):664-674.
LactMed: Drugs and Lactation Database. http://toxnet.nlm .nih.gov/cgi-bin/sis/htmlgen?LACT

6

7

MATERNAL SEPSIS

SOAP/SOCCA PANEL
EXTENDING KNOWLEDGE BEYOND THE OR:
WHAT HAPPENS TO MY PATIENTS IN THE ICU?

Benjamin D. Brakke, DO

Obstetric Critical Care Anesthesiologist
Assistant Professor
Department of Anesthesiology and Perioperative Medicine
Mayo Clinic, Rochester, MN

1

LEARNING OBJECTIVES & DISCLOSURE

- Recognize maternal sepsis as a top cause of maternal mortality
- Understand the role of intensive care with maternal sepsis
- Learn new treatment recommendations for maternal sepsis

Disclosures: none

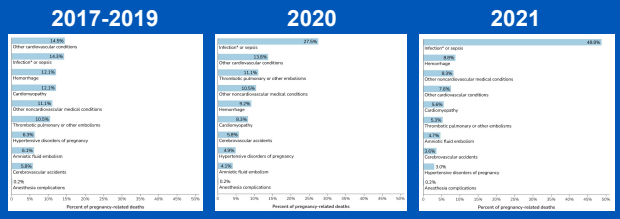
2

1 SEPSIS AND MATERNAL MORTALITY

3

CAUSES OF PREGNANCY-RELATED DEATHS

CDC PREGNANCY MORTALITY SURVEILLANCE SYSTEM



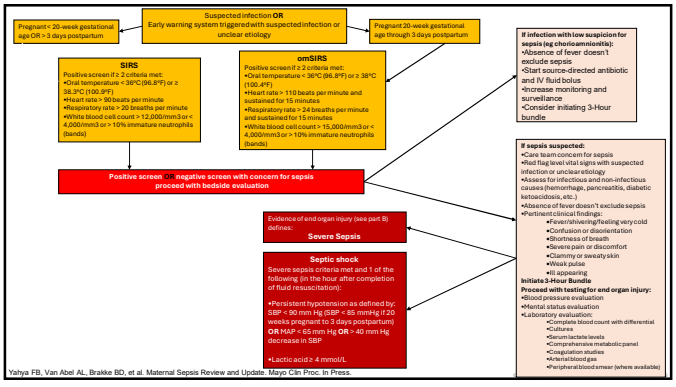
For 2020 and 2021, Infection* includes deaths from COVID-19

https://www.cdc.gov/maternal-mortality/php/pregnancy-mortality-surveillance/index.html

4

2 ROLE OF INTENSIVE CARE

5



Yahya FB, Van Abel AL, Brakke BD, et al. Maternal Sepsis Review and Update. Mayo Clin Proc. In Press.

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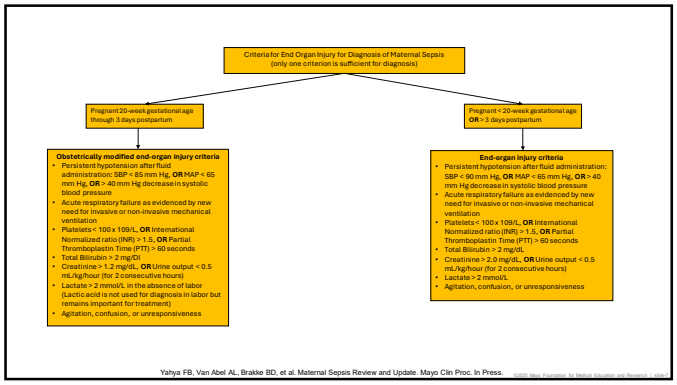

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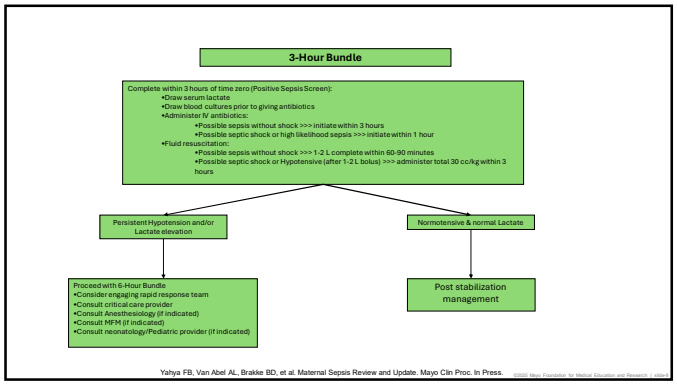

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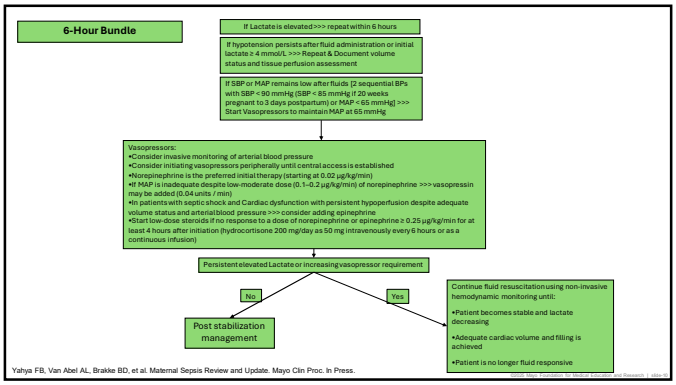

10

Infection	No beta lactam allergy	Penicillin allergy (including anaphylaxis)	Cephalosporin allergy (non-anaphylactic reactions *)	SCAR* to any beta lactam OR Anaphylaxis to any cephalosporin
Peripartum infections				
Endometritis	Piperacillin-tazobactam (4.5g q8h) **If concomitant skin/soft tissue infection is present, recommend anti-MRSA coverage only in the presence of MRSA risk factors for colonization, or necrotizing soft tissue infection:** Add Vancomycin (15mg/kg IV q12h, pharmacy to dose)	Ceftriaxone (2g IV q24h) + Metronidazole (500mg IV q8h) **If concomitant skin/soft tissue infection is present, recommend anti-MRSA coverage only in the presence of MRSA risk factors for colonization, or necrotizing soft tissue infection:** Add Vancomycin (15mg/kg IV q12h, pharmacy to dose)	Piperacillin-tazobactam (4.5g q8h) **If concomitant skin/soft tissue infection is present, recommend anti-MRSA coverage only in the presence of MRSA risk factors for colonization, or necrotizing soft tissue infection:** Add Vancomycin (15mg/kg IV q12h, pharmacy to dose)	Vancomycin (15mg/kg IV q12h, pharmacy to dose) + Gentamicin (7 mg/kg q24h) + Metronidazole (500mg IV q8h)
Septic abortion	Piperacillin-tazobactam (4.5g q8h)	Ceftriaxone (2g IV q24h) + Metronidazole (500mg IV q8h)	Piperacillin-tazobactam (4.5g q8h)	Levofloxacin (750mg q24h) + Metronidazole (500mg q8h)

Yahya FB, Van Abel AL, Brakke BD, et al. Maternal Sepsis Review and Update. Mayo Clin Proc. In Press.

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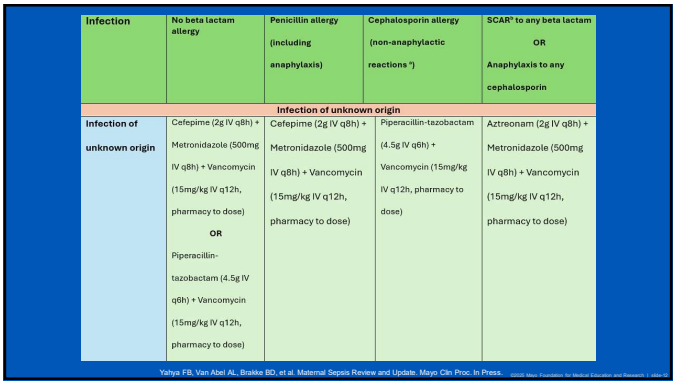

Infection	No beta lactam allergy	Penicillin allergy (including anaphylaxis)	Cephalosporin allergy (non-anaphylactic reactions *)	SCAR* to any beta lactam OR Anaphylaxis to any cephalosporin
Infection of unknown origin				
Infection of unknown origin	Cefepime (2g IV q8h) + Metronidazole (500mg IV q8h) + Vancomycin (15mg/kg IV q12h, pharmacy to dose) **OR** Piperacillin-tazobactam (4.5g IV q6h) + Vancomycin (15mg/kg IV q12h, pharmacy to dose)	Cefepime (2g IV q8h) + Metronidazole (500mg IV q8h) + Vancomycin (15mg/kg IV q12h, pharmacy to dose)	Piperacillin-tazobactam (4.5g IV q6h) + Vancomycin (15mg/kg IV q12h, pharmacy to dose)	Aztreonam (2g IV q8h) + Metronidazole (500mg IV q8h) + Vancomycin (15mg/kg IV q12h, pharmacy to dose)

Yahya FB, Van Abel AL, Brakke BD, et al. Maternal Sepsis Review and Update. Mayo Clin Proc. In Press.

12


QUESTIONS
& ANSWERS
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13

Peripartum Cardiomyopathy (PPCM)

Monica I. Lupei, MD
Associate Professor of Anesthesiology and Critical Care
University of Minnesota

1

Speaker disclosure

- I have no conflict of interest to disclose.

2

Objectives: PPCM

- Discuss the incidence and risk factors
- Understand the etiology and pathogenesis
- Elaborate on clinical presentation, diagnosis and evaluation
- Learn about management and outcomes.

3

Incidence and risk factors of PPCM

- Globally the incidence varies from 1:100 (Nigeria) to 20,000 (Japan)
- The incidence is higher patients of African ancestry and older patients
- In the US the incidence is 1: 800 to 1:1,200.

4

Incidence and risk factors of PPCM

- Risk factors include:
  - Advanced maternal age
  - African descent
  - Hypertension
  - Pre-eclampsia
  - Obesity.

5

Incidence and risk factors of PPCM

- Risk factors include:
  - Multiparous women
  - Twin pregnancy
  - In vitro fertilization
  - Socio-economic disparities
  - Prolonged tocolytic agents use.

6

Objectives: PPCM

- Discuss the incidence and risk factors
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7

Etiology and pathogenesis of PPCM

- Etiology is not fully understood, but likely multifactorial
- Potential mechanisms:
  - Autoimmune process
  - Hemodynamic changes of pregnancy
  - Nutritional deficiency
  - Viral myocarditis.

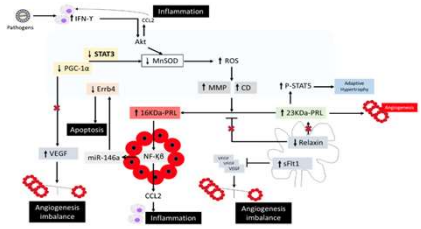
8

Etiology and pathogenesis of PPCM

- Potential mechanisms:
  - Genetic predisposition
  - Myocardial inflammation
  - Oxidative stress
  - Prolactin.

9

Etiology and pathogenesis of PPCM



10

Objectives: PPCM

- Discuss the incidence and risk factors
- Understand the etiology and pathogenesis
- Elaborate on clinical presentation, diagnosis and evaluation
- Learn about management and outcomes.

11

Clinical presentation, diagnosis and evaluation

- Typical clinical presentation include:
  - Dyspnea with exertion
  - Fatigue, malaise
  - Orthopnea
  - Paroxysmal nocturnal dyspnea
  - Chest tightness, palpitations.

12

Clinical presentation, diagnosis and evaluation

- Clinical presentation for a small minority include:
  - Cardiogenic shock (3.5%)
  - Severe arrythmias (12%)
  - Thromboembolic events (5-20%).

13

Clinical presentation, diagnosis and evaluation

- The 2010 ESC Working Group definition of PPCM:
  - HF symptoms towards the end of the pregnancy or post-partum
  - HF without another identifiable cause
  - LV EF < 45% with or without dilation.

14

Clinical presentation, diagnosis and evaluation

- Echocardiography is the key evaluation test: LV EF < 45%, M-mode fractional shortening < 30%, LV end-diastolic dimension > 2.7cm/m^2
- TTE can also find complications: MVR/TVR, LV thrombus (10-17%), increased PAP.
- Cardiac MRI (postpartum): more precise diagnosis.

15

Clinical presentation, diagnosis and evaluation

- Patients with pre-existing cardiac ds. develop HF symptoms in the 2nd trimester while PPCM patients develop HF post-partum
- Delayed diagnosis often – the non-specific signs (fatigue, malaise, lightheadedness, abdominal discomfort) can mimic the cardiovascular changes in pregnancy.

16

Clinical presentation, diagnosis and evaluation

- Differential diagnosis include:
  - Pre-existing CMP - valvular disease (mitral, aortic)
  - Unknown congenital ds. (ASD, VSD, PDA)
  - Hypertensive disease of pregnancy
  - HCOM.

17

Clinical presentation, diagnosis and evaluation

- Differential diagnosis include:
  - Ischemic CMP
  - Coronary dissection
  - Non-impaction CMP
  - Takotsubo CMP
  - Viral myocarditis.

18

Objectives: PPCM

- Discuss the incidence and risk factors
- Understand the etiology and pathogenesis
- Elaborate on clinical presentation, diagnosis and evaluation
- Learn about management and outcomes.

19

The management and outcomes of PPCM

- Diuretics - fluid overload (pregnancy and postpartum)
- Betablocker - HR control and decrease myocardial O2 consumption (pregnancy and postpartum)
- Hydralazine/isosorbide dinitrate - afterload reduction (pregnancy)
- ACEi/ARBs - afterload reduction (postpartum).

20

The management and outcomes of PPCM

- Digoxin – inotrope (pregnancy and postpartum)
- Anticoagulation – prevent LV thrombus formation if LV EF < 30-35% or Afib.
- Sacubitril–valsartan and Sodium–glucose cotransporter 2 inhibitors - newer HF therapies (postpartum)
- Bromocriptine - inhibits prolactin secretion, improves cardiac function, reduce heart size, increase survival (post-partum).

21

The management and outcomes of PPCM

- Obstetric management:
  - Delivery is individualized
  - Early delivery is not typically indicated
  - Vaginal delivery is preferred
  - Critically ill patients with advance HF or HD instability require C-section.

22

The management and outcomes of PPCM

- Mechanical support may be needed:
  - IABP
  - Impella
  - VA-ECMO
  - LVAD (up to 10%)
- Transplantation in rare cases without recovery
- Cardioverter/defibrillator.

23

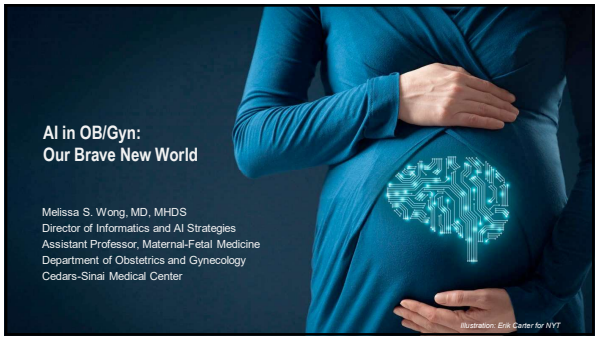
The management and outcomes of PPCM

- Most patients recover LV EF > 50% at 6 month after dg
- Mortality 2.5 to 32% worldwide
- Recurrence is 30-50%
- Prognosis is worse the lower the LV EF and persistent low EF
- Worse outcome in late presentations.

24

- Questions? Comments?

25



1

Disclosures

- I have no disclosures.
- "We have not succeeded in answering all our problems—indeed we sometimes feel we have not completely answered any of them. . . In some ways we feel that we are as confused as ever, but we think we are confused on a higher level and about more important things."

2

Objectives

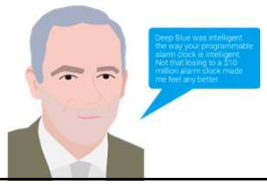
AI

Clinical AI

AI & You

3

Artificial Intelligence



4

What is AI?

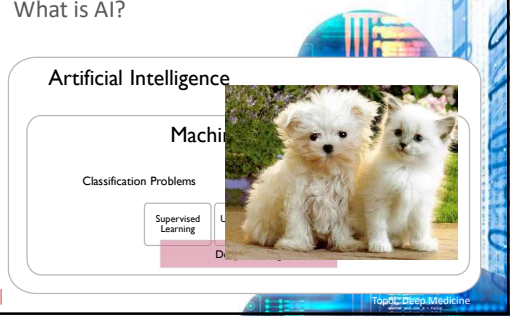
"

the theory and development of computer systems able to perform tasks that normally require human intelligence

"

5

What is AI?



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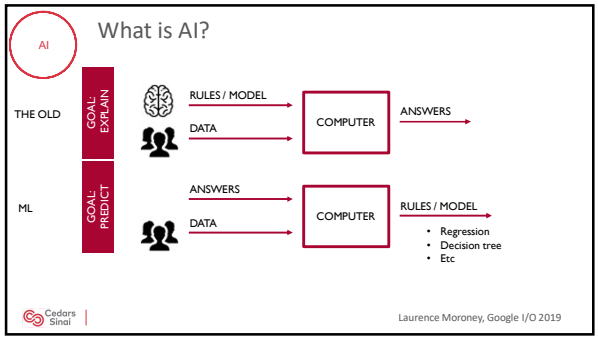
AI
What is AI?
THE OLD
GOAL: EXPLAIN
RULES / MODEL
DATA
COMPUTER
ANSWERS
ML
GOAL: PREDICT
ANSWERS
DATA
COMPUTER
RULES / MODEL
Regression
Decision tree
Etc
Cedars Sinai
Laurence Moroney, Google I/O 2019

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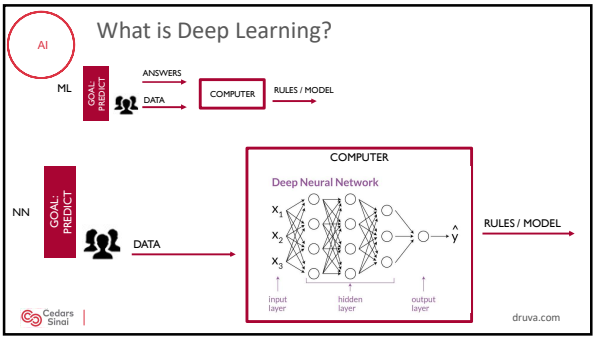
AI
What is Deep Learning?
ML
GOAL: PREDICT
ANSWERS
DATA
COMPUTER
RULES / MODEL
NN
GOAL: PREDICT
DATA
COMPUTER
Deep Neural Network
input layer
hidden layer
output layer
RULES / MODEL
Cedars Sinai
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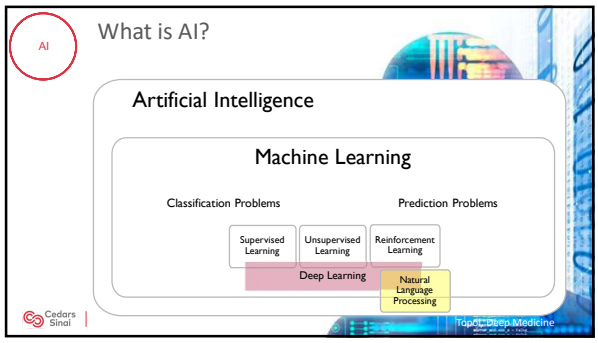
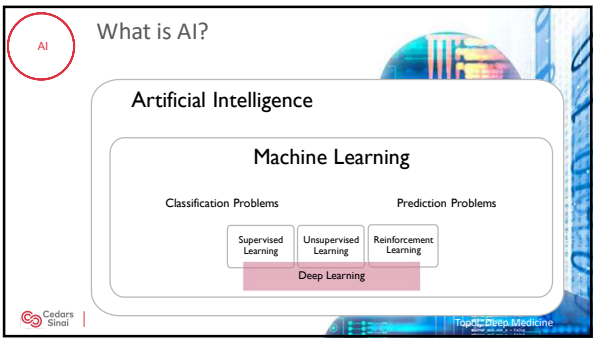

AI
What is AI?
Artificial Intelligence
Machine Learning
Classification Problems
Prediction Problems
Supervised Learning
Unsupervised Learning
Reinforcement Learning
Deep Learning
Natural Language Processing
Cedars Sinai
Topol: Deep Medicine

9


AI
What is AI?
Artificial Intelligence
Machine Learning
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Reinforcement Learning
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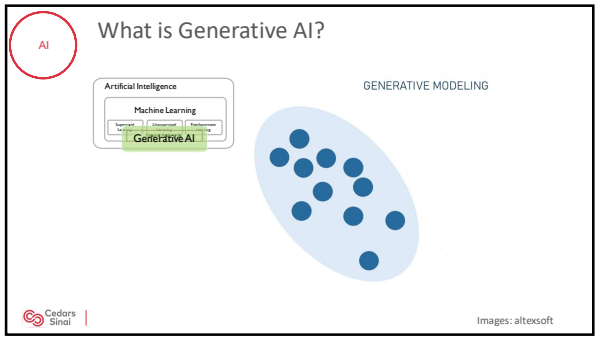
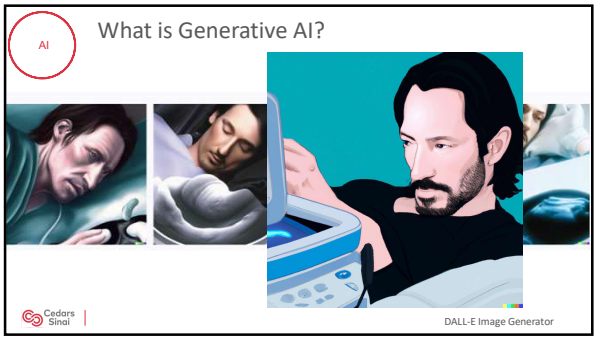
Cedars Sinai
Topol: Deep Medicine

10


AI
What is Generative AI?
Artificial Intelligence
Machine Learning
Generative AI
GENERATIVE MODELING
Cedars Sinai
Images: altexsoft

11


AI
What is Generative AI?
Cedars Sinai
DALL-E Image Generator

12

What is Generative AI?

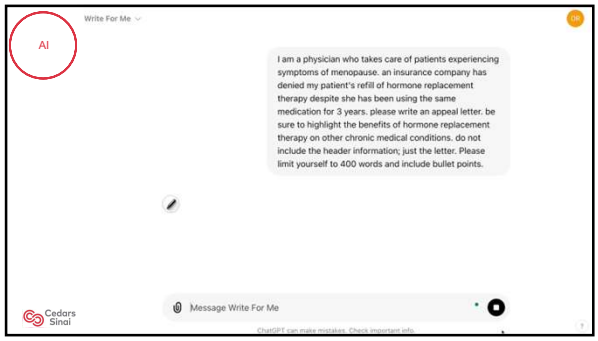
Forrest Gump explaining the menstrual cycle.

13

What is Generative AI?

I am a physician who takes care of patients experiencing symptoms of menopause. an insurance company has denied my patient's refill of hormone replacement therapy despite she has been using the same medication for 3 years. please write an appeal letter. be sure to highlight the benefits of hormone replacement therapy on other chronic medical conditions.

14



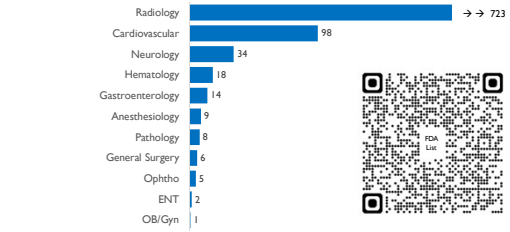
15

Objectives

- AI
- Clinical AI
- AI & You

16

FDA-listed AI/ML-Enabled Devices by Specialty

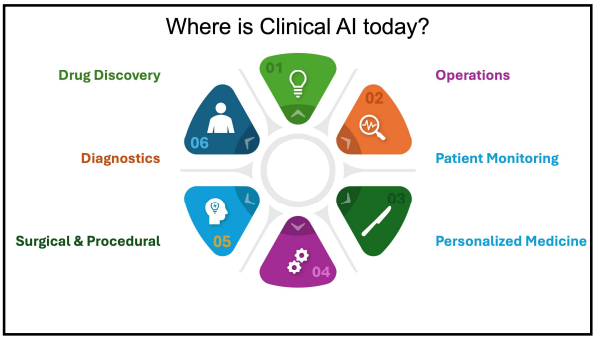


https://www.fda.gov/medical-devices/software-medical-device-samd/artificial-intelligence-and-machine-learning-aiml-enabled-medical-devices

17

Where is Clinical AI today?

18



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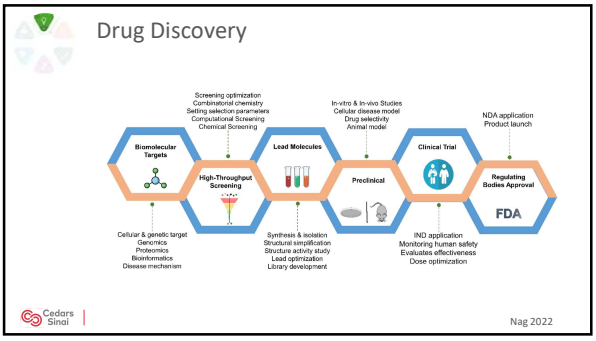

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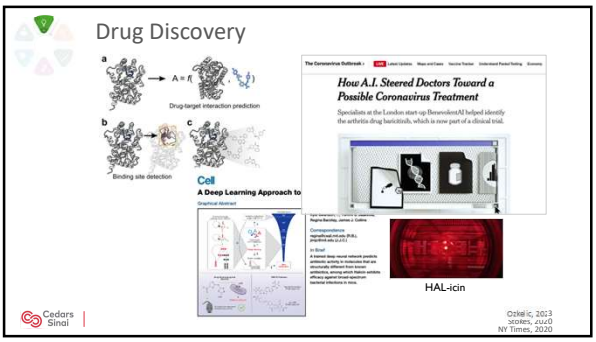

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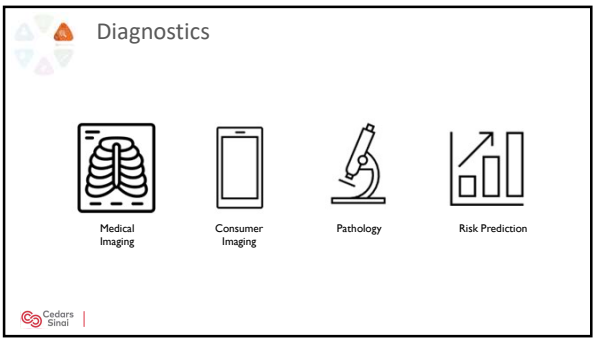

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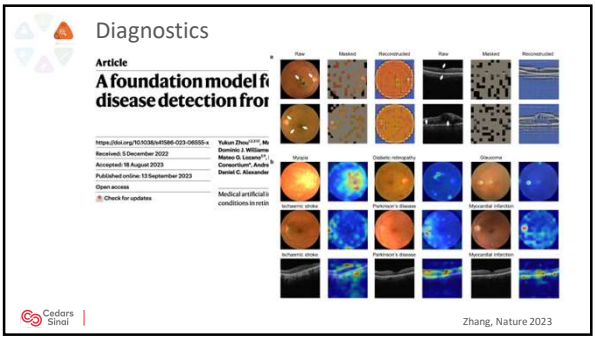

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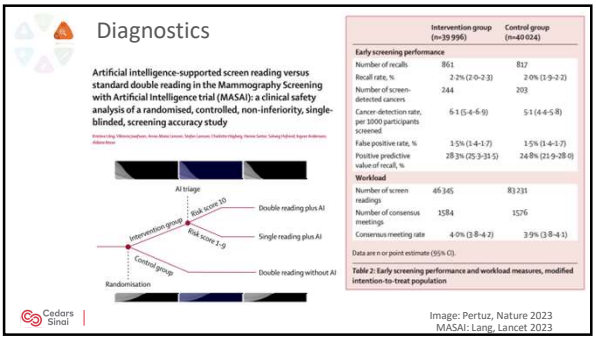

24

But what about OB Diagnostics?

25

OB AI

AI in Ultrasound

Ultrasound Obstet Gynecol 2020; 56: 498–505
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State-of-the-Art Review

Introduction to artificial intelligence in ultrasound imaging in obstetrics and gynecology

L. DRUKKER[1]*, J. A. NOBLE[2] and A. T. PAPAGEORGHIOU[1]*

1. Operations
   - Auto-measure / label
   - Anatomy list reminders
   - Biometry plane finder
2. Education
   - Probe guidance
   - Novel skills
3. Anomaly detection

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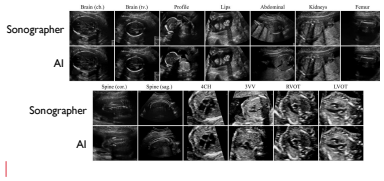
OB AI

AI in Ultrasound

SonoNet: Real-Time Detection and Localisation of Fetal Standard Scan Planes in Freehand Ultrasound

Christian F. Baumgartner, Konstantinos Kamnitsas, Jacqueline Matthew, Tara P. Fletcher, Sandra Smith, Lisa M. Koch, Bernhard Kainz, and Daniel Rueckert



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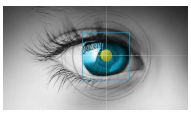
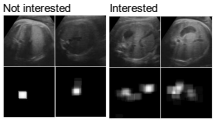
OB AI

AI in Ultrasound

SonoEyeNet: Standardized Fetal Ultrasound Plane Detection Informed by Eye Tracking

Y. Cai, **H. Sharma**, **P. Chatelain**, and **J. A. Noble**
Institute of Biomedical Engineering, Department of Engineering Science, University of Oxford, UK





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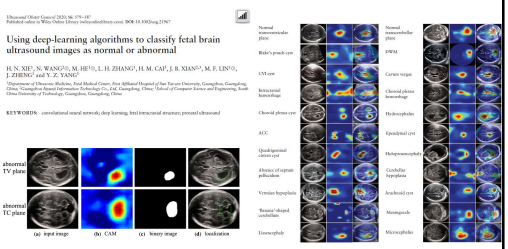
OB AI

AI in Ultrasound

30

OB AI

AI in Ultrasound



Cedars Sinai

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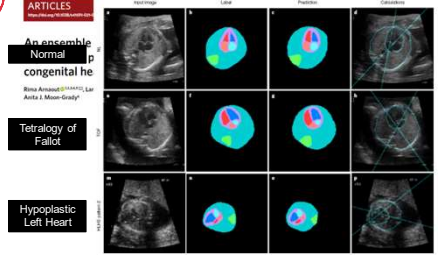
OB AI

AI in Ultrasound



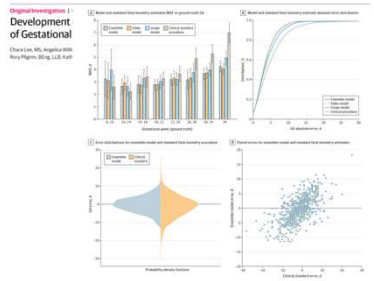
Cedars Sinai

Arnaout, Nature Medicine 2021

32

OB AI

AI in Ultrasound



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work Open 2023

33

Surgical / Procedural

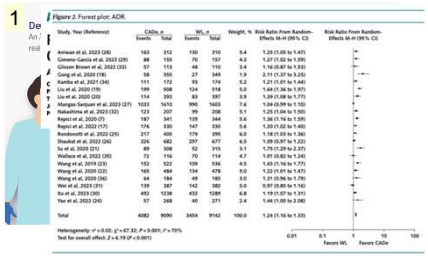

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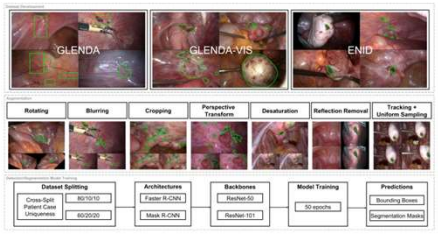
Image: DeepGI
Hassan, Annals of Internal Medicine 2023

34

Surgical / Procedural



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Leibetseder, 2022

35

Operations

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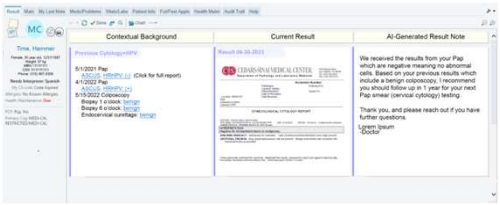
https://www.cnbc.com/2024/08/21/epic-systems-ugm-2024-ai-tools-in-mychart-cosmos-.html

36

Operations

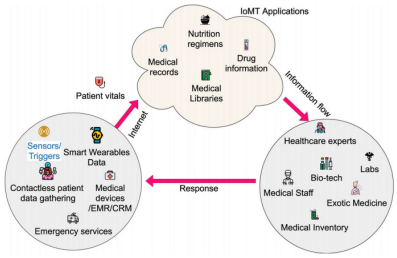
CARE-AI (Contextual Analysis of Results using AI) Pap



Source: Me and Photoshop

37

Patient Monitoring

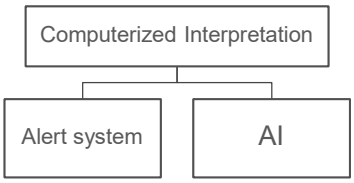


Umer, Nature Scientific Reports 2023

38

AI in Fetal Monitoring

Clinical AI



O'Sullivan "Challenges of Developing Robust AI for Fetal Monitoring" 2021

39

AI in Fetal Monitoring: Alert System

Clinical AI

INFANT system

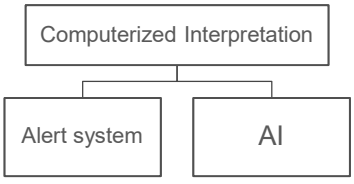
RCT at 24 hospitals in the UK and Ireland from 2010-2013

No difference in outcomes.

40

AI in Fetal Monitoring

Clinical AI



O'Sullivan "Challenges of Developing Robust AI for Fetal Monitoring" 2021

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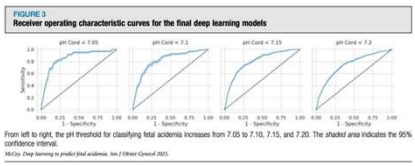
AI in Fetal Monitoring: AI to detect

OB AI

- Terminal 60 minutes from 10,182 EFM tracings
- Target: fetal acidemia or BE > -10



McCoy J, AJOG 2025

42

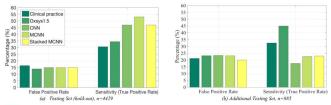
OB AI

AI in Fetal Monitoring: AI to detect

IEEE Access

Multimodal Convolutional Neural Networks to Detect Fetal Compromise During Labor and Delivery

ALESSIO PETROZZIELLO[1], CHRISTOPHER W. G. REDMAN[2], ARIS T. PAPAGEORGHIOU[2], IVAN JORDANOV[1], AND ANTONIYA GEORGIEVA[2]



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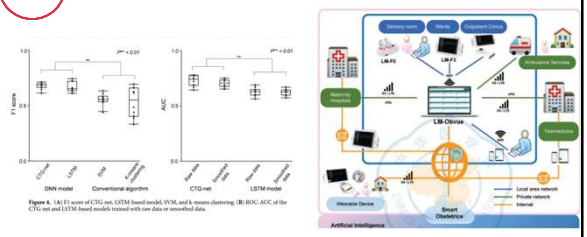
OB AI

AI in Fetal Monitoring: AI to detect



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Zhong, 2022

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OB AI

Cardiotocography landscape

Table A1
Characteristics of sources of evidence: overview of the commercially available AI systems.

	Studies	Year	Country	Number of tracings	Guidelines	Main findings
INFANTS System[TM]	Brocklehurst et al. [14]	2017	UK	47,062	-	System does not reduce poor neonatal outcome. No significant difference with or without AI-assisted system.
	Sinet et al.[15]			46,614		
PeriCALM Patterns	Parer et al.[17]	2010	USA	2,132	2008 NICHD	Good performance except in abnormal tracings.
Omniview-SisPorto 4.0	Ayres-de-Campos et al.[30]	2017	Portugal	-	2015 FIGO	Updated parameters, revised baseline algorithm, needs re-evaluation
Trium©TG® online	Schiermeier et al. [35]	2008	Germany	4,659	2015 FIGO	Present a correlation of fetal scalp pH to CTG tracings. Decelerations have the highest sensitivity for low pH prediction. Computerized analysis is promising for more objectivity.
	Schiermeier et al. [36]			132		
IntelliSpace Perinatal	Devoe et al.[37]	2000	USA	50	NICHD	System was more precise in baseline analysis. Significant interobserver disagreement.
Oxford Sonicaid	Dawes et al.[34]	1985	UK	629	Dawes-Redman criteria	System had slightly better outcome than clinicians and reduced fetal tests.
	Dawes et al.[39]	1991		2,000		
	Ribbert et al.[40]	1991		77		No relationship between computer parameters and metabolic acidosis of fetus found.
	Bartnicki et al.[41]	1992		120		
	Tincello et al.[42]	1998		26		Only outside of labor.
	McCartney et al.[38]	2000		-		
	Bracero et al.[44]	2000		121		
	Roberts et al.[43]	2001		112		
	Agrawal et al.[45]	2003		51		

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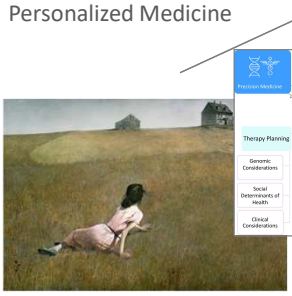
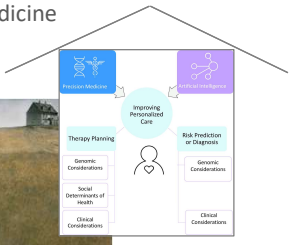
OB AI

Personalized Medicine





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Andrew Wyeth, *Christina's World*
Johnson, 2020

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But what about Personalized OB?

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OB AI

AI to Predict / Prescribe

Prediction model development of late-onset preeclampsia using machine learning-based methods

Machine Learning and Statistical Models to Predict Postpartum Hemorrhage

Original Research

Prediction of vaginal birth after cesarean deliveries using machine learning

Using Electronic Health Records and Machine Learning to Predict Postpartum Depression

RESEARCH Open Access

Development of caesarean section prediction models: secondary analysis of a prospective cohort study in two sub-Saharan African countries

Development and validation of a machine-learning model for prediction of shoulder dystocia

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OB AI

Fetal outcomes are most studied

Systematic Review

Novel machine learning applications in peripartum care: a scoping review

Shani Steinberg, MD; Melissa Wong, MD, MHDS; Eyal Zimlichman, MD, MSc; Abraham Tsur, MD, MBA

TABLE 1
Distribution of learning paradigms by topic

Topic	Total	Supervised learning, = n, (n%)	Unsupervised learning, = n, (n%)	Reinforcement learning, = n, (n%)	Unspecified learning mechanism = n, (n%)
Fetal distress and acidemia	275	234 (85%)	26 (10%)	3 (1%)	12 (4%)
Preterm birth	267	239 (89%)	18 (7%)	0	10 (4%)
Mode of delivery	135	131 (97%)	0	0	4 (3%)
Birth weight	132	122 (92%)	8 (6%)	0	2 (2%)
Postpartum haemorrhage	50	46 (92%)	1 (2%)	0	3 (6%)
Placenta accreta spectrum	47	44 (94%)	3 (6%)	0	0
Surgical complications	18	18 (100%)			
Uterine laceration or rupture	18	18 (100%)	0	0	0
Severe maternal morbidity (SMM)	12	10 (83%)	1 (8.5%)	0	1 (8.5%)
Obstetric anal sphincter injuries	10	10 (100%)	0	0	0
Time to delivery	10	8 (80%)	1 (10%)	0	1 (10%)
Shoulder dystocia	6	6 (100%)	0	0	0
Chorioamnionitis	6	6 (100%)	0	0	0
Maternal ICU admission	5	5 (100%)	0	0	0

Steinberg. Novel machine learning applications in peripartum care. Am J Obstet Gynecol 2023.

Steinberg, Wong, Tsur, et al. AJOG MFM 2025.

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AI to Predict

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OB AI

AI to Predict (NLP)

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OB AI

…including our own

Original Article

Applying Automated Machine Learning to Predict Mode of Delivery Using Ongoing Intrapartum Data in Laboring Patients

Melissa S. Wong, MD, MHDS[1,2] Matthew Wells, MHDS[3] Davina Zamanzadeh, MSc[4] Samir Akre, BS[4] Joshua M. Pevnick, MD[2,5] Alex A.T. Bui, PhD[4,6] Kimberly D. Gregory, MD, MPH[1,7,8]

[1]Department of Obstetrics and Gynecology, Cedars-Sinai Medical Center, Los Angeles, California

Address for correspondence Melissa S. Wong, MD, MHDS, 8635 West 3rd Street, Suite 160 West, Los Angeles, CA 90048

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BUT WHY USE AI FOR LABOR?

Cesarean Decision Characteristic	Machine Learning Feature/Need
Multiple interacting maternal and fetal factors affecting outcome	Synthesize multiple factors interacting in nonlinear ways
Large amount of data from varied sources	Can passively collect data from EHR
Data continuously changing	Ability to recalculate probability in real time
Outcome (delivery) is clearly documented	Benefits from clearly labeled outcome

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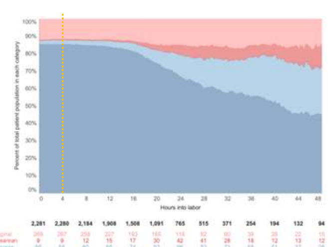
OB AI

Model Performance

Accuracy at 4 hrs: 87.1%

ROC AUC 0.82



Wong, et al. Amer Journ Peri 2022.

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Patient name

ed patient delivery method over the course of labor

iginal delivery more likely, 0 indicates cesarean delivery more likely

55

Ta-Da!

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AI to Predict/Prescribe

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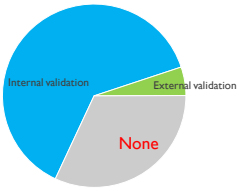
OB AI

Validation is rare.

Systematic Review

Novel machine learning applications in peripartum care: a scoping review



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Steinberg, Wong, Tsur, et al. AJOG MFM 2025.

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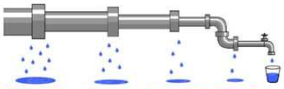
Leaky prognostic model pipeline



Not fit for purpose	No validation	No implementation	Not adopted
Developed on wrong patient population	Lack of data or incentive to pursue validation studies	No impact on decision making or patient (health) outcomes	Prediction (perceived as) not useful
Expensive or non-available predictors	Incompletely reported prediction model	No software developed to implement and use the model	Predictions not trusted
Time intensive to use model	Poorly developed or overfitted model	Requirements for adherence to (medical device) regulations	Model not transparent enough, or no tools available to enhance its use in practice
Outcome measured unreliably	Proprietary model code	Cost-effectiveness of use proprietary model	Model (perceived as) outdated

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van Royen, 2022

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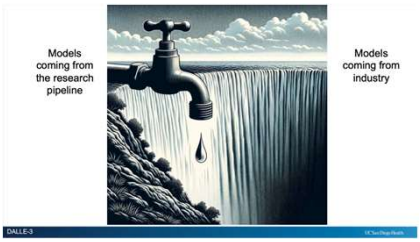
OB AI

Models that are validated are not implemented.
Models that have been implemented are not validated.



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Presentation by Karandeep Singh, 2024

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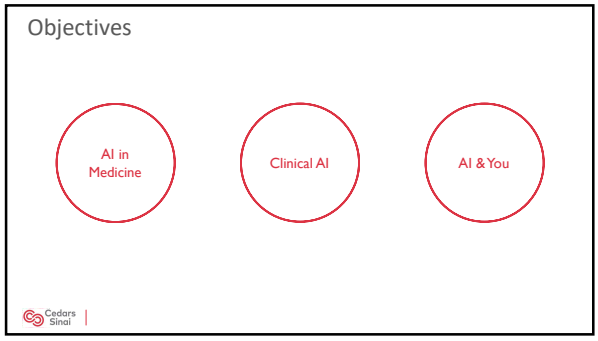

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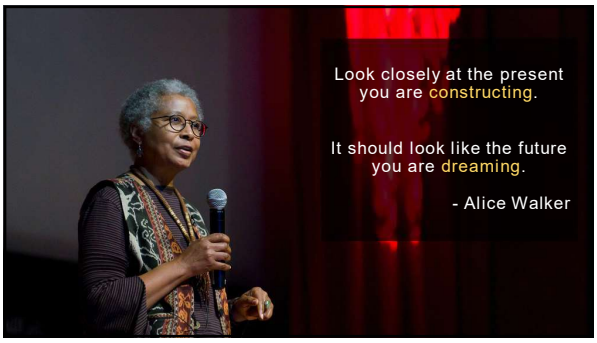

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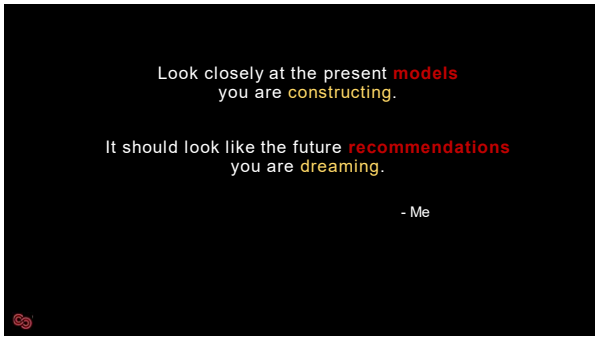

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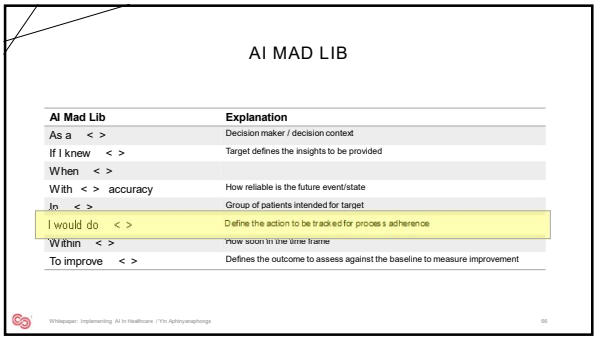

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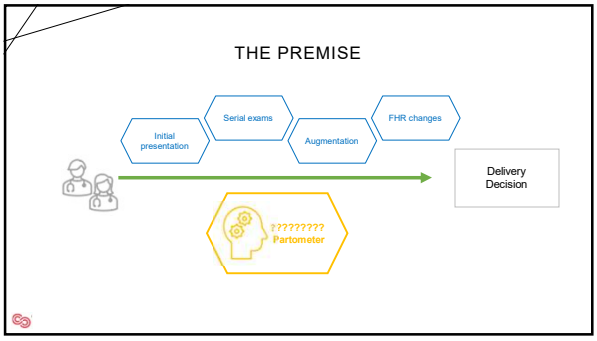

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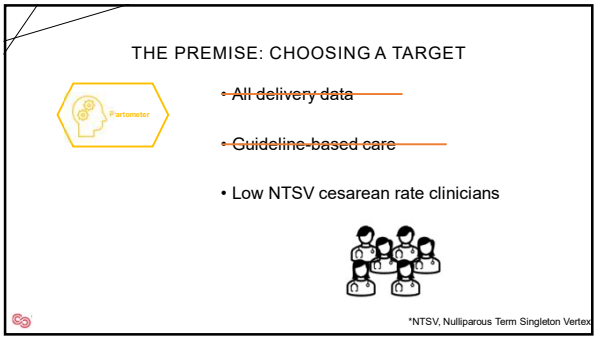

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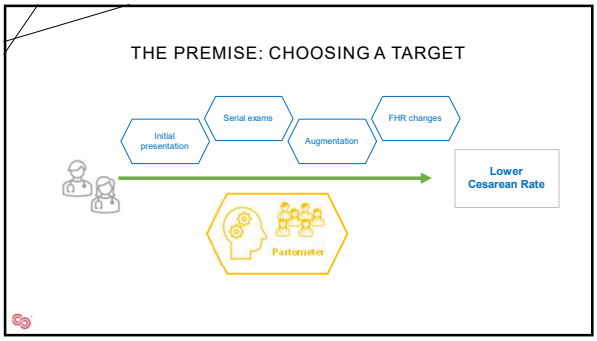

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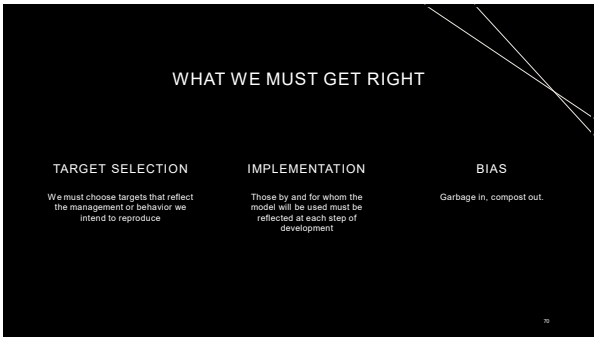

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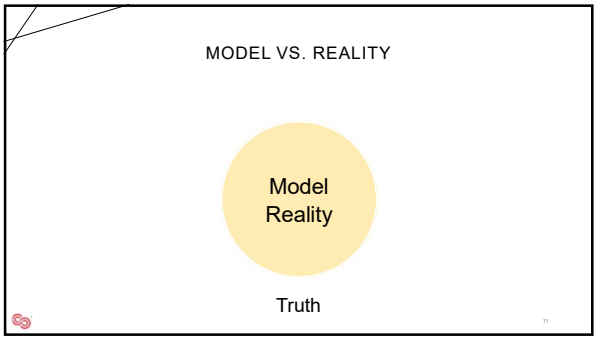

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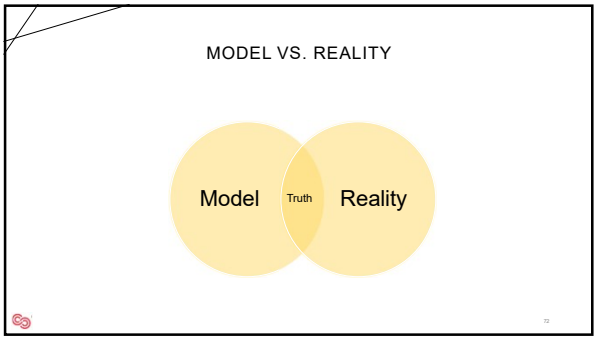

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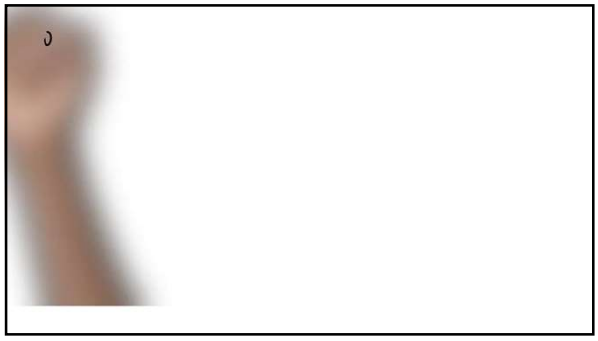

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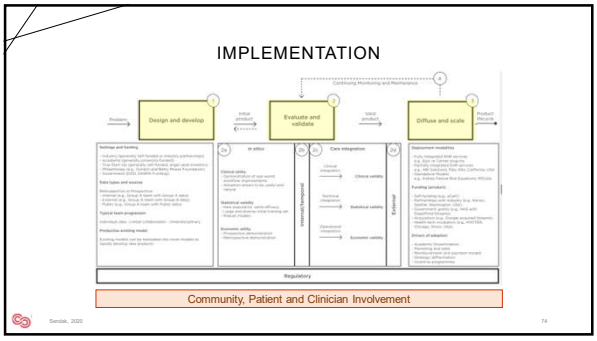

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WHAT WE MUST GET RIGHT

TARGET SELECTION

We must choose targets that reflect the management or behavior we intend to reproduce

IMPLEMENTATION

Those by and for whom the model will be used must be reflected at each step of development

BIAS

Garbage in, compost out.

75

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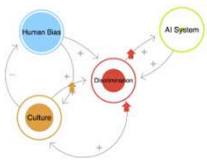
HOW AI CAN MAKE BIAS WORSE

Scale

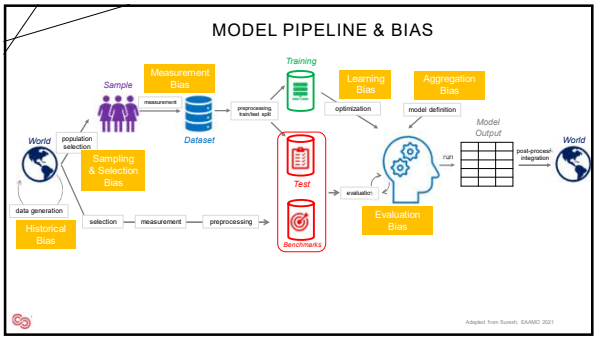
Opaque

Feedback Loops



Cathy O’Neil, WMD
GIF: J. Nathan Mathias

77



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Objectives

AI in Medicine

Clinical AI

AI in the Future

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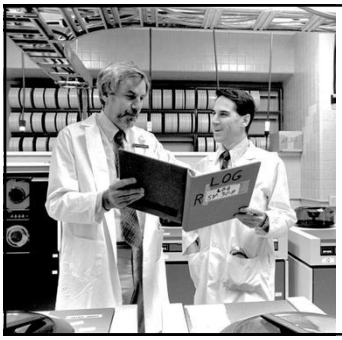

"

If a physician can be replaced by a computer, then he or she deserves to be replaced by a computer.

"

Dr. Warner Slack 1933-2018

80

References

Me!

mycshs.com/_nfc/583.html

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Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 01

Breathless After Birth: Flash Pulmonary Edema Following Cesarean Delivery

Presenting Author: Adam Bindelglass, MD

Presenting Author's Institution: Stony Brook University - Port Jefferson, New York

Co-Authors: Tiffany Angelo, D.O., FASA - Stony Brook Medicine
Morgane Factor, MD - Stony Brook Medicine
Anisha Javvaji, BS - Stony Brook University

Abstract :

Objectives:

1. Discuss the risks associated with administering IV fluids in patients with epidural anesthesia and pre-eclampsia with severe features during a C-section.
2. Review the clinical significance of pre-eclampsia and its implications in the immediate postpartum period.

Case Description:

This case involves a 44-year-old G1P0 at 36.6 weeks with advanced maternal age, obesity, type 2 diabetes, and pre-eclampsia without severe features, admitted for induction of labor. Following a prolonged labor course, the patient underwent an uncomplicated cesarean section under epidural anesthesia and received a total of 1L of crystalloid during the case.

Post-operatively, the patient had a low oxygen requirement with clear lung fields bilaterally. 45-minutes after arriving in PACU, the anesthesia team was called due to anxiety and a sudden increase in oxygen requirement to 8-10 L on a non-rebreather. The patient developed severe hypoxia, progressing to cardiac arrest, requiring 15 minutes of CPR for ROSC. Intubation was challenging due to patient positioning, anterior airway and excessive frothy secretions. After resuscitation, the patient exhibited seizure-like activity controlled with Midazolam and Magnesium. The patient was transferred to the ICU for further care and had a full recovery.

Discussion:

Acute pulmonary edema is a rare, life-threatening complication affecting approximately 0.08% of women during pregnancies. Risk factors for pulmonary edema include advanced maternal age, obesity, pre-eclampsia and cesarean delivery1.

Decreased pulmonary vascular resistance in pregnancy and increased pulmonary capillary permeability in pre-eclampsia, predispose patients to pulmonary edema. An epidural promotes venodilation which helps reduce preload and decrease the pressure

within the pulmonary vasculature. As the anesthetic recedes, patients may experience an increase in sympathetic tone, potentially exacerbating fluid shifts2.

Administering an IV fluid bolus during neuraxial anesthesia is a standard practice to reduce hypotension. However, pre-eclamptic parturients with liberal fluid administration have a higher incidence of acute pulmonary edema over parturients with restricted fluid administration during the perioperative period highlighting the importance of conservative fluid management3.

References:

1. Ram M, Anteby M, Weiniger CF, et. al. Acute pulmonary edema due to severe preeclampsia in advanced maternal age women. Pregnancy Hypertens. 2021 Aug;25:150-155. PMID: 34144403
2. Alves B, Cunha F, Pereira C. Epidural Anesthesia for Cesarean Section in a Pregnant Woman With Acute Pulmonary Edema: A Case Report. Cureus. 2023 Aug 23;15(8):e43994. PMID: 37746384
3. Thornton CE, von Dadelszen P, Makris A, et. al. Acute pulmonary oedema as a complication of hypertension during pregnancy. Hypertens Pregnancy. 2011;30(2):169-79. PMID: 19900075

Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 02

A Case of Paradoxical Vocal Fold Motion in Pregnancy

Presenting Author: Bryce M. Marshall, MD

Presenting Author's Institution: University of Kentucky Anesthesiology, Perioperative, Critical Care, and Pain Medicine - Lexington, Kentucky

Co-Authors: Blake Caracci, DO - University of Kentucky Anesthesiology, Perioperative, Critical Care, and Pain Medicine
James Damron, MD - University of Kentucky Department of Anesthesiology Perioperative Critical Care and Pain Medicine, Division of Obstetrical Anesthesia

Introduction: Paradoxical vocal fold motion disorder (PVFM) is a rare but well described process. PVFM is often misdiagnosed as an asthma exacerbation leading to excessive hospitalization, medication utilization and tracheal intubation. 1 PVFM has been shown to respond to botulinum toxin, voice therapy and treatment of underlying laryngopharyngeal reflux.2 There is a paucity of information regarding PVFM and pregnancy, especially during the peripartum phase as presented in this case

Case One: A 23-year-old G1P0 presented at 33w3d in respiratory distress secondary to PVFM. History included gestational diabetes, gestational hypertension, asthma, ADHD and depression. Episodes began prior to pregnancy requiring multiple intubations and ICU admissions. Symptom control was previously achieved with repeated botulinum injections, which were stopped once she became pregnant. After admission, her symptoms temporarily improved following nebulized racemic epinephrine, nebulized lidocaine, midazolam and BiPAP ventilation. On day 2, she underwent bilateral vocal cord injections with botulinum toxin with visualization via flexible nasal bronchoscopy. Multiple episodes of paradoxical movement with adduction on inhalation were directly observed. She was discharged on day 4 with symptom resolution; however, she re-presented the following week for 2-hours of frequent episodes. She was admitted to the ICU with planned IOL at 36 weeks. On readmission day 2, she experienced respiratory distress due to increased stridor resulting in desaturation. During this event, it became difficult to obtain fetal monitoring, and she was urgently evaluated by the obstetric team. Bedside ultrasound revealed fetal bradycardia to 60bpm; a stat cesarean delivery (CD) was called. Due to operating room distance and need for immediate delivery, a bedside CD was performed in the ICU. The patient was induced with propofol and rocuronium. OB anesthesia easily secured the airway with an endotracheal tube via video laryngoscopy. The patient was placed on the ICU ventilator and general anesthesia was maintained with a propofol infusion. A viable male was delivered at 35w3d. Bloody amniotic fluid was noted, concerning for placental abruption. The patient was then successfully extubated on post-operative day 1.

Case Two:

Discussion: This case describes management of PVFM in the peripartum period. It displays the crucial role of the obstetric anesthesia team. Routinely securing a high-risk airway, providing safe nonoperating room anesthesia, and being trained and available for neonatal resuscitation are a few of the highlights. This experience revealed areas of improvement in our hospital system. Future improvements include a standardized response cart including surgical tools, neonatal resuscitation equipment and medications like uterotonics and local anesthetics that are not commonly available in the ICU setting.

References: PMID: 17344570 PMID: 32418667

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Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 03

Combined Cesarean Delivery and Tracheal Dilation in Parturient with Subglottic Stenosis

Presenting Author: Julia Epelbaum, MD

Presenting Author's Institution: Hospital of the University of Pennsylvania - Philadelphia, Pennsylvania

Co-Authors: Huafeng Wei, MD, PhD - Hospital of the University of Pennsylvania

Introduction: Idiopathic subglottic stenosis is rare (1:400,000), and characterized by fibrosis of the subglottic larynx that can cause life-threatening airway obstruction. The etiology is uncertain but female sex and ages 20-40 years are primarily affected. It is rare in pregnancy and no management consensus exists [1,2]. Physiologic changes of pregnancy, including airway edema and hyperemia, increase in minute ventilation, oxygen consumption, and weight may exacerbate dyspnea and affect the ability to tolerate labor [1]. Successful tracheal balloon dilation with non-invasive ventilation techniques during early pregnancy has been reported [2]. We present the first report of a parturient with symptomatic subglottic stenosis to undergo combined elective cesarean delivery and tracheal balloon dilation.

Case One: A 31y.o. G3P2, 36 weeks' gestation, BMI 34 kg/m2, with a history of asthma presented with dyspnea, stridor and RSV infection. Workup revealed grade 3 subglottic stenosis (Figure). She denied prior intubations or autoimmune disease. IV dexamethasone, bronchodilators and nasal cannula O2 4L/min were administered. The otolaryngology, maternal fetal medicine, neonatology and anesthesiology teams determined that urgent airway intervention was necessary and that she would not tolerate labor. She was scheduled to undergo cesarean delivery with spinal anesthesia, followed by airway dilation with general anesthesia. Local anesthetic infiltration of the anterior neck was performed prior to abdominal skin incision in case awake tracheotomy became necessary. High flow nasal cannula O2 40L/min was provided. To mitigate aspiration risk with an unprotected airway, p.o. sodium citrate, IV famotidine, ondansetron and metoclopramide were administered. After abdominal wound closure, general anesthesia was induced. Orogastric suctioning was performed. Direct laryngoscopy and tracheal balloon dilation were performed with supraglottic jet ventilation [driving pressure, 25 Psi, frequency: 120/min, FiO2 1, I/E ratio: 40%.]. SpO2 saturations ranged between 85% - 99% and end tidal CO2 reached a maximum of 65 mmHg during the case. Full paralysis facilitated a stable surgical field and minimized barotrauma risk. After emergence, the patient reported immediate improvement in dyspnea.

Case Two:

Discussion: Preemptive awake tracheotomy was discussed but considered a last resort due to its invasiveness, operative risks and delayed complications. If tracheal dilation were conducted before delivery, decreased maternal functional residual capacity and prolonged supine positioning would have accelerated intraoperative hypoxemia and hypercarbia, reducing oxygen delivery to the fetus, thus risking emergency cesarean delivery with a compromised airway [3]. Sequential cesarean delivery and airway management facilitated controlled conditions.

References: 1. Laryngoscope. 2024 Mar;134(3):1014-1022. 2. J Laryngol Otol. 2019 May;133(5):399-403. 3. Clin Otolaryngol. 2020 Mar;45(2):253-258.

Subglottic Stenosis Figure.pdf

Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 04

DIFFICULT AIRWAY AND NEUROFIBROMATOSIS TYPE 2:ANESTHESIA FOR URGENT CESAREAN SECTION

Presenting Author: Makenzie A. Cherveny, DO

Presenting Author's Institution: Univeristy of Minnesota - Saint Paul, Minnesota

Co-Authors: Davina Tolbert, MD, MPH - University of Minnesota

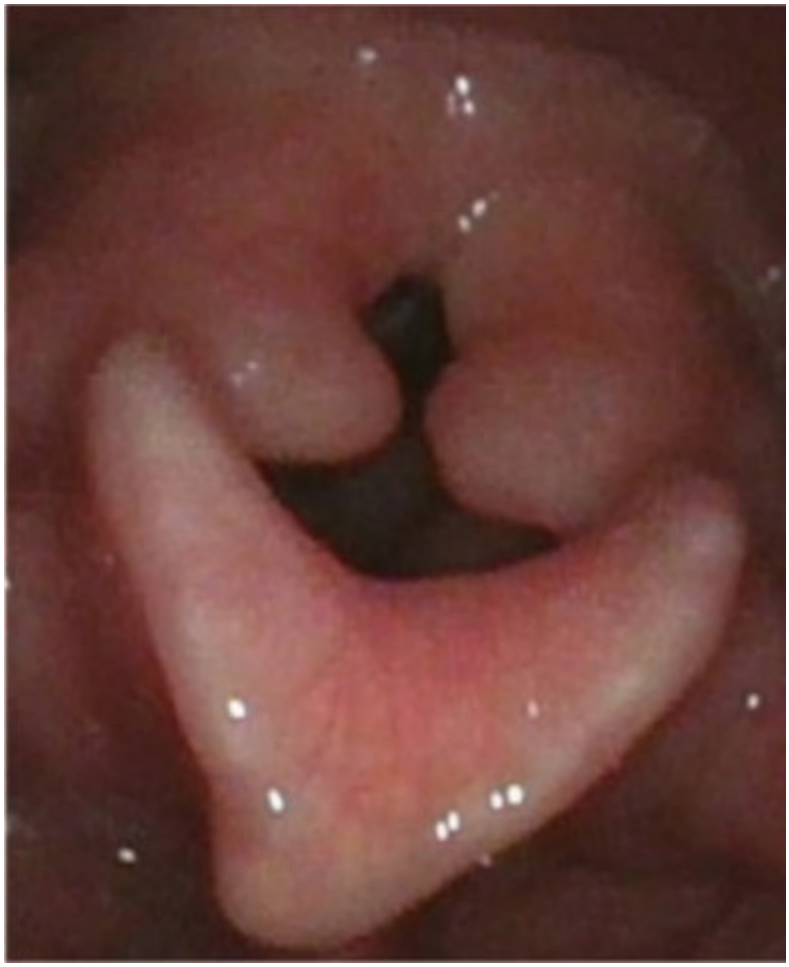
Introduction: Neurofibromatosis Type 2 (NF2) is characterized by vestibular schwannomas and central nervous system tumors. These tumors can lead to concerns for both neuraxial and general anesthesia.

Case One: A 33 week primigravid female with di-di twins via IVF, NF2, DMII, recent COVID-19, and tracheostomy in childhood was admitted for preeclampsia with severe features and DKA. An anesthesia consultation recommended spine MRI to evaluate for spinal tumors and an ENT consult due to history of tracheostomy. An urgent cesarean section was called the next day for worsening blood pressure, new oxygen requirement, and category two fetal heart rate tracing. The MRI and ENT evaluation had not been completed. Her neurology team recommended against neuraxial anesthesia. Head MRI was reviewed which did not demonstrate trachea narrowing. Through shared decision making with the patient and obstetricians, general anesthesia was planned. Rapid sequence induction with video laryngoscopy yielded a grade 1 view, but both a 6.5mm and 6.0mm endotracheal tube failed to pass for two providers. The patient was mask-ventilated and a supraglottic airway was placed with improvement in oxygenation. The infants were delivered. Uterine atony and hemorrhage required uterine balloon tamponade and red blood cell transfusion. Bronchoscopy through the LMA required significant flexion to enter the trachea and found no airway soiling. Her obstetricians expected no further intervention for hemorrhage control, so the patient was extubated and had an uneventful recovery, as did her infants. Postoperative nasal fiberoptic evaluation by ENT recommended fiberoptic intubation or LMA for future airway management. Outpatient reassessment revealed elongated arytenoids and posterior tissue with significant vocal cord hooding.

Case Two:

Discussion: This case explores unique considerations and strategies for anesthetic management in an obstetric patient with NF2 and difficult airway. This patient had concerns regarding intubation including obesity, preeclampsia, symptomatic COVID-19, and history of tracheostomy and lack of recent spine imaging evaluating possible NF2 tumors. Our institution has implemented more timely antepartum consultation. There is a need for thorough and timely interdisciplinary planning given the shifting relationship of risks and benefits with evolving comorbidities.

References: Mushambi, M. C., V. Athanassoglou, and S. M. Kinsella. "Anticipated difficult airway during obstetric general anaesthesia: narrative literature review and management recommendations." Anaesthesia 75.7 (2020): 945-961. Sakai, T., M. C. Vallejo, and K. T. Shannon. "A parturient with neurofibromatosis type 2: anesthetic and obstetric considerations for delivery." International journal of obstetric anesthesia 14.4 (2005): 332-335.



Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 05

Baby, You Take My Breath Away

Presenting Author: Kimberly Mendoza, MD, PhD, MPH

Presenting Author's Institution: University of Colorado Anschutz Medical Campus - Aurora, Colorado

Co-Authors: Madison Kohl, MD - University of Colorado Anschutz Medical Campus

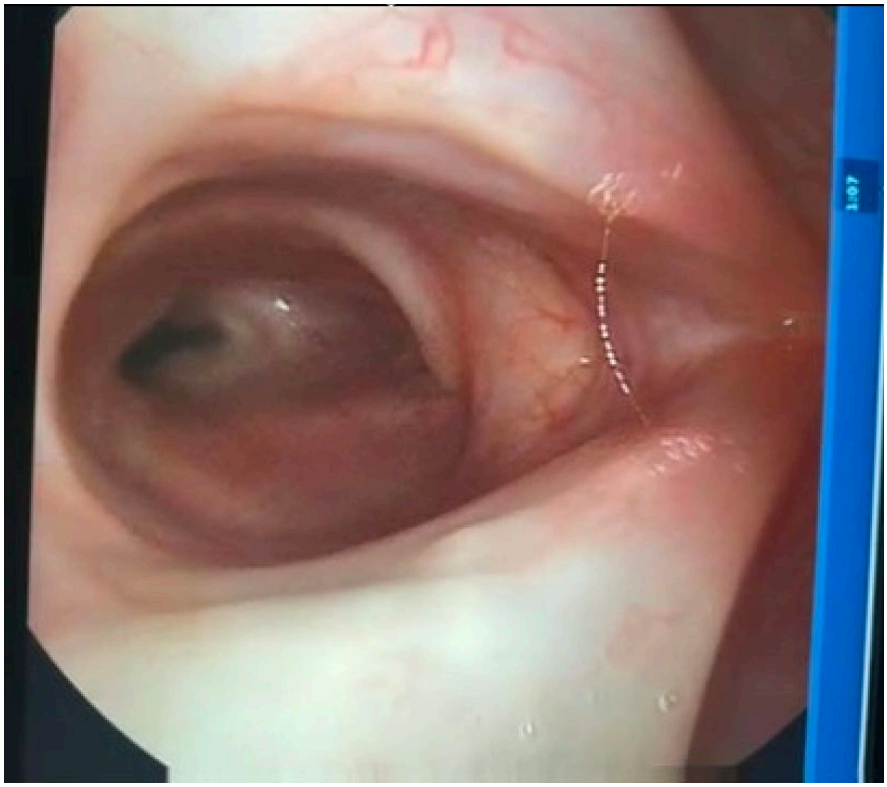
Introduction: Laryngeotracheal stenosis (LTS) is a narrowing of the upper airway between the larynx and trachea. It can lead to complications including respiratory failure, cardiopulmonary arrest and death. LTS can occur as a result of trauma, autoimmune disease, or an infectious process. LTS can cause symptoms of upper airway obstruction or patients can be asymptomatic. This report presents the case of a 19 year old G1P0 at 37 weeks with severe tracheal stenosis admitted for preoperative management before primary cesarean section (CS). A multidisciplinary approach composed of OB anesthesia, ENT, CT surgery/ECMO team, OB and NICU was required to develop a care plan addressing airway management. Thorough pre-operative management led to successful outcome for the patient and baby.

Case One: A 19 year old G1P0 with PMH significant for tracheal stenosis s/p tracheoplasty, decannulation, Chiari I malformation and hydrocephalus s/p VP shunt with revision, anxiety and scoliosis presented for pre-operative evaluation. Imaging demonstrated tracheal stenosis measuring 3.5 mm in the narrowest dimension. On physical exam the patient had a well healed subtle tracheostomy scar, mild stridor, was able to lie flat without dyspnea and able to achieve >4 METS without symptoms. She was offered a tracheostomy for symptom management but declined. The patient had a planned antepartum admission. Neuraxial anesthesia was utilized with combined spinal epidural (CSE). The catheter was kept available to avoid unplanned general anesthetic. Perioperative steroids were given and the patient maintained spontaneous ventilation during surgery. CS proceeded without complications. On POD #3 patient and baby were discharged home after meeting appropriate milestones.

Case Two:

Discussion: Subglottic tracheal stenosis in pregnancy requires multidisciplinary planning. There is high concern for airway compromise during expected airway edema associated with pregnancy, labor, valsalva maneuvers and pitocin infusion. Physiologic changes during pregnancy also include mucosal congestion, airway swelling and bleeding. Pregnant patients are at an increased risk for aspiration and often receive pre-medications to reduce gastric aspiration. Patients with tracheal stenosis during pregnancy are often managed with balloon dilation followed by normal spontaneous vaginal delivery. For known tracheal stenosis similar to this case, elective tracheostomy has been placed with reversal 4 weeks postpartum. Neuraxial use may also be preferred to minimize airway manipulation. However, patients with a VP shunt require additional consideration as intrathecal medications have unpredictable spread and can have a risk of high spinal compromising spontaneous breathing.

References: 1. Fang S, Pai B H P. Successful management of subglottic stenosis in pregnancy. BMJ Case Rep. 2021;14(3):e236466. Published 2021 Mar 24. 2. Kuczkowski KM, Benumof JL. Subglottic tracheal stenosis in pregnancy: anaesthetic implications. Anaesth Intensive Care. 2003 Oct;31(5):576-7.



Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 06

ANESTHETIC CONSIDERATIONS OF ANTERIOR MEDIASTINAL MASS IN THE PERIPARTUM PERIOD

Presenting Author: James Meisenheimer, MD

Presenting Author's Institution: University of Kansas Medical Center - Oak Grove, Missouri

Co-Authors: Taylor Leathers, MD - The University of Kansas Medical System

Introduction: Patients with mediastinal masses are at risk for cardiopulmonary complications, particularly when general anesthesia is induced. These complications can be exacerbated in gravid patients and additional thought and preparation in the anesthetic plan is paramount to the success of these cases

Case One: We present A 30-year-old G4P2012 at 34w2d with a past medical history of ruptured ectopic status post right salpingectomy and 2 previous cesarean sections (CS) presented to KUMC ED with sudden onset shortness of breath. Due to an elevated d-dimer and clinical picture, a CTA Chest was negative for PE but positive for and undiagnosed large left anterior mediastinal mass which involved the pericardium as well as the anterior chest wall and left upper lobe. An ultrasound guided biopsy revealed a pulmonary blastoma. A multidisciplinary team met to discuss treatment plans for this rare cancer and the MFM team decided to perform a repeat CS at 35w2d so that the patient could prepare to undergo surgical resection with adjuvant chemotherapy. The CTA did not reveal any compression on the trachea or mainstem bronchus and the echocardiogram demonstrated normal heart function without clear encroachment on the cardiac structures. The patient was able to maintain adequate oxygenation and ventilation on room air in the supine position. We decided to proceed with a neuraxial technique due to the risks of cardiopulmonary compromise with the induction of general anesthesia. Ultimately, secondary to her compromised respiratory status, the anesthesia team chose to perform a CSE to facilitate slightly decreased spinal dosing to decrease the chances of a high spinal while allowing the ability to give additional epidural anesthesia if necessary. Spinal dosing of 1.4mL of hyperbaric bupivacaine, 10mcg of fentanyl and 100mcg of morphine achieved a T4 sensory level block. Standard ASA monitors were used during the case. Additional equipment available in the room included supplies for an arterial line, video laryngoscopy, central venous access and a rigid bronchoscope. The patient underwent successful CS under neuraxial anesthesia without the need to convert to a general anesthetic.

Case Two:

Discussion: In the third trimester, the optimal management of pulmonary blastoma consists of delivery by caesarean section, stopping lactation and implementation of surgery treatment1. The success of these cases relies heavily on multidisciplinary planning and preparedness for general anesthesia. Management of anterior mediastinal mass in pregnancy is an anesthetic challenge. GA can worsen severe airway and vascular compression. CSEA is a safe alternative in these patients2.

References: 1. Budzik MP. Et al. (2022) BMC Pulm Med: 4;22(1):8 2. Bevinaguddaiah Y. et al. (2014) Saudi J Anaesth: 8(4):556-8

Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 07

Large Plexiform Neurofibroma causing Supraglottic and Subglottic Tracheal Stenosis

Presenting Author: Andrew Hackney, MD

Presenting Author's Institution: UAB Heersink School of Medicine - Birmingham, Alabama

Co-Authors: Annalese Neuenschwander, MD - The University of Alabama at Birmingham
Nathalia Torres Buendia, MD - UAB Heersink School of Medicine

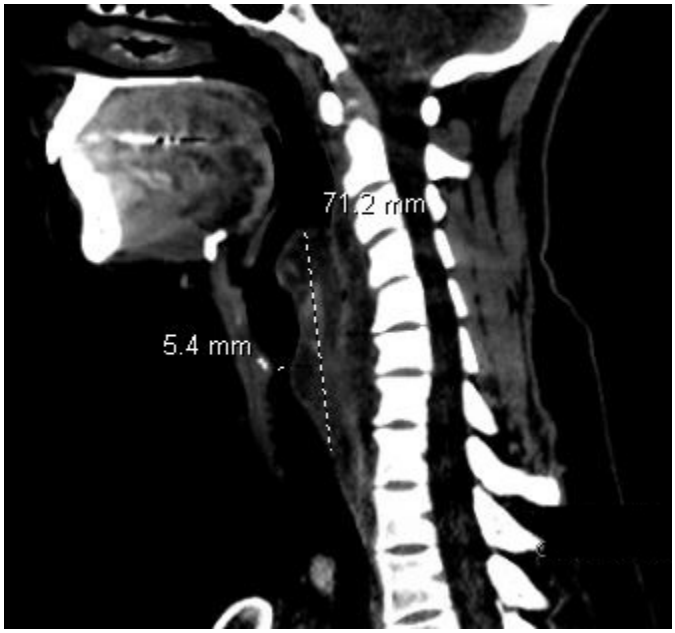
Introduction: Neurofibromatosis type 1 (NF1) presents unique challenges in obstetric anesthesia, particularly concerning the airway, cardiopulmonary, and neurologic manifestations.[1] This case report highlights the management of a parturient with a large plexiform neurofibroma causing supraglottic and subglottic tracheal stenosis.

Case One: A 31-year-old G2P1001 with a history of a difficult airway due to a large plexiform neurofibroma presented for repeat Cesarean delivery (CD). She previously underwent an awake tracheostomy and attempted resection of the neurofibroma. The mass was unresectable, and surgery was aborted after a partial resection. She was decannulated one year after surgery. She subsequently required a balloon dilation, LASER, and debridement of the neurofibroma. On exam, she had audible stridor which was reportedly her baseline and not progressive. Imaging showed a neurofibroma extending from the superior mediastinum to the retropharynx, with moderate supraglottic and severe subglottic stenosis. Otolaryngology (ENT) evaluation via fiberoptic laryngoscopy confirmed stable disease, with no need for surgical intervention prior to delivery. A multidisciplinary team, including obstetrics (OB), ENT, and OB anesthesia, planned for a repeat CD under neuraxial in the main operating rooms to ensure ENT availability for airway backup. Airway equipment such as a fiberoptic scope, McGrath, LMAs, and small-diameter endotracheal tubes (ETTs) was prepared. Neuraxial anesthesia was achieved using a low-dose combined spinal-epidural technique with 1 ml of 0.75% hyperbaric bupivacaine, intrathecal fentanyl, and morphine. A T4 block level was obtained after 15 ml of 2% lidocaine epidurally. The intraoperative and postoperative course was uncomplicated.

Case Two:

Discussion: NF1 can involve multiple organ systems, necessitating careful obstetric anesthetic evaluation. Patients face an increased risk of hypertension, including renovascular disease or pheochromocytoma.[1] Neurofibromas affecting the airway may cause glottic obstruction or subglottic tracheal stenosis, necessitating thorough preoperative airway evaluation. Pregnancy can both worsen subglottic stenosis and increase neurofibroma size putting a patient with both of these pathologies at high risk for airway compromise.[2] Spinal involvement, though typically extradural, may alter neuraxial anesthesia spread or increase the risk of bleeding into the epidural space.[1] These considerations underscore the importance of multidisciplinary planning for safe delivery.

References: 1. Hirsch NP, Murphy A, Radcliffe JJ. Neurofibromatosis: clinical presentations and anaesthetic implications. Br J Anaesth. 2001;86(4):555-564. doi:10.1093/bja/86.4.555. 2. Kuczkowski KM, Benumof JL. Subglottic tracheal stenosis in pregnancy: anaesthetic implications. Anaesth Intensive Care. 2003;31(5):576-577. doi:10.1177/0310057X0303100514.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Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 08

Jet Ventilation in a Pregnant Patient during her Third Trimester

Presenting Author: Walter Taylor, MD

Presenting Author's Institution: NewYork-Presbyterian Weill Cornell - New York, New York

Co-Authors:

Introduction: Pregnancy causes anatomic and physiologic alterations that increase risk of hypoxemia, aspiration, cardiopulmonary arrest, and mortality during intubation (1). Incidence of failed intubation is nearly eight-fold higher than in non-obstetric populations (2). Other airway interventions such as jet ventilation during pregnancy are exceedingly rare. Guidelines for management do not exist as current literature is based on case reports, small case series, and surveys (3). Specific anesthetic concerns include an unprotected airway in a patient at high risk for aspiration, unreliable oxygenation and ventilation in a patient with reduced FRC, frequent airway manipulation in a patient with edematous and friable mucosa, and increased risk for perioperative preterm labor.

Case One: A 35 year-old G2P1001 female at 30w0d with history of diffuse large B-cell lymphoma in remission presented to an outside hospital for progressive dyspnea on exertion and significant hypoxia with ambulation. A 1.5cm left main stem bronchial mass was found. On hospital day (HD) 5, the patient was transferred to our institution for further management. After multidisciplinary discussion, rigid bronchoscopy was planned for resection with pre- and post-operative fetal non-stress tests (NST). On HD7, patient came to OR. Standard ASA monitors were placed, and patient was positioned with left lateral uterine displacement. She was preoxygenated and underwent a rapid sequence induction and intubation. General anesthesia was maintained with propofol and remifentanil infusions. An orogastric tube was placed for gastric decompression. She was extubated and a rigid bronchoscope was placed. Jet ventilation using 100% FiO2 was initiated. The right endobronchial mass was excised. Shortly after excision, bleeding around the site was noted. FiO2 was decreased to 30%. Bleeding was controlled with electrocautery, and patient was reintubated using a fiberoptic bronchoscope. Neuromuscular blockade was reversed, and she was extubated. She was transferred to PACU where began painfully contracting q2-4min. Indomethacin PO 50mg was administered. Contractions spaced to q10-12 min and ceased being painful. NST continued to be reactive and the tocodynamometer was acontractile. Patient was discharged home on HD8. Pathology showed low-grade mucoepidermoid carcinoma.

Case Two:

Discussion: Surgical intervention requiring jet ventilation during pregnancy is uncommon. This case describes the safe administration of GA with jet ventilation in the third trimester and highlights the importance of multidisciplinary planning to ensure the best outcomes for mother and fetus.

References: (1) Myatra S, et al. The physiologically difficult airway: an emerging concept. Curr Opin Anesthesiol. 2022. (2) Chestnut DH, et al. Chestnut's Obstetric Anesthesia (6th ed). Elsevier. 2020. (3) Gascon L, et al. Surgical management of iSGS in pregnant patients: Survey among North American expertise centers. Am J Otolaryngol-Head and Neck Med Surg. 2024.

2025 SOAP CT scan.pdf

Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 09

Management of Cesarean Delivery in a Patient with Large Mediastinal Mass and Bronchovascular Compression

Presenting Author: Harvy Freitag, MD

Presenting Author's Institution: UAB Hospital - Birmingham, Alabama

Co-Authors: Andrew Hackney, MD - UAB Heersink School of Medicine

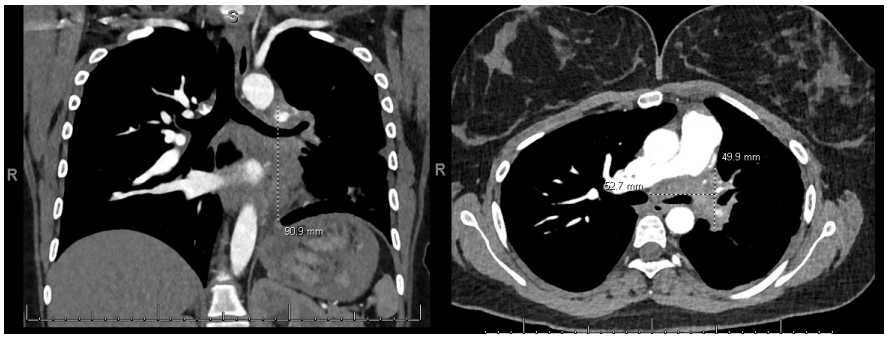
Introduction: Mediastinal masses can critically compromise both the airway and cardiovascular system during anesthesia by compressing the trachea and major vessels [1]. These challenges intensify in pregnancy, where increased oxygen demand and decreased functional residual capacity heighten the risk of decompensation. Moreover, cardiorespiratory symptoms at initial presentation and abnormal pulmonary function tests (PFTs) are linked to higher perioperative complications in patients with large mediastinal masses [2]. This report describes the anesthetic and obstetric management of a pregnant patient with an enlarging fibrosing mediastinitis mass causing left pulmonary artery and left mainstem bronchi occlusion.

Case One: A 31-year-old P0101 with known fibrosing mediastinitis presented at 34 weeks gestation with persistent nausea, vomiting, and progressively worsening shortness of breath. A chest CT angiogram showed an increase in the mediastinal mass to 5.3 × 5.5 × 9.1 cm, causing chronic occlusion of the mid/distal left pulmonary artery and mild compression of the anterior left mainstem bronchus. She required 2–3 L/min supplemental oxygen for symptomatic relief and experienced dyspnea when lying flat or walking short distances. Her past medical history included Wolff-Parkinson-White syndrome status post-ablation, baseline sinus tachycardia, and intermittent tachyarrhythmias. Obstetric history was notable for a prior Cesarean delivery under neuraxial anesthesia and severe preeclampsia. PFTs revealed mixed obstructive and restrictive patterns. An extracorporeal membrane oxygenation (ECMO) team was consulted as a precaution for potential airway collapse during induction if general anesthesia became necessary. She underwent a scheduled repeat Cesarean section using a combined spinal epidural with 12mg of 0.5% isobaric bupivacaine with intrathecal fentanyl and morphine to avoid airway manipulation. The surgery proceeded without complications, requiring no escalation to general anesthesia. A healthy neonate was delivered, and the patient's postoperative course remained uneventful.

Case Two:

Discussion: Pregnancy-related physiologic changes—including increased blood volume and elevated diaphragms—can aggravate the mass effect of mediastinal tumors, necessitating meticulous perioperative planning. Neuraxial anesthesia helps maintain airway patency and stable hemodynamics, while having ECMO on standby provides a crucial safety net in the event of sudden decompensation. Early recognition, strategic anesthetic planning, and interdisciplinary coordination are key to optimizing outcomes in this challenging clinical scenario.

References: [1] Gothard, J. W. (2008). Anesthetic considerations for patients with anterior mediastinal masses. Anesthesiology clinics, 26(2), 305-314. [2] Béchard, P., Létourneau, L., Lacasse, Y., Côté, D., & Bussières, J. S. (2004). Perioperative cardiorespiratory complications in adults with mediastinal mass. Anesthesiology, 100(4), 826-34.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Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 10

Pregnancy in Goldenhar Syndrome: Potential for both difficult airway and difficult neuraxial anesthesia

Presenting Author: Kaylea Gunn, MD

Presenting Author's Institution: Vanderbilt University Medical Center - Nashville, Tennessee

Co-Authors: Neva Lemoine, MD - Vanderbilt University Medical Center
Laura L. Sorabella, MD - Vanderbilt University Medical Center

Introduction: Goldenhar Syndrome, otherwise known as oculo-auriculo-vertebral spectrum, is a rare condition that affects the development of facial features, the skull, and rarely, other organs. It is due to inappropriate development of the first and second branchial arches1. Goldenhar Syndrome is typically sporadic, with low incidences of inherited patterns. However, if inherited, it follows an autosomal dominant pattern1-3. The deformities are typically unilateral and are most commonly contained to the face and neck. Other affected body parts include vertebrae, ribs, heart, lungs, and kidneys. Their craniofacial abnormalities can lead to complex anesthetic considerations and difficulties; the most concerning being their airway. The potential for spine malformations can also lead to neuraxial difficulty, which is of higher yield in obstetric anesthesia. There is no definitive treatment for Goldenhar Syndrome, although many individuals will have surgeries done to help correct asymmetry or cranio-facial abnormalities that affect their daily lives.

Case One: A 27 year-old G1P0 female presented at 17w0d to establish care. She had a history of asthma and Goldenhar Syndrome. Her phenotype included cleft lip, right ear atresia, and micrognathia for which she underwent jaw lengthening surgery. She also had scoliosis of the lumbar spine with hemivertebrae noted at L1 & L3, as well as significant torticollis. Her BMI was 39.4 kg/m2 and her height was 60 inches. Her anesthetic history included a documented difficult airway with prior attempts at asleep fiberoptic intubation with difficulty. Her pregnancy was otherwise complicated by velamentous cord insertion and heart failure with reduced ejection fraction (LVEF 45-55%). She was started on 12.5 mg metoprolol succinate daily as part of guideline directed medication therapy (GDMT). Through shared decision making, the patient elected for a primary cesarean delivery at 39 wks. Combined spinal epidural (CSE), with 7.5mg of hyperbaric bupivacaine, 15 mcg of fentanyl, and 150 mcg of morphine was chosen to minimize the risk of high spinal given her stature and neuraxial abnormalities. Neuraxial was successful, and the patient underwent uneventful cesarean delivery. She did not require diuresis and was discharged home on PPD 3.

Case Two:

Discussion: Goldenhar Syndrome is a rare genetic condition that can create obstacles in obstetric anesthesia, including both facial abnormalities and pronounced spine deformities. Heart failure can also be seen. A multidisciplinary approach to an affected individual can create the safest plan with time to properly prepare for potential difficulties that may arise.

References: PMID: 35015423 PMID: 1648462 PMID: 2316841

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Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 11

A Case of Tracheal Stenosis in the Second Trimester of Pregnancy

Presenting Author: Talia Scott, MD

Presenting Author's Institution: Icahn School of Medicine at Mount Sinai - New York, New York

Co-Authors: Ann Powers, MD - Icahn School of Medicine at Mount Sinai

Introduction: Tracheal stenosis in pregnancy is a rare but potentially life-threatening condition that poses significant challenges for diagnosis and management. The narrowing of the trachea can lead to respiratory distress, which is particularly concerning for both the mother and fetus due to the physiologic changes of pregnancy, e.g., increased oxygen demand and altered airway dynamics. This case report highlights the management of tracheal stenosis in pregnancy, emphasizing the need for an interdisciplinary approach to optimize outcomes for both mother and fetus.

Case One: A 19-year-old female with seizure disorder developed tracheal stenosis due to repeated traumatic tracheal intubations for status epilepticus. Her most recent intubation was eight months prior to presentation. She had balloon dilations performed twice but again became symptomatic. She presented to her local hospital who refused to do the procedure because she was pregnant. She presented to our hospital for a scheduled diagnostic laryngoscopy, bronchoscopy, lysis of tracheal scar, steroid injection, and balloon dilation. On the day of surgery, she was 18 weeks pregnant and presented with worsening airway distress. The obstetric anesthesia team raised the concern that her airway could become more edematous during the pregnancy and she should undergo a more definitive procedure. The patient was presented with the options of a tracheostomy or tracheal resection and opted for tracheal resection. Prior to surgery a fetal heart rate was checked. On presentation to the OR her airway exam was unremarkable. Tracheal intubation proved difficult due the narrowing of the trachea, and ultimately a 4.5 mm ETT was passed. The tracheal resection was performed, and a 3 cm segment of tracheal stenosis with a pinpoint airway was identified and removed. Following surgery, the FHR was again normal. The patient did well postoperatively and was discharged home on postoperative day 8 without respiratory issues.

Case Two:

Discussion: Airway stenosis is a diagnosis that includes both tracheal and subglottic stenosis. Commonly, symptoms worsen over the course of pregnancy.1 The management must be tailored to the individual patient. In this case, the patient had recurrent stenosis requiring frequent balloon dilations with worsening symptoms that would likely require repeat dilations over the course of her pregnancy. Therefore, the joint decision was to offer definitive treatment during the pregnancy. Tracheal stenosis during pregnancy is rare but with a multidisciplinary approach a successful outcome can be achieved.

References: McCrary H, Torrecillas V, Conley M, Anderson C, Smith M. Idiopathic Subglottic Stenosis during Pregnancy: A Support Group Survey. Ann Otol Rhinol Laryngol. 2021;130(2):188-194

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Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 12

Choosing the Best Path: Difficult Airway Versus Challenging Neuraxial During Cesarean Delivery

Presenting Author: Ezana Girmai, MD

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Introduction: Neuraxial anesthesia is recommended for cesarean section (CS) due to its safety profile. However, patients with prior spinal surgery can present challenges due to altered anatomy and the presence of fibrosis1,2. Neuraxial in such patients is further complicated by factors like previous neurological complications, obesity, poor positioning, and labor pain. This case describes the successful placement and use of an intrathecal catheter for labor analgesia and CS anesthesia in a patient with super morbid obesity and prior L4/L5 laminectomy for Cauda Equina Syndrome (CES).

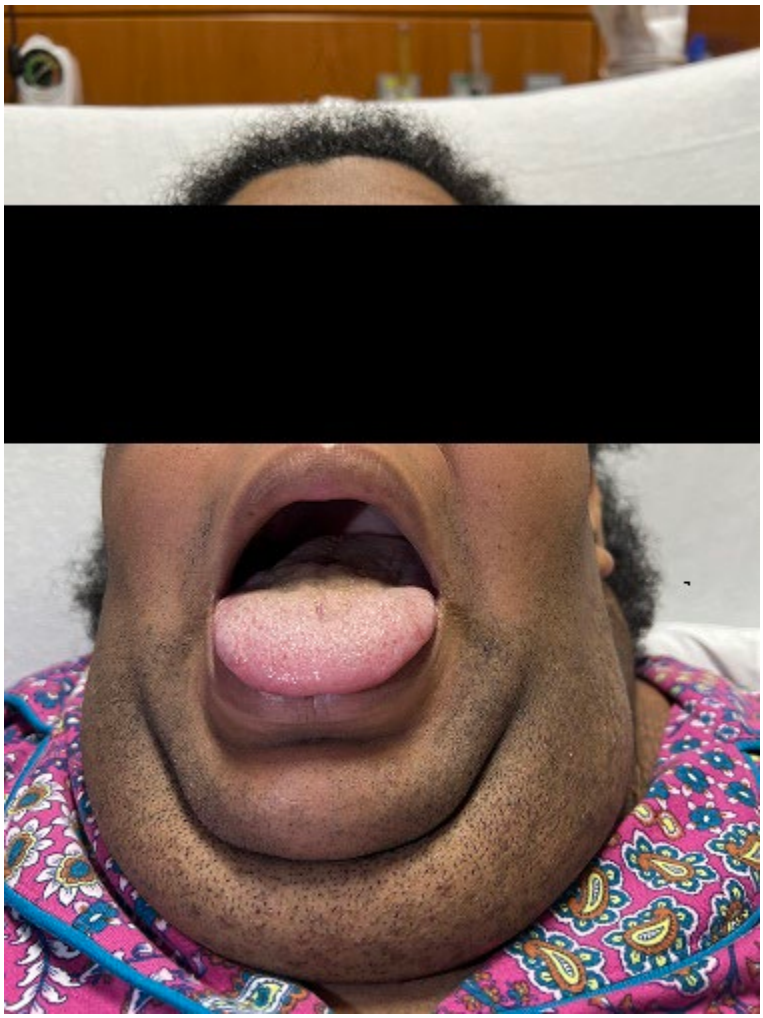
Case One: A 26-year-old G1 with super morbid obesity, spinal stenosis, and CES was scheduled for induction of labor (IOL) for fetal macrosomia. Physical exam revealed central obesity, prominent dorsocervical fat pad, scoliosis, Mallampati IV, short thyromental distance, and cushingoid appearance (Figure 1). An epidural was offered after discussion with neurosurgery, who warned that spinal canal fibrosis was likely. After many failed attempts with and without ultrasound, the procedure was aborted. Given the high risk to the lives of both mother and infant in a likely difficult airway during an obstetric emergency and limited night staffing, the decision was made to pause the IOL until dayshift. After a multidisciplinary huddle, the team opted to pursue IOL instead of primary CS due to the risk of morbidity and favorability of vaginal delivery. Given the likely canal fibrosis which could result in patchy spread, a decision was made to attempt an intrathecal catheter via a left paramedian approach, using a Gertie Marx needle. The patient was moved from the soft bed to a firm stretcher covered by a hard plastic board. Dorsal fat pads were displaced with silk tape, optimizing visualization of bony landmarks. With optimized positioning and paramedian approach from the side of the outer lumbar scoliotic curve, intrathecal access was successfully achieved at 13cm depth. The patient achieved an adequate level using dilute local at 1.2mL/hr. She remained comfortable for 6hrs until a fetal late deceleration and was dosed successfully for an emergent CS with 1.3mL of 0.75% bupivacaine. She remained comfortable without complaint and did not suffer spinal headache or additional neurological impact post-delivery.

Case Two:

Discussion: This case shows the complexities of neuraxial and highlights the importance of individualized, multidisciplinary planning. Including consideration of alternate techniques, pre-procedural assessment, positioning, and a well-coordinated team approach to achieve a favorable outcome.

References: 1. Kopp SL, Jacob AK, Hebl JR. Regional Anesthesia in Patients With Preexisting Neurologic Disease. Reg Anesth Pain Med. 2015 Sep-Oct;40(5):467-78. doi: 10.1097/AAP.0000000000000179. 2. Kii N, Kimizuka M, Someya M, et al #35887 Successful management of labor epidural analgesia for a nulliparous woman with prior spinal surgery of congenital

scoliosis and tibial deficiency. Regional Anesthesia & Pain Medicine 2023;48:A24



Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 13

An unconventional use of airway ultrasound in a difficult and traumatic obstetric airway

Presenting Author: Max C. Schmideler, MD

Presenting Author's Institution: University of Virginia - Charlottesville, Virginia

Co-Authors: Brett Elmore, MD - University of Virginia

Introduction: Obstetric airway management is known to present unique challenges due to the anatomical and physiological changes undergone during pregnancy. We present a case of difficult airway management which utilized airway ultrasound to evaluate ETT placement and evaluate surrounding soft tissue injury. Additionally, ENT was urgently consulted for repair following airway trauma.

Case One: A 21-year-old G2P0010 female at 38w5d with past medical history of BMI 62, LGA, and carcinoid tumor, presented for induction for preeclampsia with severe features. She presented with a blood pressure of 162/101 mmHg and headaches and was started on magnesium. She had uneventful epidural placement with a T10 sensory level. The patient was ruptured on oxytocin for 15 hours without cervical change, occasionally having category 2 tracings, meeting criteria for unsuccessful IOL. Her epidural was dosed for surgical anesthesia with 100 mcg fentanyl and ultimately 30 ml of 2% lidocaine. The patient initially reported T4 level bilaterally checked with ice and tolerated vertical midline skin incision. However, the patient reported intolerable sharp discomfort as the obstetrician began to access the fascia and the decision to convert to general anesthesia was made. After preoxygenation, an RSI was performed with propofol and succinylcholine. Due to a large tongue and small mouth opening, it was initially difficult to obtain a view with video laryngoscopy. After obtaining a grade 1 view, the ETT was advanced without resistance and the airway was secured. Shortly after, the mouth filled with blood and 20 ml of blood was suctioned from oropharynx. Our view was again obtained with the glidescope and the ETT was seen to be passing through the soft palate (figure 1). An airway ultrasound was performed to confirm ETT placement and try to evaluate the extent of soft tissue injury. Given evidence of soft tissue edema and fluid collection, ENT was urgently consulted. Under video laryngoscopy, the ETT was slowly removed while a second ETT was ready to be placed. No further bleeding was observed, and the airway was secured. The defect was repaired by ENT with interrupted Vicryl suture due to concern for rebleeding. The patient later denied sore throat or pain and reported satisfaction with her care.

Case Two:

Discussion: Airway ultrasound is a noninvasive tool which can provide valuable information regarding anatomy, measurements, ETT placement, identification of the cricothyroid membrane for cricothyrotomy, and assessment of a difficult airway (1). In obstetric airway management, and in the morbidly obese population, it can prove to be invaluable. Additionally, the availability of an ENT colleague who can provide a second opinion and assist with laceration repairs is a tremendous resource.

References: https://pmc.ncbi.nlm.nih.gov/articles/PMC10177245/

Airway ultrasound used in a difficult and traumatic obstetric airway, US Schmideler.pdf

Abstract #: THURS - CR - BS 1 - BR 1 – Airway – 14

Spinal Anesthesia for a Patient with Achondroplasia, Prior Lumbar Fusion, and Obesity: Development of a Novel Difficult Back Algorithm

Presenting Author: Jordan A. Francke, MD MPH

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Introduction: The American Society of Anesthesiologists published its first difficult airway algorithm in 1993.1 Clinical spinal anesthesia predates the modern cuffed endotracheal tube by over two decades, but a formalized difficult back algorithm has yet to be created.2,3 Anesthesiologists frequently encounter patients with challenging neuraxial anatomy due to scoliosis, instrumentation, obesity – concurrence of these factors can compound neuraxial difficulty. For patients who also have a difficult airway, strategies to optimize neuraxial success are a central priority. Achondroplasia is an autosomal dominant condition caused by a FGFR3 mutation, and is the most common bone dysplasia.4 Patients can have thoracic kyphoscoliosis and lumbar lordosis, which may worsen in pregnancy.4 Spinal instrumentation is common due to claudication from narrowing of the spinal canal or foramen magnum.4 Challenging airway is also a concern due to adenotonsillar hypertrophy, macrocephaly, and midface retrusion.4

Case One: A 32-year-old G1P0 at 38 weeks' gestation presented for a primary cesarean delivery due to achondroplasia. The patient's history was otherwise notable for asthma, Class III obesity (height 130 cm, BMI 55.4 kg/m2), and prior single-level lumbar fusion. On exam, the patient had a Mallampati IV airway with reduced thyromental and interincisor distances. Her neuraxial exam was notable for a scar spanning from approximately L2-L5 and poorly palpable anatomic landmarks. After consultation with the patient and obstetrician, a single-shot spinal was planned. No prior imaging was available. Pre-placement lumbar neuraxial ultrasound was technically difficult due to scarring, but midline was confirmed. Multiple attempts (by fellow, then attending) with a 25G Whitacre needle were unsuccessful. A 22G Quincke needle was subsequently used with success after one redirection. A spinal dose of 9 mg hyperbaric bupivacaine, 15 mcg fentanyl, and 100 mcg morphine yielded bilateral sensory blockade to T4. Cesarean delivery under spinal anesthesia proceeded uneventfully, with no new postpartum neurologic sequelae.

Case Two:

Discussion: The challenges and considerations of this case were an impetus for us to develop a difficult back algorithm (Figure). The algorithm prioritizes 3 key tenets: (1) utilization of available imaging modalities, (2) escalation of provider experience to limit failed attempts, (3) harnessing of the benefits of neuraxial needles while minimizing risk. The anesthetic approach for patients with rare, unique neuraxial and airway challenges should be individualized. Team decision-making with our proposed difficult back algorithm may reinforce success and enhance safety by avoiding general anesthesia. Further studies to validate the difficult back algorithm are warranted.

References: 1. ASA Practice Guidelines. . Anesthesiology. 1993;78(3):597-602. 2. Guedel A et al. A&A. 1928; 238-239. 3. Bier A. Zeitschrift für Chirungie.1899; 51: 361-9. 4. Pauli R. J Rare Dis. 2019;14(1):1.

Francke Difficult Back Algorithm 1 27 2025.pdf

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 01

Amniotic Fluid Embolism with Echocardiographic Evidence of Intracardiac Thrombus: Two Case Reports

Presenting Author: Dan Mija, MD

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Introduction: Amniotic fluid embolism (AFE) is a rare but critical obstetric emergency characterized by sudden cardiovascular collapse and disseminated intravascular coagulation (DIC). The incidence is estimated between 2.2 to 7.7 per 100,000 deliveries, with a fatality rate of up to 26%. The condition is triggered by the tearing of placental or uterine veins allowing amniotic fluid to enter maternal circulation. An anaphylactoid reaction ensues leading to cardiopulmonary collapse, coagulopathy, and the release of inflammatory mediators. We present two cases of AFE during cesarean delivery that demonstrate the rapid transition from a hypercoagulable to hypocoagulable state.

Case One: Case 1: 38-year-old woman undergoing a scheduled repeat cesarean at 39 weeks experienced pulseless electrical activity (PEA) arrest immediately after delivery. Resuscitation achieved ROSC and intraoperative TEE revealed a large intracardiac thrombus with right ventricular dilation. ROTEM analysis demonstrated hypocoagulability despite earlier hypercoagulable findings. Management included TXA and MTP initiation. Postoperative CTA revealed subsegmental pulmonary emboli.

Case Two: Case 2: A 37-year-old woman underwent a scheduled cesarean delivery for suspected focal placenta accreta. Following placental delivery, she suffered PEA arrest. ROSC was achieved after one round of ACLS. Intraoperative TEE once again revealed an intracardiac thrombus extending into the IVC, and ROTEM confirmed hypocoagulability. Persistent hemorrhage necessitated hysterectomy and ongoing MTP. Postoperative imaging revealed multiple subsegmental PEs.

Discussion: Disseminated coagulation and consumptive coagulopathy are hallmarks of AFE. Fibrinogen replacement and antifibrinolytics are critical to reversing hypocoagulability. Conflicting management goals arose due to simultaneous thromboembolism and consumptive coagulopathy. While fibrinogen replacement and TXA are essential for hypocoagulability, their safety in the presence of thrombus is unclear. In the first case, hesitancy to administer cryoprecipitate delayed coagulopathy correction. However, lessons from this case guided aggressive treatment in the second. TEE aids in guiding resuscitation efforts; however an intracardiac thrombus, in our limited experience, should not delay component and anti-fibrinolytic therapy. More studies on the nature and evolvement of the coagulation cascade during the hyperacute phase of AFE will help formulate the best treatment methods.

References: 1. Abenhaim Am J Obstet Gynecol 2008 2. Clark Obstet Gynecol 2014 3. Coggins Obstet Gynecol Clin North Am 2022

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 02

Amniotic Fluid Embolism and Multisystem Organ Failure

Presenting Author: Marcia Chen, MD

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Co-Authors:

Introduction: Amniotic fluid embolism (AFE) is a rare (~1/8000 to 1/80000 pregnancies) but catastrophic obstetric emergency, associated with mortality rates ranging from 10-61%. It occurs when amniotic fluid, fetal cells, hair, or other debris enter the maternal circulation. Presentation can vary greatly, but the classic triad is hypotension, hypoxia, and coagulopathy. AFE may lead to sudden cardiovascular collapse.

Case One: A 32-year-old G1P0 at 38 weeks 5 days with gestational diabetes was admitted for induction of labor for a blood pressure of 146/93 in the office. She received a combined spinal-epidural for labor analgesia. 20 hours later, she underwent emergent Cesarean delivery for fetal bradycardia. Intraoperative 'oozing' was noted, and ROTEM showed coagulopathy and FIBTEM A5 3mm. Near the end of surgery, she reported difficulty breathing. Her SpO2 acutely dropped to 70s with PaO2 49 on ABG , and nasal CPAP was trialed. In the setting of disseminated intravascular coagulation (DIC) and sudden hypoxia, differential diagnoses included HELLP, pulmonary embolism, and AFE. Magnesium was started for seizure prophylaxis. Bedside XR showed mild bilateral interstitial edema. Repeat ABG revealed PaO2 65 despite 100% FiO2 via CPAP . Given acute worsening of her respiratory (P/F ratio 65) and hemodynamic status, the decision was made to intubate and transfer to the medical intensive care unit (MICU). ECHO later that day revealed a severely dilated right heart with septal flattening, reduced right ventricular (RV) function with McConnell's sign, moderate tricuspid regurgitation, and moderate pericardial effusion without tamponade. Troponins were >9000, and non-invasive cardiac output monitor showed a cardiac index of 2.0. RV failure was managed with dobutamine and inhaled nitric oxide. Her MICU course was complicated by atypical hemolytic uremic syndrome and renal failure requiring dialysis. Her heart and kidney failure slowly recovered, and she was discharged home on POD 15.

Case Two: N/A

Discussion: AFE is a clinical diagnosis that must be considered in pregnant or recently postpartum patients who present with respiratory distress, hemorrhage, and/or cardiovascular collapse. Lab findings may suggest DIC characterized by elevated D-dimer, low fibrinogen, and thrombocytopenia. XR may show bilateral infiltrates. RV pressures become acutely elevated and may precipitate RV failure, left ventricular failure, and acute hypoxic respiratory failure. Right heart enlargement with septal flattening or bowing may be seen on CT or ECHO. Treatment includes advanced cardiac life support, vasopressors, inotropic agents, respiratory support, and transfusion. Multidisciplinary management (MFM, OB anesthesiology, and critical care teams) is crucial, as AFE is a complex disease that can affect every organ system and result in severe maternal morbidity and mortality.

References: Kaur K et al. Amniotic fluid embolism. PMID: 27275041 Haftel Aet al. Amniotic Fluid Embolism. https://www.ncbi.nlm.nih.gov/books/NBK559107/

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 03

Successful resuscitation from amniotic fluid embolism with extracorporeal membrane oxygenation

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Presenting Author's Institution: TeamHealth Anesthesia at Tampa General Hospital - Clearwater, Florida

Co-Authors: Joby Chandy, MD - Dept of Anesthesiology and Perioperative Medicine, USF Morsani College of Medicine
Suvikram Puri, MD - Dept of Anesthesiology and Perioperative Medicine, USF Morsani College of Medicine

Introduction: A patient with amniotic fluid embolism was successfully resuscitated using venoarterial extracorporeal membrane oxygenation (VA-ECMO) after cardiopulmonary arrest.

Case One: A 24-year-old G4P1021 at 38 weeks, with a history of anemia, asthma, and variegate porphyria, was admitted for labor induction due to recent hypertension. Her past surgical history included two pregnancy terminations due to acute porphyria attacks. Labor was induced with vaginal misoprostol and IV oxytocin. The anesthesia team was called for emergent assistance after the patient had a seizure, followed by respiratory distress and hypotension. Fetal bradycardia prompted an emergency transfer to the operating room, where the patient was found pulseless. ACLS protocol was initiated, including IV epinephrine, chest compressions, intubation, and emergent cesarean section. The fetus was delivered within 3 minutes, with Apgar scores of 3, 5, and 9 at 1, 5, and 10 minutes. The patient developed disseminated intravascular coagulation (DIC) and required a massive transfusion protocol, followed by hysterectomy. Central venous access and an arterial line were placed, and a transesophageal echo revealed a dilated right ventricle, partially filled left ventricle, and a widened pulmonary artery, with no pulmonary clots. Despite these measures, her oxygenation remained poor, leading to the placement of venous and arterial sheaths in the left groin, and venoarterial extracorporeal membrane oxygenation (VA-ECMO) was initiated. She was weaned from ECMO after several days and discharged home neurologically intact following a two-month hospital stay.

Case Two:

Discussion: The differential diagnosis considered exacerbation of porphyria, but the sudden onset of cardiopulmonary collapse, DIC, and a dilated right ventricle was most consistent with amniotic fluid embolism (AFE). AFE is a rare, potentially catastrophic complication of pregnancy, often involving an anaphylactic-type response when fetal or amniotic components enter the maternal circulation. The classic triad includes acute hypoxia, hypotension, and coagulopathy.[1] AFE occurs in about 1 in 40,000 births, with a mortality rate of 20-60%.[1,2] It is the second leading cause of peripartum maternal death and the primary cause of peripartum cardiac arrest.[3] Diagnosis is primarily clinical, based on sudden cardiopulmonary collapse, DIC, with the absence of fever.[4] Management is mainly supportive and resuscitative, with immediate cesarean delivery improving outcomes for both mother and baby. This case highlights the role of diagnostic interventions of TEE and VA-ECMO in managing cardiac arrest due to AFE. Early TEE, rapid ECMO implementation, and a multidisciplinary approach were key to the patient’s successful outcome.

References: 1. J Anaesthesiol Clin Pharmacol. April-June 2016, Vol 32, Issue 2 2. Amniotic

Fluid Embolism Foundation. https://amnioticfluidembolism.org/education/afe-facts/ 3. StatPearls [Internet]. 2024 Jan 10. PMID: 32644533 4. APSF Newsletter 2022;37:83-84

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 04

Seizure to Hysterectomy: Suspected Atypical Presentation of Amniotic Fluid Embolism

Presenting Author: Loni Kreger, MD

Presenting Author's Institution: Cleveland Clinic - CLEVELAND, Ohio

Co-Authors: Emmarie Myers, MD - Cleveland Clinic Regional Anesthesia Institute

Introduction: Amniotic fluid embolism (AFE) is a rare but potentially fatal obstetric emergency classically characterized by sudden onset of cardiovascular collapse, respiratory distress, and disseminated intravascular coagulopathy.1 We present a case of suspected AFE presenting as sudden seizure followed by refractory uterine atony, coagulopathy, and hemorrhage necessitating emergent hysterectomy.

Case One: A 38-year-old G5P3 at 41w5d presented for cesarean section. Obstetric history included two uncomplicated cesarean sections. The current pregnancy was complicated by large for gestational age fetus, polyhydramnios, and fetal malpresentation, with negative workup for placenta accreta spectrum. The patient did not carry a diagnosis of chronic or pregnancy induced hypertension. Cesarean section was performed under combined spinal-epidural anesthesia. One isolated severe range blood pressure was noted during neuraxial placement. Surgical course was notable for dense scarring and adhesions with concern for uterine window. Shortly after delivery, the patient experienced a seizure which resolved without intervention. Blood pressure at the time of seizure was 141/60 in the setting of phenylephrine infusion. Due to concern for eclampsia, magnesium therapy was initiated. The placenta was delivered with easy extraction, and the uterus was closed with adequate tone and hemostasis. Quantitative blood loss was 825cc. In the PACU, the patient developed vaginal bleeding refractory to uterotonics, TXA, and magnesium cessation. A JADA was placed with persistent uterine atony and 800cc JADA output over one hour. During this time the patient was mildly hypotensive requiring a total of 400 mcg phenylephrine. After one unit of pRBC, the patient's hemoglobin was 7.9 g/dL from a baseline of 10.8 with INR 1.2 and fibrinogen 149 mg/dL, concerning for coagulopathy out of proportion to blood loss. The decision was made to proceed with emergent hysterectomy. Hemodynamics were maintained with continued resuscitation with fluids and blood products. Postpartum, the patient did not experience any further seizures or episodes of hypertension.

Case Two:

Discussion: This report highlights the importance of considering atypical presentations of AFE. The patient’s seizure, coagulopathy, and refractory uterine atony were concerning for AFE despite the absence of cardiovascular collapse or respiratory distress. While seizures in obstetric patients should initially be treated as eclampsia, clinicians must maintain high suspicion for AFE, particularly in pregnant or postpartum women with sudden seizure followed by unexplained coagulopathy.2 Vigilance and prompt intervention are crucial in such cases to ensure timely diagnosis and management.

References: 1. Clark, S. L., & Hankins, G. D. (2003). Amniotic fluid embolism. Obstetrics & Gynecology, 102(5), 1217-1229. 2. Society for Maternal-Fetal Medicine (SMFM) with the assistance of Pacheco LD, Saade G, et al. Amniotic fluid embolism: diagnosis and management. Am J Obstet Gynecol 2016;215:B16-24.

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 05

Amniotic fluid embolism resulting in severe right heart failure: clues to a diagnosis

Presenting Author: Haylee Bergstrom, MD

Presenting Author's Institution: Vanderbilt University Medical Center - Nashville, Tennessee

Co-Authors:

Introduction: Amniotic fluid embolism (AFE) remains one of the most feared complications of pregnancy. Presentation is often sudden and rapidly progressive, making timely treatment essential. Cardiorespiratory collapse, hemorrhage, and subsequent coagulopathy are commonly present (1). We present a case of intrapartum AFE complicated by severe right ventricular (RV) failure.

Case One: A 30 year old G1P0 with a history of asthma presented at 39w1d for elective induction of labor. A dural puncture epidural was performed and bolused with 10cc 0.125% bupivacaine and 5mcg/mL of fentanyl. Immediately after rupture of membranes, she experienced a prolonged fetal heart rate deceleration, and the decision was made to proceed to emergent cesarean delivery. Epidural dosed with 20cc 3% chloroprocaine. After incision but before delivery, she became acutely unresponsive, hypoxic, and hypotensive (BP 60/42). While preparing for intubation, her mental status improved, and intubation was deferred. Delivery followed one minute later and profound atony quickly developed. An arterial line and two 16ga peripheral IVs were placed. Obstetric massive transfusion protocol was activated and the patient developed coagulopathy disproportionate to blood loss (platelet count 63, fibrinogen 126) despite fibrinogen concentrate administration. She received 5 units (U) packed red blood cells, 7U fresh frozen plasma, 4 pooled U cryoprecipitate, 2 pooled pheresis U of platelets, 3g fibrinogen concentrate, and 3g of tranexamic acid. Estimated blood loss was 5L. She went to the intensive care unit on 4L O2 via nasal cannula. Urgent transthoracic echo (TTE) was performed due to concern for AFE and narrow pulse pressure noted on the arterial line tracing, showing moderate RV dilation and severely reduced systolic function, with findings consistent with RV pressure overload. A pulmonary artery catheter (PAC) was placed on postpartum day (PPD) 0, with an initial cardiac index (CI) of 2.1, lower than expected for a newly PP patient. Inotropic support was initiated with dobutamine. Inhaled epoprostenol was added for RV afterload reduction on PPD 1. Dobutamine was weaned gradually on PPD 2 & 3, and inhaled epoprostenol was weaned off on PPD 3. She was discharged on PPD 8, and a TTE at 6 weeks PP showed normal RV function.

Case Two:

Discussion: Though rare, AFE carries a high risk of mortality. RV dysfunction is common, and much of the pathophysiology may be related to acute pulmonary hypertension. Early use of TTE may be beneficial in the prompt diagnosis of RV failure (2). Narrowed pulse pressure on the arterial line can be a sign of acute RV dysfunction and should prompt urgent TTE in patients with suspected AFE. Invasive monitors with a PAC and inotropic support are routinely required in cases of severe RV dysfunction. Thoughtful interpretation of CI in the early PP period often reveals a CI lower than expected. Dobutamine and inhaled epoprostenol are safe in pregnancy and PP (3).

References: 1. PMID: 32644533 2. PMID: 36307749 3. PMID: 15121623

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 06

Suspected Anaphylaxis During Emergent Cesarean Section

Presenting Author: Eric A. Krause, M.D.

Presenting Author's Institution: Department of Anesthesiology, University of Kansas Medical Center, Kansas City, Kansas - Prairie Village, Kansas

Co-Authors:

Introduction: Intraoperative hemodynamic instability and hypoxia during cesarean section necessitate prompt recognition and treatment of potential causes to ensure maternal-fetal safety. Key differentials include anaphylaxis, air embolism, and anaphylactoid syndrome of pregnancy (ASP), each posing diagnostic challenges. Here we report a case of sudden cardiovascular collapse and severe hypoxia during cesarean section. Allergy testing revealed reactions to succinylcholine and ondansetron, supporting an anaphylactic etiology.

Case One: A 36-year-old G4P4 female at 38 weeks gestation presented in active labor with a breech presentation and complete cervical dilation, necessitating an emergent cesarean section. General anesthesia was induced with propofol and succinylcholine. Intubation was uneventful. Ten minutes post-induction, she developed progressive hypotension, hypoxemia, tachycardia, and elevated peak airway pressures. Arterial blood gas revealed severe hypoxemia and metabolic acidosis (pH 7.22, PaCO2 39 mmHg, PaO_2 49 mmHg, HCO_3^- 16.2 mEq/L). Coagulation studies were normal. Tryptase level was normal at 2.4 ng/mL, and no urticaria was observed. Initial management targeted anaphylaxis and ASP. Treatment for anaphylaxis included epinephrine (110 mcg cumulative dose), albuterol, ketamine, corticosteroids, famotidine, and diphenhydramine, while therapy for ASP involved atropine, ondansetron, and ketorolac. Hemodynamics and airway pressures consistently improved following epinephrine boluses. Transesophageal echocardiogram showed a hyperdynamic left ventricle, normal right ventricle, and no signs of air embolism or pulmonary embolism. Following 30 minutes of instability, the patient's condition improved. She was extubated in the operating room and postoperative course was uncomplicated. Outpatient allergy testing demonstrated positive skin tests to succinylcholine and ondansetron, with negative results to cefazolin and propofol.

Case Two:

Discussion: This case highlights key differential diagnoses for hemodynamic collapse during cesarean section, as well as the management and diagnostic strategies used to refine the differential. Although the exact etiology remains uncertain, clinical presentation and positive skin testing to succinylcholine and ondansetron support anaphylaxis, despite a normal tryptase level. Practice guidelines from Ann. Allergy Asthma Immunol. suggest a normal tryptase level should not exclude perioperative anaphylaxis.1 Meanwhile, ASP became less likely in this case due to the absence of coagulopathy, with DIC present in 83% of cases.2 Early recognition and supportive management ensured an optimal maternal outcome.

References: 1. PMID: 38108678 2. PMID: 26987420

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 07

Anaphylaxis and Regional Anesthesia: A Catastrophic Combination During Cesarean Delivery

Presenting Author: Bhavani Shankar Kodali, MBBS, MD, FASA

Presenting Author's Institution: University of Maryland School of Medicine - Baltimore, Maryland

Co-Authors: Shobhana Bharadwaj, MD - University of Maryland Schoo of Medicine
Jessica Galey, MD - University of Maryland School of Medicine

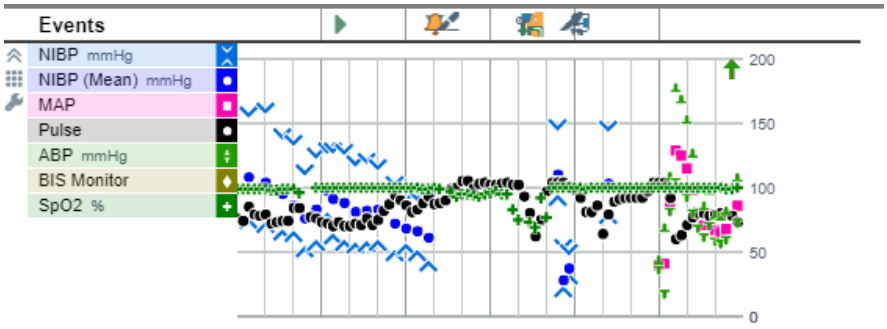
Introduction: It is mandatory to use antibiotics during cesarean delivery. Anaphylaxis to antibiotics is a rare event. We describe a case where anaphylaxis occurred after the attainment of T4 anesthetic level achieved with neuraxial anesthesia for cesarean delivery in a parturient with morbid obesity.

Case One: 37 yr G2P1001 at 29w6d, BMI 44, type 2 diabetes, fetal macrosomia and preeclampsia with severe features scheduled for cesarean delivery. She had one prior cesarean delivery and received Ancef. Adequate level for cesarean delivery was achieved via combined spinal epidural neuraxial anesthesia. Spinal components included bupivacaine 10 mg and fentanyl 10 µgm. Phenylephrine boluses and infusion was used to maintain blood pressure. Ancef 3gm was given IV, and azithromycin 500 mg commenced. At about 15 minutes, while the cesarean delivery was underway, the patient complained of severe itching in both hands and became restless. The blood pressure unit could not record blood pressure because the patient moved both upper arms in agitation. When arms were held, the oxygen saturation was 95 to 96%. The pulse was difficult to palpate. Benadryl and hydrocortisone were administered along with boluses of phenylephrine and epinephrine. When she complained of difficulty breathing and would not stay still, general anesthesia was induced, and an endotracheal tube was placed without difficulty. The end-tidal carbon dioxide was 38 mmHg consistently with sloping phase 3, signifying good pulmonary circulation but no palpable arterial pulse. An artery line was placed, with a notable pulsating radial artery on ultrasound, and a low blood pressure of 66 was confirmed. In addition to continuous infusion of epinephrine, norepinephrine, and phenylephrine, multiple doses of epinephrine and phenylephrine were given. Good transient response to every epinephrine. Oxygenation was good on pulse oximetry and ABG. Boluses of bicarbonate and calcium were also administered. Red top clotted blood and Rotem ruled out amniotic fluid Embolism. Transthoracic and esophageal echo showed hyperdynamic LV with low filling with good RV function. The baby was delivered expeditiously and required therapeutic hypothermia (cord pH 6.75, Po2 14, PCO2>100, and low Apgar). Blood pressure stabilized over two hours, and ionotropic support was withdrawn towards the end of the procedure. Despite normal coagulation, the obstetricians preferred to delay the closure of the abdomen by placing Abthera wound vac over the rectus muscles for 14 hr. The baby made a completely normal recovery. Tryptase (56.9 µgm/L 10 times regular) levels confirmed anaphylaxis, most likely to azithromycin. The patient refused allergy confirmation.

Case Two:

Discussion: We are required to administer antibiotics before the start of cesarean delivery. Anaphylaxis to these is rare. However, if it occurs soon after neuraxial anesthesia, it may have catastrophic consequences for the mother and the baby.

References: Int J Obstet Anesth . 2007 Jan;16(1):63-7.



Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 08

Cardiac Arrest and Resuscitation in a Parturient with Multiple Risk Factors

Presenting Author: Caleb Bauman, DO

Presenting Author's Institution: UAMS - Little Rock, Arkansas

Co-Authors: Cash Arcement, MD - UAMS
Muhammad W. Athar, MD, DESA, MCAI - UAMS

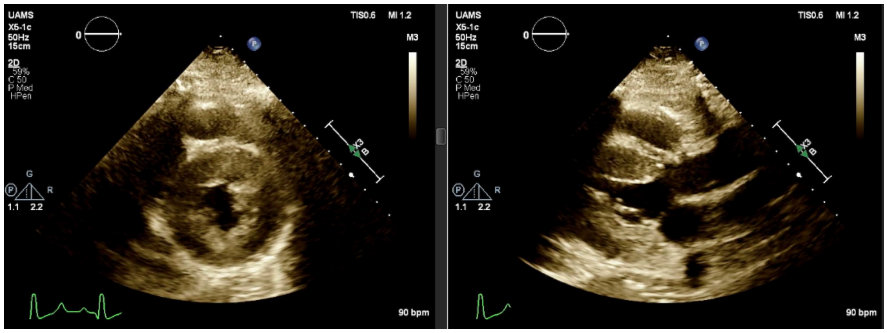
Introduction: We present a case of a 44-year-old G7P6 at 41w6d of gestation admitted for preeclampsia with severe features. She had a history of prior cesarean delivery, VBAC, and limited prenatal care and elected TOLAC over repeat cesarean delivery.

Case One: On admission, she received escalating doses of labetalol (maximum BP 192/112), magnesium sulfate, fluid restriction, and oxytocin for a TOLAC induction. A labor epidural was placed, and analgesia established with a fentanyl-bupivacaine solution. Due to failure to progress, she was taken to the OR for cesarean delivery. Following epidural fentanyl 100 mcg and lidocaine 100 mg, a T5 block was confirmed. She reported severe pruritus, treated with naloxone 40 mcg. Her agitation continued to increase with acute dyspnea and relative hypotension (BP 97/54) followed by oxygen desaturation, bradycardia (HR 42), and decreased level of consciousness. She was intubated with 50mg propofol and 100mg succinylcholine, and despite persistent hypoxemia (SpO2 50-60%), the airway was confirmed by auscultation, ETCO2, and repeat videolaryngoscopy. The infant was delivered within 5 minutes, followed immediately by cardiopulmonary arrest. She received four rounds of CPR over 14 minutes. Following the first ROSC, TTE revealed left ventricular hypertrophy with concentric remodeling, volume contraction, and anterior motion of the mitral valve with left ventricular outflow track obstruction. Following a second arrest with ROSC after 2 minutes, hemodynamics and oxygenation stabilized with volume resuscitation (5 PRBC, 3 FFP) and vasopressors. Patient was transferred to the ICU after surgery. Vasopressors were rapidly weaned, and she responded well to diuretics overnight. On PPD1, she returned to OR for irrigation and debridement, and bilateral salpingectomy. Patient was extubated in ICU on the evening of PPD1, transferred to floor on PPD2, and discharged home neurologically intact on PPD5. Post-event conversations revealed a history of methamphetamine use.

Case Two:

Discussion: In this patient with evidence of longstanding untreated hypertension and superimposed preeclampsia with severe features, the combination of fluid restriction, supine position, and neuraxial sympathectomy resulted in decreased left ventricular filling, anterior motion of the mitral valve, LVOT obstruction, acute heart failure, that presented with agitation, dyspnea, and cardiogenic hypoxemia, followed by cardiopulmonary arrest. The presenting signs and symptoms were consistent with amniotic fluid embolism, however she never developed coagulopathy. In patients with multiple risk factors and limited prenatal care, we recommend preoperative TTE to screen for severe left ventricular hypertrophy and reduced cardiac function and filling. If present, these findings indicate the need careful cardiac and hemodynamic management with volume and vasopressors during extension of epidural analgesia for cesarean anesthesia.

References: .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Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 09

A Diagnostic Dilemma: Multi-System Collapse in Peripartum Cardiac Arrest

Presenting Author: Claudia L. Sotillo, MD

Presenting Author's Institution: Stanford Medicine Division of Obstetric Anesthesiology - Palo Alto, California

Co-Authors: Jordan Abrams, MD - Stanford Medicine Division of Obstetric Anesthesiology
Kelly A. Fedoruk, MD, FRCPC - Stanford University

Introduction: Background: Peripartum cardiac arrest complicates 1 in 12,000 deliveries.1 Pregnancy-related physiologic changes can persist up to 8 weeks postpartum, creating potential for multiorgan failure well after delivery. Common causes of maternal cardiac arrest in the United States include hemorrhage, heart failure, amniotic fluid embolism, and sepsis.1 While most cases have a clear etiology, some defy definitive diagnosis.

Case One: Case: A 37-year-old woman with gestational hypertension presented 6 days postpartum with new-onset pre-eclampsia (PEC). Thirty hours after readmission for hypertension management with IV magnesium and oral antihypertensives, she developed acute hypoxemia and dyspnea accompanied by fulminant disseminated intravascular coagulation without a known source. Despite escalating oxygen therapy, she suffered pulseless electrical activity (PEA) arrest during endotracheal intubation. After failed ACLS, extracorporeal cardiopulmonary resuscitation (ECPR) was initiated with successful veno-arterial ECMO cannulation within 25 minutes of arrest. Rescue TEE revealed a severely dilated right ventricle with severe systolic dysfunction, and an underfilled left ventricle with normal function (Figure 1). A chest CT showed severe pulmonary edema without pulmonary embolism. Despite good end-organ perfusion during ECPR, the patient developed severe cerebral edema and hypoxic ischemic brain injury, leading to withdrawal of care 5 days post arrest.

Case Two:

Discussion: Discussion: While the final diagnosis remains elusive, this case illustrates several important learning points: (1) the potential for rapid deterioration in postpartum patients with pre-eclampsia, even with appropriate therapy;2 (2) the importance of considering atypical presentations of common obstetric emergencies; and (3) the role of ECPR as a rescue strategy in maternal cardiac arrest.3 The lack of a definitive diagnosis despite close inpatient monitoring underscores the need for further research into delayed postpartum cardiovascular collapse and development of better predictive tools for identifying high-risk patients.

References: References: 1. Anesthesiology 2014; 120:810–8 2. J Am Coll Cardiol 2018; 72:1–11 3. J Am Heart Assoc 2020; 9:e016072

Sotillo Dilemma Soap Figure.pdf

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 10

Multi-system Collapse and Fatal Subscapular Liver Hematoma in a Patient with Intrauterine Fetal Demise

Presenting Author: Kelsey C. De Silva, MD

Presenting Author's Institution: University of North Carolina, Chapel Hill - Durham, North Carolina

Co-Authors:

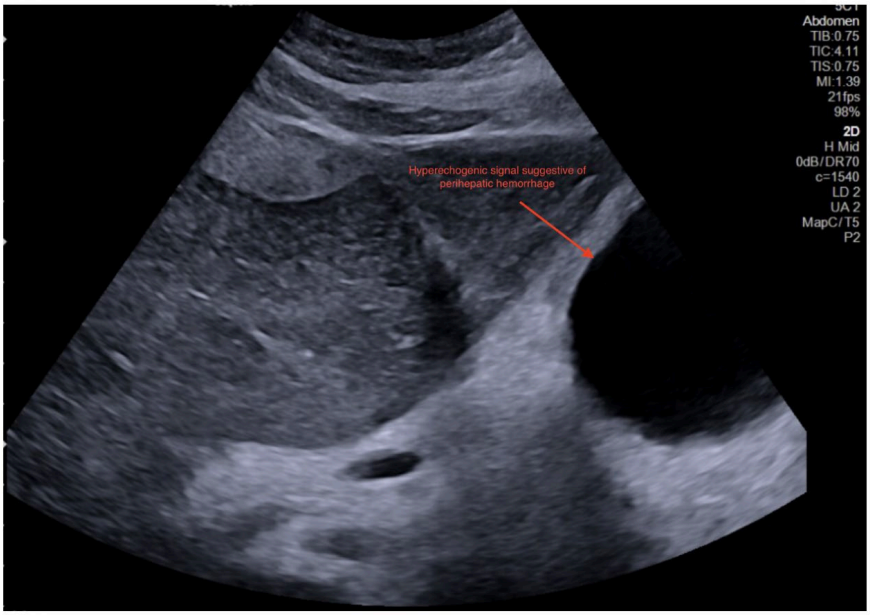
Introduction: Subscapular liver hematoma (SLH) is a rare but severe complication of hypertensive disorders in pregnancy, particularly HELLP syndrome, with an incidence of 1–2 per 100,000 pregnancies. Rupture is rarer, occurring in 1 in 45,000–225,000 pregnancies. 1 Management of unruptured SLH involves intensive care and occasionally embolization, while rupture can cause catastrophic hemorrhage and organ failure. This case highlights the challenges of managing ruptured SLH in a critically ill patient.

Case One: We present a 36-year-old G5P4004 at 32w1d with gestational diabetes, hemoglobin S trait, and advanced maternal age who presented with 24 hours of right upper quadrant pain, nausea, and vomiting. Labs showed elevated liver enzymes, thrombocytopenia, hemolysis, and acute kidney injury consistent with HELLP syndrome. Ultrasound confirmed intrauterine fetal demise. The patient became obtunded, hypotensive, and hypoxemic, requiring aggressive resuscitation. Upon transfer to a tertiary care center, she was intubated and started on continuous renal replacement therapy (CRRT). Imaging revealed an SLH with perihepatic hemorrhage. Labor induction resulted in uncomplicated vaginal delivery. Twelve hours later, the patient suffered acute desaturation and cardiac arrest. Exploratory laparotomy revealed 2L hemoperitoneum, liver capsule tears, and bowel injury. Despite hepatic artery embolization and surgical intervention, coagulopathy and hemorrhage persisted. Refractory cardiac arrest occurred 36 hours after presentation.

Case Two:

Discussion: SLH is a rare, life-threatening complication of HELLP syndrome. Management depends on stability, rupture status, and bleeding severity. Stable hematomas may be managed conservatively, while rupture often requires embolization, laparotomy, or both. 1 Key considerations include: Efficacy of Embolization: Embolization can control bleeding in ruptured SLHs but carries risks like hepatic ischemia and biliary necrosis. 2 Pregnancy-Specific Factors: Altered hemodynamics, including increased hepatic blood flow, may influence embolization outcomes. Guidelines: ACOG emphasizes individualized care, with surgical intervention often necessary for hemodynamic instability. In this case, hemoperitoneum, coagulopathy, and systemic instability precluded prophylactic embolization. Despite multidisciplinary efforts, massive hemorrhage and multi-organ failure proved fatal. SLH in pregnancy requires a multidisciplinary approach and tailored interventions. Prophylactic embolization is reserved for select cases, while surgical control is crucial for hemorrhagic instability. Further research is needed to refine protocols and improve maternal outcomes

References: 1. Wicke C, Pereira PL, Neeser E, et al. Am J Obstet Gynecol. 2004;190(1):106-112. 2. Green CS, Bulger EM, Kwan SW. Angioembolization for hepatic trauma: Complications. J Trauma Acute Care Surg. 2016;80(3):529-37.



Abdominal Ultrasound with findings concerning for subscapular hematoma.

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 11

Anaphylaxis to Corn and Its Implications On Anesthetic Management During Obstetrical Care - Navigating a Perioperative Maize of Derivatives

Presenting Author: Maria D. Patrocinio, MD

Presenting Author's Institution: Beth Israel Deaconess Medical Center - Boston, Massachusetts

Co-Authors: Philip E. Hess, MD - Beth Israel Deaconess Medical Center
Yunping Li, MD - Beth Israel Deaconess Medical Center

Introduction: Severe reactions, including anaphylaxis, to food or medications are infrequently encountered. Allergy to corn has a prevalence of 0.28% among children and 0.22% in adults. [1,2] Corn derivatives are present in about 37% of marketed medications, are part of blood product storage processes, and may be used to coat material used in the operative setting. [3,4] However, very sparse literature is available. We describe a challenging case of severe corn allergy, that led to a deep dive into the intricacies of medication formulation and operating room safety.

Case One: A 39-year-old female, with reported anaphylaxis to corn and corn-derivatives, required an urgent dilation and evacuation procedure at 12 weeks gestation. Pre-filled syringes, medications containing dextrose, intravenous fluids, blood products and equipment commonly used by anesthesia and surgical teams were found to be incompatible as dextrose and other derivatives originate from corn syrup and could place the patient at risk for perioperative anaphylaxis. An extensive list of case-pertinent medications available at our institution were reviewed by a multidisciplinary team to determine their safety. The National Drug Code was used to determine if corn derivatives were used to produce each drug. The patient declined neuraxial anesthesia as well as sedation due to the possible corn derivative exposure with bupivacaine 0.75% and propofol. Anesthesia was performed with a supraglottic airway with inhaled volatile agents. Normal saline was used for intravenous repletion. Select opioids were used for pain management, but anti-emetics and uterotonics were limited due to incompatibility with the reported allergy. No adverse perioperative outcomes were reported.

Case Two:

Discussion: Anesthesiologists frequently manage patients with allergies. However, patients with allergies to corn and derivatives are rare. Discussing the patient’s reaction to corn and derivatives and thoroughly reviewing with pharmacy all medications, resuscitation fluids and equipment can avoid an adverse reaction. Extensive and early preparation is encouraged in the setting of severe corn allergies as formulations between institutions may vary. This patient is currently pregnant and will be delivering at our institution in February.

References: 1.PMID: 23992749 2.PMID: 9236505 3.PMID: 1696439 4.PMID: 1808842

Medications containing corn derivatives.pdf

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 12

Heat of the Moment: Managing Burn Trauma in Pregnancy

Presenting Author: Briel Lee, MD

Presenting Author's Institution: University of North Carolina - Chapel Hill, North Carolina

Co-Authors:

Introduction: 25yo G4P3013 at 38w5d presented to an outside hospital after sustaining 50% TBSA 2nd degree flame burns to her bilateral upper and lower extremities, face, and abdomen. She experienced uterine contractions on presentation with cervical exam of 4cm/50% effaced/-2 station. She was intubated shortly after arrival due to respiratory compromise and transferred to our tertiary care hospital. The obstetric team planned to move forward with delivery, initially planning induction given she was multigravida with 3 prior vaginal deliveries and already dilated to 4cm. After a prolonged discussion about placement, the patient was taken to the labor and delivery unit with a burn intensive care nurse. Initial burn wound care was performed and both central and arterial lines were placed. During this time, subtle late decelerations were noted and cervical exam was unchanged. The decision was made to move toward cesarean delivery. While preparing to move to the operating room, the fetus had a prolonged deceleration and the patient was then emergently moved to cesarean delivery.

Case One: The patient remained intubated and underwent general anesthesia for her primary cesarean. Anesthesia was maintained with fentanyl and propofol infusions, no volatile anesthetic, and existing endotracheal tube. She experienced uterine atony requiring methergine, tranexamic acid and calcium administration, and bolus oxytocin as well as 500 mUnits/minute oxytocin infusion over one hour. Blood loss for the case alone was estimated at 600mL, but additional resuscitation was required due to her burns and anemia and she was given 2L crystalloid, 500mL of 5% albumin, 2 units pack red blood cells, 1 unit fresh frozen plasma, and 1 unit of cryoprecipitate intra-operatively. She was taken to the burn intensive care unit where she recovered post-operatively and was extubated on post-operative day three. In the days following delivery, she underwent serial debridements and skin grafts in the operating room with ongoing wound care and resuscitation until she was appropriate for discharge on hospital day 20.

Case Two:

Discussion: This case highlights special considerations of burn patients such as increased resuscitation needs, concerns for neuromuscular blockade, and respiratory care. Additionally, burn care is complicated by concurrent and often competing interests in obstetric care, including increased cardiac output, decreased oncotic pressure, and special fetal considerations. Though rare, burns in the parturient carry a high risk of mortality for both the mother and the fetus, with one study showing a mortality rate of 45% and 46%, respectively. This case also highlights the importance of procedures for where (L&D, ICU, OR) and how we care for pregnant women presenting with trauma and how labor care can be complicated by critical illness.

References: Karimi H et al. Pregnancy and burns: guidelines for safe management. Burns, 46(7): 1620-31, 2020. Smith BK et al. Burns and pregnancy. Clin Perinatol. 1983 Jun;10(2):383-98.

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 13

Bezold-Jarisch Reflex with Elective C-Section Under Epidural Anesthesia

Presenting Author: Maithili Khandekar, MD

Presenting Author's Institution: Loyola University Medical Center - Chicago, Illinois

Co-Authors:

Introduction: The Bezold-Jarisch reflex (BJR), initially described in the 1800s, is a cardioinhibitory reflex mediated by vagal sensory neurons and is classified by hypopnea, bradycardia, hypotension, and syncope. While more often known to occur after an acute myocardial infarction, we describe a unique case of the BJR occurring during epidural placement of a patient with a complex cardiopulmonary history resulting in the need for multiple vasopressors to achieve hemodynamic stability.

Case One: Our patient is a 40 year old G6P2032 at 34w0d with a monochorionic-diamniotic twin gestation presenting for C-section. Her pregnancy was complicated by fetal growth restriction of both twins, gestational diabetes, and a history of total anomalous pulmonary venous return for which she underwent pericardial baffle, ASD repair, and a pulmonary valvulotomy in 1990. She also underwent a pulmonary valve replacement in 2009 for severe pulmonary insufficiency and an enlarged right ventricle. Prior to C-section, her echocardiogram showed continued pulmonary valve stenosis, insufficiency, and a dilated right ventricle. After admission for her operative delivery, the decision was made to place an epidural catheter over spinal anesthesia to avoid hypotension. An arterial line was also placed for constant blood pressure monitoring due to a high risk of hemodynamic collapse. During her epidural placement, while administering a final bolus of bupivacine 0.25% to achieve surgical grade analgesia, loss of P-waves as well as a junctional rhythm was observed. Immediately after, she became profoundly hypotensive with an arterial line reading of 81/37 and MAPs down to 48. She started losing consciousness and ultimately required 10mg of ephedrine and an infusion of norepinephrine to stabilize her vitals. She then successfully underwent C-section and delivered 2 female newborns. Postpartum, she was transferred to SICU for continuous cardiac monitoring and was discharged on POD 3.

Case Two:

Discussion: Our patient's cardiopulmonary history may have predisposed her to the BJR occurring peripartum despite our efforts to avoid hemodynamic instability by placing an epidural rather than spinal anesthesia. We highlight how the BJR can occur even with alternative anesthetic plans and proper invasive monitoring, necessitating a need for caution in high-risk patients. We also call attention to the use of certain vasoactives; ephedrine is used over phenylephrine to avoid reflex mediated bradycardia. Our case emphasizes how parturients with significant cardiopulmonary histories necessitate thorough anesthetic evaluation to determine the safest outcome prior to delivery.

References: Agboola, Kolade M., et al. "Bezold–Jarisch Reflex mediated syncope in pulmonary arterial hypertension: An illustrative case series." Pulmonary Circulation, vol. 12, no. 4, Oct. 2022, https://doi.org/10.1002/pul2.12147.

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 14

MANAGEMENT OF A PARTURIENT WITH MAST CELL ACTIVATION SYSTEM AND HISTORY OF TETHERED CORD

Presenting Author: Kayla Jardine, MD

Presenting Author's Institution: The Ohio State University Wexner Medical Center - Columbus, Ohio

Co-Authors: Caroline E. Tybout, MD - Ohio State University Wexner Medical Center Department of Anesthesiology

Introduction: Mast Cell Activation Syndrome (MCAS) is a condition in which patients experience symptoms of inappropriate mast cell degranulation while not reaching the degree of mastocytosis. Multiorgan system involvement can lead to significant morbidity and mortality, especially in the peripartum period. Previous case reports have described successful labor management with early neuraxial anesthesia but there remains a paucity of literature on optimal management and neuraxial anesthesia may not be possible in patients with concomitant spinal abnormalities. We present a case highlighting the peripartum management of a patient with both MCAS and history of repaired tethered cord with persistent neurologic symptoms.

Case One: A 33-year-old G1P0 with history of MCAS (managed with ketotifen, famotidine and IM diphenhydramine rescue) and history of tethered cord repaired in October 2023 presented for anesthesia consultation for delivery planning at 16 weeks. Despite surgical repair of her tethered cord, she reported persistent neurologic symptoms including urinary retention, constipation, and intermittent lower extremity weakness. Discussion with her neurosurgeon and anesthesiologist for her prior surgery determined that she was not a candidate for neuraxial anesthesia due to her persistent symptoms. Given this and concerns about ability to sustain Valsalva, she elected for scheduled primary cesarean delivery under general anesthesia. In preparation for delivery, interdisciplinary meetings with pharmacy, obstetrics and the patient generated a list of tolerated medications and a plan for special preparation with minimal inactive ingredients. On the day of delivery, the patient was pre-treated with H1 and H2 receptor blockers as recommended in the literature, as well as midazolam. General anesthesia was induced with a carefully planned multimodal anesthetic regimen based on her prior medication tolerances and treatment for anaphylaxis was readily available. Her operative course was uneventful with delivery of a healthy infant and she was extubated in the operating room. She recovered well post-operatively with no significant complications, and minimal symptoms of her MCAS.

Case Two:

Discussion: Our case demonstrates the importance of labor planning for a complex patient with MCAS. For such patients, an interdisciplinary team approach paired with patient history and review of prior medication reactions is essential in planning appropriate timing and mode of delivery. In addition to standard labor risks, these patients also pose an increased risk of anaphylaxis and providers should be prepared to treat if necessary.

References: Dorff, S. et al. (2020) J Obstet Gynaecol. 40(7):889-901. Kumaraswami, S. et al. (2018) Case Rep Anesthesiol. 8920921. Lide, B. et al. (2022) J Biomed Res. 36(6):435-439.

Abstract #: THURS - CR - BS 1 - BR 2 - High Acuity Intensive Care – 15

Perinatal Sepsis: Anticipate and Act Early, Preventing Tube to Tracheostomy

Presenting Author: Lukas Croner

Presenting Author's Institution: The Ohio State University College of Medicine - Columbus, Ohio

Co-Authors: Adam Alluis, n/a - The Ohio State University College of Medicine
Archis Deshpande, n/a - The Ohio State University College of Medicine

Introduction: Maternal sepsis is a rare but life-threatening complication of pregnancy– affecting only 0.04% of deliveries, yet is responsible for 23% of all maternal deaths in the USA [1]. Its consequences can be profound, including metabolic, renal, cardiogenic, and pulmonary dysfunction, among others.

Case One: A 29 yo G1P1 presented with a single intrauterine pregnancy at 40w3d gestation. Her pregnancy was complicated by chorioamnionitis, gestation HTN, morbid obesity (BMI>60), fetal non-wellbeing, and maternal fever, raising concern for maternal sepsis. After a comprehensive anesthesia evaluation (ASA-PS IV) and administration of epidural anesthesia, the patient (Pt) underwent primary low transverse C-section, with observation of significant uterine atony. Postoperatively, the Pt was transferred to the SICU. During the recovery period, the Pt had a rising lactate level, hemodynamic (HD) instability requiring multiple vasopressors, and signs of metabolic acidosis with respiratory distress. Emergent bedside intubation was attempted using an 8.0 endotracheal tube (ETT) with grade 1 view via McGrath, initially encountering difficulty advancing ETT through vocal cords (VC). Ventilation through ETT worked initially but was met with ventilation resistance, prompting bronchoscopy notable for complete obstruction distal to ETT. Difficult Airway Response Team was activated, and after multiple unsuccessful attempts and signs of desaturation, an emergent bedside cricothyroidotomy was performed with ECMO on standby. The Pt was then transferred to the OR for immediate tracheostomy revision and exploratory laparoscopy due to HD instability. During the procedure, an ischemic uterus was identified, necessitating open hysterectomy, and bilateral salpingectomy. Furthermore, with worsening anemia and circulatory compromise, the Pt returned to the OR for hemoperitoneum evacuation and ligation of L and R uterine arteries. After her 4th operation, her incision was closed, vasopressors were weaned, and she transitioned to continuous positive airway pressure. The Pt was discharged 27 days after admission with tracheostomy in place.

Case Two:

Discussion: This study demonstrates a challenging airway case where VC were visualized but intubation was unsuccessful. Ultimately, the airway was secured via emergent tracheostomy. While the complexity of the case was compounded by mixed maternal sepsis, postpartum hemorrhage, and morbid obesity, closer monitoring of lactate levels, vital signs, and thorough consideration of Pt's risk factors may have helped anticipate complications. Additionally, institutional adaptation of systems like Modified Early Obstetric Warning System may allow for better risk stratification and prevention. Implementing early warning systems in obstetric anesthesia could facilitate earlier recognition of perinatal sepsis, providing more time to address complex airway management [2].

References: 1. Hensley MK, et al. JAMA 2019. 2. Umar A, et al. PLoS One. 2019.

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 01

Spinal Anesthesia Challenges in Geriatric Pregnancy with Hypertension and Delayed Block Onset : Case report

Presenting Author: Sooah Cho, MD

Presenting Author's Institution: Seoul National University Hospital - Jongno-gu, Seoul-t'ukpyolsi

Co-Authors:

Introduction: Geriatric pregnancies are increasing, often complicated by hypertension, which poses anesthetic challenges. This case report examines two hypertensive geriatric pregnancies, focusing on neuraxial blockade, vasopressor titration, and intraoperative hemodynamic management.

Case One: A 63-year-old G0P0 (ASA II) conceived via frozen-thawed embryo transfer. She had hypertension but was not on medication and had GDM controlled by diet. Prenatal SBP >160 mmHg led to antihypertensive therapy. During hospitalization, SBP remained >150 mmHg. On surgery day, BP was 176/88 mmHg, HR 112 bpm. Spinal anesthesia (11.5 mg hyperbaric bupivacaine + 10 mcg fentanyl) resulted in T4 in 7 min, but BP dropped to 75/63 mmHg, requiring 100 mcg phenylephrine. A spike to 192/123 mmHg with headache was treated with 500 mcg nicardipine, stabilizing MBP at 70-80 mmHg. The neonate was admitted to the newborn nursery. And the patient recovered and was discharged on antihypertensive therapy.

Case Two: A 54-year-old G5P2 (ASA II) with a history of severe preeclampsia, GDM, and preterm deliveries (33 & 34 wks) had chronic hypertension (on metoprolol, later amlodipine added). She experienced severe, uncontrolled hypertension (SBP >200 mmHg) accompanied by blurred vision and headache, necessitating an emergent cesarean section at 31+3 weeks of gestation. Baseline BP was 194/96 mmHg, HR 74 bpm. Spinal anesthesia with 10 mg hyperbaric bupivacaine and 10 mcg fentanyl led to a delayed onset, reaching the T5 level after 25 minutes. Intraoperative SBP was maintained at 140 mmHg. The neonate was admitted to the NICU. Postpartum, BP remained 160/100 mmHg, requiring nifedipine. The patient continues cardiology follow-ups.

Discussion: Maternal age plays a critical role in anesthetic management during cesarean delivery. Advanced age is associated with increased vascular stiffness, autonomic dysregulation, and reduced CSF volume, all of which impact neuraxial anesthesia efficacy and hemodynamic stability. Delayed onset of spinal blockade is more common due to age-related epidural space changes, necessitating adjustments in dosing and monitoring. Older parturients also have a higher prevalence of chronic hypertension and pregnancy-related hypertensive disorders, making intraoperative BP control essential. Excessive vasopressor use can lead to sudden hypertensive surges, increasing the risk of maternal and fetal complications. While phenylephrine remains the first-line vasopressor, its dosing in geriatric pregnancies requires a more individualized approach. As maternal age continues to rise globally, further research is needed to establish clear anesthetic guidelines for this population. Future studies should focus on optimizing neuraxial anesthesia techniques, vasopressor titration, and defining BP targets to improve maternal and neonatal outcomes.

References: Yousofzai B et al. (2024). Cureus, 16(9): e70316. doi:10.7759/cureus.70316 Kawale AM. (2021). J Pharm Res Int, 33(38A): 113-118. Doi 10.9734/jpri/2021/v33i38A32065

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 02

Management of a Patient with Moyamoya, Neurofibromatosis Type 1 Requiring Urgent Delivery for Pre-eclampsia with Severe Features

Presenting Author: William Quach, MD

Presenting Author's Institution: Ohio State University Wexner Medical Center Department of Anesthesiology - Columbus, Ohio

Co-Authors: Caroline E. Tybout, MD - Ohio State University Wexner Medical Center Department of Anesthesiology
Xiaobin Wang, MD - Ohio State University Wexner Medical Center Department of Anesthesiology

Introduction: Moyamoya disease (MMD) is a rare cerebrovascular disorder in which narrowing of the internal carotid arteries and the formation of fragile collateral vessels predisposes the patient to cerebrovascular accidents (CVA). The physiologic changes of pregnancy can heighten this risk posing significant challenges for maternal and fetal health.

Case One: We present a 25 year old G1P0 with a history of MMD with bilateral encephaloduroarteriosynangiosis (EDAS), neurofibromatosis type 1 (NF1), seizures and CVA in childhood with residual right upper extremity weakness and numbness requiring cesarean delivery at 27w4d for pre-eclampsia with severe features. The patient's hypertension was treated with nifedipine and labetalol and she was diuresis with furosemide for management of pulmonary edema. Neurology was consulted and MRI of the lumbar spine was completed to evaluate for contraindications to neuraxial. Progressive hypertension, rising creatinine, and worsening flank pain prompted urgent cesarean delivery. Combined spinal epidural was attempted but inadequate dermatomal spread necessitated conversion to general anesthesia. RSI with propofol, succinylcholine, and fentanyl was uneventful and maintenance achieved with propofol infusion and nitrous oxide. Arterial line placement was challenging in the setting of vasculitis, so ClearSite noninvasive blood pressure monitor was applied to facilitate tight hemodynamic control. The patient remained hemodynamically stable without use of vasopressors or anti-hypertensives, was extubated uneventfully and recovered in the PACU.

Case Two:

Discussion: This case illustrates the complex anesthetic management of comorbidities with oppositional goals. Cesarean deliveries for MMD are typically performed under general anesthesia, however, there is a trend towards using epidural and spinal anesthesia to improve hemodynamic stability. NF1 complicates this option, as neurofibromas increase in size and number during pregnancy, increasing the risk of epidural hematoma. Recent spinal imaging can help identify any pathology before choosing an anesthetic plan. Regardless of approach, the focus in moyamoya cases is maintaining adequate cerebral perfusion. Although invasive blood pressure monitoring would have been ideal, the severity of the patient's vascular disease and urgency of the case made noninvasive monitoring with ClearSight an acceptable alternative. The agent selected for maintenance should balance reduction of cerebral oxygen consumption while maintaining cerebral blood flow. While we utilized propofol and nitrous oxide, TIVA with propofol and remifentanil or sevoflurane alone have also been described. Nitrous oxide is often avoided due to concern for elevated ICP and cerebral steal, though its safe use has been demonstrated in patients with moyamoya with the added benefit of rapid titratability without decreasing uterine tone.

References: Maragkos Acta Neurochirurgica 2018 Yang Anaesthesiology 2024 Sharma J. Neuroanes and Crit Care 2014

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 03

Management of Newly Diagnosed Adrenal Mass in the setting of Chronic Hypertension with Superimposed Pre-eclampsia with Severe Features

Presenting Author: Amy J. Bingham, MD

Presenting Author's Institution: University of North Carolina at Chapel Hill - Durham, North Carolina

Co-Authors: Amy Penwarden, MD - University of North Carolina

Introduction: Adrenal masses are often incidental findings, with a prevalence of 1.4% to 7.3%. Most masses are non-functional. Functional adenomas most commonly secrete cortisol or aldosterone, with pheochromocytomas being rare. Adrenal mass in pregnancy in the setting of hypertension can complicate diagnosis. Evaluation is important due to potential impacts of hypertensive crisis that can lead to maternal and fetal demise.

Case One: A 23-yo G3P0112 at 36w2d with hx of chronic HTN treated with nifedipine was transferred to our hospital in the setting of a hemorrhagic adrenal mass and new diagnosis of superimposed pre-eclampsia with severe features. She was admitted to an outside hospital three days prior due to persistent left flank pain and severe range blood pressure, initially 163/131, treated with labetalol and improved to 143/76. A CTA chest was performed due to persistent tachycardia and chest pain and was notable for a 3.7cm left adrenal mass. Laboratory evaluation revealed elevated urine protein and normetanephrine with normal electrolytes, creatinine, liver function tests and platelets. Symptoms included palpitations, chest pain, headaches with visual changes and diaphoresis. Although the radiology read favored a subacute adrenal hemorrhage, pheochromocytoma could not be ruled out. BP was managed with oral nifedipine. Initiation of alpha blockade was deferred due to risk for maternal hypotension which would be poorly tolerated by the fetus. Beta blockers and hydralazine were avoided due to the risk of unopposed alpha-adrenergic activity and risk of precipitating tachycardia. Volume resuscitation was recommended for tachycardia. Due to the new diagnosis of pre-eclampsia with severe features, the patient was consented for a repeat cesarean. An arterial line was placed prior to induction and c-section was performed under CSE. She remained normotensive through the case and did not require additional anti-hypertensives. CT scan performed two months after delivery showed resolution of left adrenal gland hemorrhage. Assessment of catecholamine, aldosterone, and cortisol were also unremarkable at that time.

Case Two:

Discussion: Pregnancy related adrenal hemorrhage is rare, reported in 0.14% to 1.1% of pregnancies. Factors predisposing to adrenal hemorrhage include increased blood supply to the adrenal glands and hypercoagulable state. Adrenal masses in pregnant patients require comprehensive workup. While this patient was identified to have a spontaneous adrenal hemorrhage, hormone secreting adrenal masses can cause conditions such as hypertension and diabetes. Risk factors for adrenal hemorrhage include underlying adrenal tumors, severe infections, blunt trauma, pregnancy, major abdominal surgery, severe hypertension and coagulopathy.

References: Jing Y, et al. Ann Intern Med. 2022;175(10):1383. Reimondo G, et al. J Clin Endocrinol Metab. 2020;105(4) Gavrilova-Jordan LP, et al. Obstet & Gynec Survey. 2005;60(3):191-5. Yasir SE, et

al. J Clin Endocrinol Metab. 2023;108(4): 995-1006.

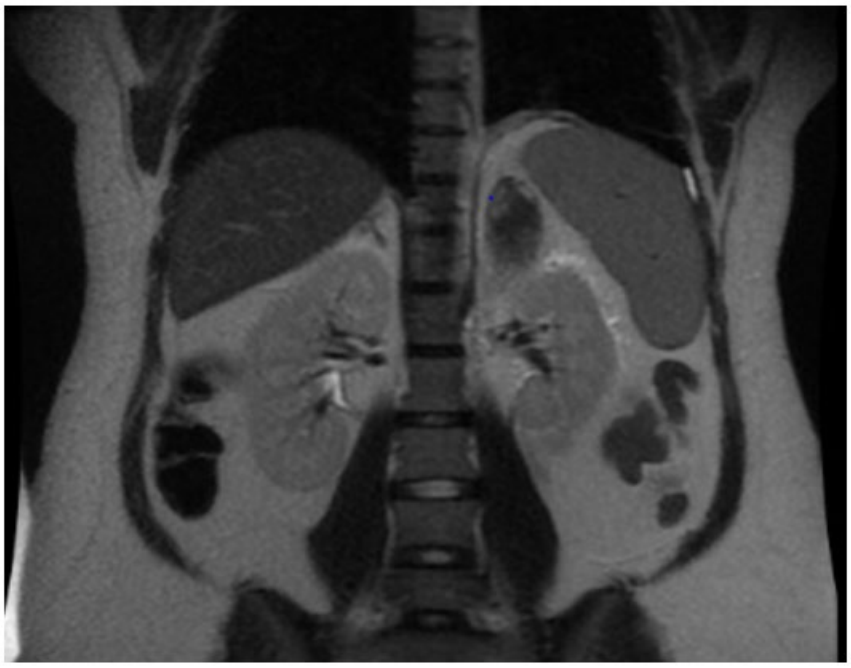


Fig. 1: MRI of left adrenal mass measuring 3.5 cm with imaging features favored to represent subacute adrenal hemorrhage

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 04

Management of an Urgent Cesarean due to PRES

Presenting Author: Dmytro Orel, MD

Presenting Author's Institution: University of Kentucky - Lexington, Kentucky

Co-Authors: Brian Abiri, DO - University of Kentucky
Andrew Poore, MD - University of Kentucky

Introduction: Posterior reversible encephalopathy syndrome (PRES) is a neurologic disorder that presents with symptoms including altered mental status, headache, seizures, and visual disturbances. Imaging characteristics on MRI show a symmetric pattern of vasogenic edema in the posterior cerebral hemispheres.1 Although PRES can affect people at any age, there is an association with hypertensive disorders of pregnancy.2 The pathophysiology is not well understood, but is attributed, in part, to altered cerebral autoregulation in the setting of severe hypertension as well as endothelial dysfunction resulting in increased blood brain barrier permeability.1

Case One: A 28-year-old G2P0010 female at 38w3d presented to Labor and Delivery with sudden onset cortical blindness starting 2 hours earlier. She had a blood pressure of 221/122 and was treated with IV labetalol. IV magnesium was started for seizure prophylaxis. An urgent neurology consult was obtained. The differential diagnosis included ischemic or hemorrhagic stroke, venous sinus thrombosis, and PRES. After a multidisciplinary discussion, a decision was made to proceed with emergent c-section under general anesthesia. A preinduction arterial line was placed for hemodynamic monitoring. GETA was induced and an uncomplicated C-section was performed. SBP was maintained >160 to minimize ischemic risk from potential CVA. The patient remained intubated after delivery and taken for imaging. CT revealed bilateral multifocal parieto-occipital and left frontal hypodensities, without evidence of hemorrhagic or ischemic stroke. The patient was transferred to the medical ICU and later extubated. She was noted to have residual hemianopsia, mild hemiparesis, and ataxia on POD 1. A non-contrast MRI was obtained showing evidence of vasogenic edema in the parieto-occipital region bilaterally consistent with PRES. By POD3 she reported blurry vision but no other focal neurologic deficits and discharged the following day. Her vision had returned to normal by her follow-up appointment one week later.

Case Two:

Discussion: PRES is potentially reversible if the offending process and associated hypertension are treated promptly. Over 90% of eclampsia patients with brain imaging had findings similar to those seen with PRES.3 If there is concern for pre-eclampsia with focal neurologic changes, the fetus should be delivered as soon as possible.3 However, urgent delivery in the OR may delay imaging necessary to rule out other diagnoses and initiate interventions such as TPA or thrombectomy.

References: 1. PMID: 32119379 2. PMID: 38074208 3. PMID: 23395926

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 05

The Kidney Conundrum: Differentiating Lupus Nephritis Flare from Preeclampsia with Severe Features

Presenting Author: Ashley Peotter, MD

Presenting Author's Institution: Vanderbilt University Medical Center - Nashville, Tennessee

Co-Authors: John A. Johnson, MD - Vanderbilt University Medical Center

Introduction: Systemic lupus erythematosus (SLE) is an autoimmune disease most common in women of reproductive age. In addition to nonspecific symptoms of arthralgias, rash, fever and fatigue, common manifestations are hypertension and kidney disease from lupus nephritis (LN). LN is an immune complex-mediated glomerulonephritis associated with complement activation. Patients with SLE also experience vasculitis and thromboembolic disease. SLE is associated with increased risk of preeclampsia during pregnancy, but LN flare can mimic preeclampsia with severe features.

Case One: 22yo G5P0040 parturient with history of SLE, chronic hypertension, intracranial hypertension due to chronic cerebral venous thrombosis, and stage 3 CKD who presented at 26w5d with SBP 167/113, visual scotoma, “flashing lights”, right upper quadrant and chest pain. Laboratory studies were notable for Cr 2.11 mg/dL, hyperkalemic metabolic acidosis, thrombocytopenia (platelets 94,000), high anti-dsDNA (109 IU/mL), and low C3/C4 (78/9 mg/dL respectively). Prior LN flares had been associated with hypertension, headache, visual changes, and chest pain. Differential diagnosis included preeclampsia with severe features vs. LN flare. Treatment was initiated for both conditions with magnesium and solumedrol. The patient required ICU admission for nicardipine infusion. Rheumatology and nephrology were consulted. Due to uncontrolled hypertension and non-reassuring fetal heart tracing, the patient required cesarean delivery at 26w6d. She received a combined spinal epidural (10.5mg 0.75% bupivacaine, 0.15mg morphine, and 15mcg fentanyl intrathecally). Nicardipine was discontinued intraoperatively due to normotension but resumed on resolution of the spinal block. Postoperatively, rapid clinical improvement supported a diagnosis of preeclampsia with severe features.

Case Two:

Discussion: In parturients with SLE, the physiologic increase in cardiac output during pregnancy increases renal blood flow and causes nephrotic syndrome. This patient had additional symptoms (visual disturbances due to intracranial hypertension and chest pain) which could signify either SLE flare or preeclampsia. Anti-dsDNA and complement levels are helpful to discriminate between the diagnoses. While low complement supported LN flare in this case, progressive hypertension, lack of urine sediments and arthralgias, and minimal dsDNA elevation supported preeclampsia. Many patients with SLE have coexisting renal disease which can limit pharmacologic options for treating hypertension or pro-thrombotic states. Involvement of a multidisciplinary team including nephrology, neurology, and hematology was imperative for appropriate care.

References: 1. PMID: 39153486 2. PMID: 35872104 3. PMID: 32479157

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 06

Hemorrhagic Pericardial Effusion: An Atypical Presentation of Pre-Eclampsia

Presenting Author: Rachel Reindorf, MD, MPH

Presenting Author's Institution: University of Maryland Medical Center GME - - Baltimore City, MD - Baltimore City, Maryland

Co-Authors: Shobhana Bharadwaj, MD - University of Maryland Schoo of Medicine
Jessica Galey, MD - University of Maryland School of Medicine

Introduction: Pre-eclampsia is a disease of pregnancy consisting of hypertension and proteinuria, with an incidence between 2-10% worldwide. Of patients with pre-eclampsia, one in four have severe features such as transudative pleural or pericardial effusions. However, hemorrhagic pericardial effusions are very rare, with the exact incidence unknown.

Case One: We present a 36yo G3P3003 at 38w0d with a history of hypertension, type 2 diabetes, and anemia who initially presented to an outside hospital for shortness of breath and bilateral lower extremity edema. She was found to be anemic to hemoglobin of 6.6, for which she was transfused two units packed red blood cells (pRBC). Given the hypercoagulability of pregnancy and her symptoms, initial concern was for pulmonary embolism (PE). She underwent bilateral venous duplexes, which were negative for deep venous thromboses, and a CTA chest to rule out PE. CTA was negative for PE but showed a large pericardial effusion. The patient was transferred to our hospital for emergent pericardiocentesis. On arrival she was tachycardic and hypertensive. She was started on a clevidipine drip for afterload reduction. Due to her tamponade physiology and concern for decompensation with positive pressure ventilation, we elected to proceed under local anesthesia and minimal sedation with attention paid towards maintaining spontaneous ventilation adequate preload. 2L of blood was aspirated from around the heart and a pericardial drain was placed for continuous drainage. Her dyspnea improved significantly with treatment. Due to continued hypertension and concern for severe pre-eclampsia, the patient underwent a repeat cesarean section the next day under combined spinal epidural anesthesia. A reduced spinal dose was used to minimize hypotension, and additional epidural lidocaine was used to achieve an appropriate sensory level. The procedure was uncomplicated and the patient remained hemodynamically stable throughout. Her postoperative course was uncomplicated. Her drain put out 1.6L of pericardial fluid over the next 7 days before being removed prior to discharge.

Case Two:

Discussion: This case was notable as hemorrhagic pericardial effusion is a very rare presentation of preeclampsia. Although hemorrhagic pericardial effusions in the setting of malignancy have a high mortality, in the setting of preeclampsia prognosis is good if quickly identified and treated, as demonstrated in our patient. This case showed the importance of maintaining a broad differential in the setting of pregnancy. Most importantly, this case showed the importance of interdisciplinary collaboration and communication between anesthesiology, cardiology and obstetrics and gynecology in this patient population.

References: 1. Cureus, 14(11), e31143. 2. BMC Public Health, 20(1), 1–10.

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 07

HELLP Syndrome at 19 weeks Complicated by Delayed Care

Presenting Author: Koran I. Sherman, BS

Presenting Author's Institution: Univeristy of New Mexico - Albuquerque, New Mexico

Co-Authors: Emily McQuiad-Hanson, MD/Assistant Professor - Univeristy of New Mexico

Introduction: HELLP syndrome (Hemolysis, Elevated Liver enzymes, and Low platelet count) is a variant of preeclampsia that is associated with high rates of maternal morbidity and mortality.1,2 It typically occurs in the third trimester , and presentation prior to 23 weeks is extremely rare.1 Treatment for HELLP syndrome is delivery of the fetus regardless of age of gestation.2 Here, we describe a case of HELLP syndrome in a patient at 19 weeks EGA whose course was complicated by multiple transfers and delay in definitive management.

Case One: A 32-year-old G4P3 at 19 weeks EGA presented to a community hospital in New Mexico with headache, RUQ pain, severe-range BP, elevated LFTs, and down-trending platelets. She was transferred to the nearest facility with an appropriate level of care in Texas. She received 4 units of platelets, magnesium, nifedipine, and labetalol. The fetus was noted to have severe FGR and abnormal dopplers, but a fetal heart rate was still present, and providers would not proceed with definitive management. The patient was subsequently transferred to the University of New Mexico, where she underwent emergent D&E under general anesthesia. The postoperative course was complicated by continued HTN requiring rescue and mild pulmonary edema. She was discharged on POD 2 in stable condition.

Case Two:

Discussion: After the Supreme Court's Dobbs v Jackson decision in 2022, access to abortion became increasingly limited, and 13 states have enacted near-complete abortion bans.3,4,5 The detrimental effect of these bans has been documented in a myriad of ways. 4,5 This case highlights how restrictions on abortion can delay medically indicated, life-saving interventions and transfer the burden of care to states where abortion is protected. While Texas does have exemptions for pregnancy termination if the mother's life is threatened, there is no medicolegal definition for such circumstances, leaving physicians legally vulnerable even when treating patients in accordance with standard of care.3 HELLP syndrome constitutes an obstetrical emergency, and delivery is the only definitive treatment. In pre-viable cases such as these, abortion bans put patients' lives at risk and places further stress on remaining reproductive care sites.

References: 1. Mossayebi, M. HELLP syndrome at < 23 weeks' gestation: a systematic literature review. American journal of obstetrics and gynecology. 2023 May. 2. Adorno, M. HELLP Syndrome. Critical care nursing clinics of North America. 2022 Sept. 3. Texas State Law Library. 2025 Jan. 4. Sabbath EL. S Obstetrician-Gynecologists' Perceived Impacts of Post–Dobbs v Jackson State Abortion Bans. JAMA Netw Open. 2024 Jan. 5. Baden K. Clear and Growing Evidence That Dobbs Is Harming Reproductive Health and Freedom. Guttmacher. 2024 May. 6. Le Thi Thuong D. The HELLP syndrome in the antiphospholipid syndrome: retrospective study of 16 cases in 15 women. Ann Rheum Dis. 2005 Feb.

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 08

Intravenous Midazolam in the Treatment of Eclampsia-Induced Status Epilepticus: A Case Report

Presenting Author: Thomas Quisenberry, MD

Presenting Author's Institution: University of North Carolina - Durham, North Carolina

Co-Authors:

Introduction: Eclampsia is the occurrence of 1 or more generalized tonic-clonic (GTC) seizures in women with a hypertensive disorder of pregnancy (HDP) that is not related to other medical conditions. Though associated with significant maternal and fetal morbidity and mortality, eclampsia is rare in developed nations, affecting 1.6 to 10 per 10,000 deliveries. Progression to eclampsia is most common in pre-eclampsia with severe features (PEC), and is very rare in other HDPs. When intravenous (IV) magnesium is administered to women with PEC, the incidence of progression to eclampsia is < 0.6%. Without IV magnesium, progression to eclampsia occurs in 2% of PEC cases.

Case One: Our patient is a 21-year-old G1P0 at 35w5d diagnosed with PEC by severe-range blood pressures at an outside hospital. She was given IV labetalol and magnesium and transferred to our tertiary care facility for induction of labor. Her magnesium infusion was stopped due to a supratherapeutic serum magnesium. After spontaneous vaginal delivery, she reported a severe headache and had a brief GTC seizure that resolved without abortive medications. After a short seizure-free period, she suffered another GTC seizure of 30 minutes duration, consistent with status epilepticus (SE). IV magnesium was restarted and IV lorazepam (LZP) was considered for abortive therapy, but was unavailable. 10 mg IV midazolam (MDZ) were instead given in 2 mg doses for abortive therapy. Despite these measures her seizure continued, requiring induction with propofol and intubation. Her seizures subsequently resolved and she was transferred to the intensive care unit (ICU), where she received a loading dose of levetiracetam. Her ICU stay was uneventful, and she was extubated and transferred to the post-partum floor on post-partum day (PPD) 1. She remained seizure-free on daily levetiracetam throughout the remainder of her hospital stay, and was discharged home on PPD3 on daily levetiracetam therapy.

Case Two:

Discussion: Acute management of SE in pregnancy parallels management of SE generally. One distinction is the role of magnesium in eclamptic seizure prevention. Magnesium administration should be considered following eclamptic seizure, though the increased risk of uterine atony should be weighed against the risk of recurrent seizure. First-line abortive therapy for SE is benzodiazepines. A 4 mg LZP IV bolus is preferred, but if LZP is unavailable, MDZ and diazepam (DZP) are also effective. A 0.2 mg/kg loading dose of IV MDZ (up to 10 mg) followed by a 0.1-3 mg/kg/hr infusion is especially useful in the treatment of refractory SE. DZP has rapid onset and can be given as a 5-10 mg bolus but redistributes from the central nervous system rapidly with only a 20-minute duration, requiring re-dosing. Familiarity with these alternative agents for treatment of eclamptic seizure is critical to providing care in the obstetric setting.

References: 1: Am J Obstet Gynecol (2022); 226(2S):S1237-1253 2: CNS Drugs (2022); 36:951-975 3: Neurohospitalist (2011);1(1):23-31

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 09

Anesthetic management of a pregnant patient with coexisting ESRD and preeclampsia with severe features: a case report

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Co-Authors: Suzanne Huffnagle, DO - Thomas Jefferson University Department of Anesthesiology and Perioperative Medicine
John Wenzel, MD - Thomas Jefferson University Department of Anesthesiology and Perioperative Medicine

Introduction: Preeclampsia is a leading cause of maternal and fetal morbidity; ESRD further complicates obstetric/anesthetic care. We report a case of a 34 y/o G1P0 with ESRD and preeclampsia who required a C/S under GA, followed by admission to the ICU for uncontrolled HTN.

Case One: A 34 y/o G1P0, with PMH of ESRD, renal transplant, anemia, and cHTN, was admitted at 36 wks for IOL. Her multidisciplinary team included MFM, nephrology and high-risk OB anesthesia. Although she was not anuric, hemodialysis was initiated 6x/wk at 16 wks for increasing fatigue, worsening GFR, and electrolyte abnormalities. Her BP was 126/84. Upon admission, she developed preeclampsia w/ severe features, BP 164/108 with a headache, and was treated with IV labetalol. On day 2, hydralazine, nifedipine, and magnesium (mag) were added with close monitoring of DTRs/mag levels. Platelet count, PT, PTT, INR were WNL, K+ was 2.9 mmol/L; she denied symptoms of easy bruising/bleeding. She received 500 mL NSS and an epidural was inserted. A urinary catheter was placed to facilitate fluid management and an arterial line aided in hemodynamic monitoring. IV access was obtained using US in the RUE (LUE AV fistula) after an extended dwell catheter infiltrated. C/S was performed on day 3 for protracted labor and poor FHR variability. The epidural was not adequate after using the maximal safe dose of lidocaine, so GA was induced and baby was delivered in 5 minutes. QBL was 1000 mL and was replaced with 1000 mL NSS. Hemoglobin remained 9.8 g/dL. After extubation, she was admitted to the CCU for IV clevidipine. She improved, dialysis was decreased to 3x/wk, and she was discharged on day 8. BP returned to baseline 2 weeks postpartum.

Case Two:

Discussion: Coexisting preeclampsia and ESRD complicate pregnancy/anesthetic care. Mag is used for seizure prophylaxis and is often continued for 24 hours. Because it is renally excreted, patients with ESRD may rapidly develop mag toxicity with loss of DTRs, ECG changes, respiratory arrest, and asystole. Close monitoring of DTRs/serial mag levels is necessary. If levels increase, the dose must be decreased or discontinued. Preeclampsia is a hypovolemic state due to capillary leakage of IV volume. This exacerbates peripheral edema, vasoconstriction, and end-organ damage. Vasopressor use rather than fluid preloading prior to epidural placement is preferred. If C/S is required, fluids should be limited to only what is lost during surgery. (1) Coagulopathy from low/dysfunctional platelets might limit neuraxial anesthesia. TEG and ACT evaluations can help. (2) Postpartum uncontrolled HTN must be anticipated and may require prolonged antihypertensive therapy in the ICU.

References: 1. Yearbook Anesth &Pain Manag 2008;2008:215, 2. Front Surg 2022;9:848496

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 10

Emergent Cesarean Delivery in the Setting of Severe Preeclampsia and Rapid Onset Pulmonary Edema

Presenting Author: M. Chloe Slator, BS

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Co-Authors: Keyan Jalili, DO - University of New Mexico

Introduction: Acute pulmonary edema is a rare but life-threatening complication of pre-eclampsia. We present a case of a woman with chronic hypertension and superimposed pre-eclampsia with severe features who had acute onset of severe pulmonary edema during induction of labor.

Case One: A 39-year-old G3P1 with chronic hypertension presented at 36 weeks and 5 days for induction of labor due to superimposed pre-eclampsia with severe features based on severe-range blood pressure. She was started on magnesium and had a normal progression of labor until she had sudden onset shortness of breath and was found to be tachypneic and hypoxic with fetal bradycardia to the 60s. Magnesium was discontinued, and calcium gluconate was administered due to suspicion for magnesium toxicity. The patient's respiratory status continued to deteriorate rapidly, requiring 15 liters per minute of non-rebreather mask, at which time the decision was made to proceed with an emergency cesarean delivery. The patient was transferred to the OR, and endotracheal intubation was performed. After induction, oxygen saturation percent remained in the 80s and copious frothy secretions were noted in the endotracheal tube with high peak pressures on the ventilator. The endotracheal tube was suctioned, recruitment breaths were delivered, and two additional peripheral IVs and an arterial line were placed. A transthoracic echocardiogram was performed at the bedside which revealed mildly reduced ejection fraction. The patient's oxygen saturation peak airway pressures began improving and she was transferred from the OR to the ICU. Once stable, she was extubated and transferred to the maternal fetal medicine service. She was discharged home in stable condition five days later with her healthy infant.

Case Two:

Discussion: While pulmonary edema is a relatively rare complication of pre-eclampsia, with recent research finding an incidence of 2.1%, it is associated with significantly increased odds of maternal morbidity (1), especially when severe. It is likely caused by multiple factors, including increased capillary permeability, decreased oncotic pressure, iatrogenic fluid overload, and cardiac dysfunction (2). The physiologic disturbances of pre-eclampsia pose multiple challenges for the anesthesia team, including the potential for difficult airway management, hemodynamic instability, and increased risk of postpartum hemorrhage (3). Through prompt recognition of signs and symptoms of acute pulmonary edema, the clinical team in this case was able to quickly intervene and stabilize that patient, highlighting the need for preparedness for this clinical scenario.

References: 1. Amin BZ et al. Risk Factors and Risk for Severe Maternal Morbidity in Severe Preeclampsia Complicated by Pulmonary Edema: A Case-Control Study. Am J Perinatol. 2024 2. Ives CW et al. Preeclampsia—Pathophysiology and Clinical Presentations. J Am Coll Cardiol. 2020 3. Parthasarathy S et al. Anesthetic management of a patient presenting with eclampsia. Anesth Essays Res. 2013

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 11

Shoulder pain during labor epidural analgesia, subdural anesthesia, general anesthesia, and post-dural puncture headache in a patient with preeclampsia with severe features: a case report

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Presenting Author's Institution: Columbia University - New York, New York

Co-Authors: Suzanne Mankowitz, MD - Columbia University

Introduction: Epidural anatomy is often overlooked but might influence neuraxial drug administration, effectiveness, and complications. Upper back/interscapular, neck and shoulder pain during labor epidural analgesia (PLEA) is associated with nulliparity, obesity, increased epidural pressure and subdural catheter.1 We present a case with an intrapartum cesarean delivery with multiple anesthesia complications, including PLEA, epidural catheter failure, a high spinal or subdural anesthesia, and postdural puncture headache (PDPH).

Case One: A 27-yo G1P0, BMI 41, was admitted for induction of labor for preeclampsia with severe features after 2 weeks of frontal headache. A CSE (2 attempts) was placed at L3-L4, with programmed intermittent epidural bolus (PIEB; 8mL q45min). Severe interscapular pain occurred with each bolus, and after 17h, injecting through the epidural catheter became impossible and it was removed. Since cesarean delivery for failure to progress was decided, a spinal anesthetic (bupivacaine 0.75% 1.6mL, fentanyl 15mcg, morphine 150mcg) was performed in the OR. Shortly after spinal injection, patient became unresponsive and apneic, resulting in intubation and general anesthesia. Only 55min elapsed from spinal dose to extubation, and the patient had no block (fully moving her legs and in severe pain) when she woke up. A few days later, she reported persistent headache in the setting of high blood pressure, with a clear new postural component. Brain MRI showed diffuse dural enhancement suggesting intracranial hypotension from a dural leak (Fig 1). Consulted the next day, our team agreed this was a PDPH and offered an epidural blood patch (EBP). The patient had just received unfractionated heparin (UFH) 5000 UI. In this setting, an aPTT (normal) and ROTEM (hypercoagulable) were gathered, and EBP was performed 4h after UFH dose. In lateral decubitus at L3-L4, clear loss of resistance was at 5cm, and 8mL of blood injected before sudden resistance to further injection. Adjusting the angle cephalad, additional 15mL was injected until lumbar pressure was reported, with full resolution of PDPH.

Case Two:

Discussion: Several elements suggest a narrow or low-compliance epidural space: 1. PLEA 2. Difficulty injecting through a previously functioning epidural catheter 3. MRI consistent with a dural tear, likely occurring during initial CSE procedure 4. Subdural anesthesia (more likely than high spinal) given absence of sensorimotor block 55 min post-spinal 5. EBP with needle redirection and divided blood injection volumes PLEA and its known risk factors (young age, nulliparity, high BMI, prolonged epidural infusion, and required CD) could be a marker for a narrow epidural space or unusual anatomy and should be recognized as it may be associated with subdural catheter and in this case, a series of complications resulting in a general anesthetic and an EBP. Further studies with dynamic imaging (fluoroscopy) might be valuable in patients with PLEA.

References: 1. Int J Obstet Anesth. 2024 Nov;60:104255.

Fig 1 PLEA EBP.pdf

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 12

Magnesium Toxicity during Cesarean Section

Presenting Author: Kaitlin Bruneau, MD, MS

Presenting Author's Institution: SAUSHEC - San Antonio, Texas

Co-Authors: Courtney Hood, MD - SAUSHEC

Introduction: Magnesium sulfate (MgSO4) is a high risk medication with risk for overdose and even death. Prompt recognition and treatment of MgSO4 overdose is a pillar of obstetric anesthesia.

Case One: We describe a 27-year-old G2P0010 at 37w4d admitted for IOL due to GHTN that progressed to preeclampsia with severe features by blood pressure criteria, and MgSO4 treatment was initiated per protocol. After a failed IOL a primary LTCS was recommended. After arrival to the OR, the patient voiced concerns of hot flushing, difficulty breathing, nausea, and muscle weakness. She passed an Allis test and surgery began. Her symptoms progressed to increased somnolence and respiratory depression. She remained hemodynamically stable but required an OPA and NRB mask to support ventilation. Ongoing discussions between the operating and anesthesia teams included a differential diagnosis of high spinal, LAST, opioid overdose, and AFE. A nursing staff member came to the head of the bed and noted that the MgSO4 infusion had been taken off the pump and was running wide open. The MgSO4 bag (40 g in 1 L) was approximately half empty and had been recently changed. The IV line was immediately closed and 1 g calcium gluconate and 20 mg of IV furosemide were administered. On initial laboratory evaluation the magnesium concentration was undetectably high. At the end of the case, the patient remained responsive to painful stimuli with sternal rubs, while maintaining oxygen saturation on 10 L NRB. After an additional 1 gram of calcium chloride, the patient showed improvement in symptoms and was weaned to room air. ECG showed no evidence of arrythmia or cardiac dysfunction. CXR showed no evidence of pulmonary edema. The patient remained stable during her overnight stay in the ICU and was discharged on POD3.

Case Two:

Discussion: This case outlines a rare adverse event with a significant amount of learning points. Magnesium toxicity is recognized by early signs such as loss of DTRs, somnolence, and muscles weakness, and late signs including respiratory failure, paralysis, and cardiac arrest. Key elements of safe care practices for the use of MgSO4 include pharmacy-supplied medications, decreasing maintenance bags from 40g in 1L to 20g in 500mL, and using color-coded tags on the lines.1 During care team transfers, it is recommended a bedside assessment between both parties be completed including patient status, review of dosage and pump settings, and review of written physician orders. These recommendations were implemented at our institution as part of an intradepartmental revamp of practices, which also included multidisciplinary simulation, monthly resident education, and modifications to our OR time out processes. We hope giving this rare but life-threatening complication attention will urge other institutions to review their practices and prevent this outcome.

References: 1. Simpson, K. R. (2006). Minimizing Risk of Magnesium Sulfate Overdose in Obstetrics. MCN: The American Journal of Maternal/Child Nursing, 31(5), 340.

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 13

Multidisciplinary Management for Cesarean Delivery in a Patient with Fulminant Hepatic Failure

Presenting Author: Yue Qiu, MD

Presenting Author's Institution: UPMC Magee-Womens Hospital - Pittsburgh, Pennsylvania

Co-Authors:

Introduction: Acute liver failure due to accidental acetaminophen toxicity in third trimester pregnancy is an uncommon yet life threatening presentation that requires prompt multidisciplinary coordination for maternal and fetal well-being.

Case One: Patient was a 23-year-old G2P1001 at 36 weeks and 5 days with a history of tobacco use, opioid use disorder (in remission without pharmacotherapy), and anxiety. Initially presented with nausea and emesis after 4 days of acetaminophen 1-2 grams taken every 2-3 hours for odontalgia, found to have significant transaminitis (peak several thousands) and new coagulopathy (INR 3.4). Patient was started on broad spectrum antibiotics for gingival abscess, transferred to obstetric intensive care unit to initiate N-acetylcysteine with continued monitoring, and given vitamin K supplementation in addition to four units of fresh frozen plasma. Worsening transaminases and non-reassuring fetal status in setting of irregular contractions prompted urgent cesarean delivery with anticipated maternal hepatic transplantation evaluation and neonatal intensive care admission. Preoperative invasive lines (arterial, central venous) were placed. Rapid sequence induction was performed with intubation via video laryngoscopy. Primary low transverse cesarean proceeded without excessive hemorrhage or notable abnormalities on viscoelastic testing. Multimodal pain management included intraoperative bilateral transverse abdominal plane blocks prior to extubation, ketorolac, and hydromorphone. Postanesthetic course noted remarkable improvement in maternal hepatic function. Patient was ultimately discharged on postoperative day 4 after planned short course of oral hydromorphone with addiction medicine and referral from oral and maxillofacial surgery.

Case Two:

Discussion: Acetaminophen is the most common overdose in pregnancy [1]. Early treatment can facilitate positive maternal and fetal outcomes, even in the third trimester [2]. Etiology of acute liver failure in pregnancy is strongly associated with morbidity and mortality [3]. Rapid complex care coordination is essential for optimal patient outcomes.

References: 1. Wilkes J., et al., South Med J, 2005. 98(11):1118-22. 2. Byer A., et al., JAMA, 1982. 247(22):3114-5. 3. Casey L., et al., Hepatology. 2020. 72(4):1366-1377.

Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 14

Critical Care Obstetrics: A case of postpartum respiratory failure complicated by preeclampsia, acute kidney injury and hyponatremia

Presenting Author: Paul Vozzo, MD

Presenting Author's Institution: Columbia NewYork-Presbyterian - New York, New York

Co-Authors: RUTH LANDAU, MD - Columbia University

Introduction: Respiratory failure occurs in 1 in 500 pregnancies, most commonly in the postpartum period. (1) We present the case of a patient with BMI 61 kg/m2, preeclampsia (PEC) with severe features, acute kidney injury (AKI), with post-cesarean respiratory failure and hypovolemic hyponatremia.

Case One: A 33-year-old G3P2 with prior cesarean delivery (CD) was admitted at 32+6 weeks with PEC with severe features (BP 165/67mmHg and headache). Nifedipine was initiated and betamethasone given with plan for CD at 34 weeks. One of the patient's children developed a febrile seizure secondary to COVID-19 while visiting the patient. The patient was subsequently found to be COVID+ at 33+2. She became tachycardic 3 days later, and CT PE with IV contrast was non-diagnostic. She developed AKI (creatinine 0.61 to 0.93) attributed to worsening PEC, IV contrast administration, and COVID infection. Decision was made to proceed with repeat CD the next day (33+6 weeks) for worsening PEC with severe features and AKI. Due to BMI, potential for respiratory complications, and AKI precluding use of NSAIDs, a CSE (LOR 12.5cm) with intrathecal hyperbaric bupivacaine 0.75% 1.8 mL, fentanyl 15 mcg, morphine 150 mcg, and clonidine 30 mcg. Quantitative blood loss was 400 mL with 1.5L lactated ringers given. The case was unremarkable. Postoperative day one (POD1) she remained tachycardic and developed a new O2 requirement. CXR showed vascular congestion. Serum Na+ was 129 from 138. On POD 2, she developed worsening dyspnea and orthopnea and O2sat was 77% on 3L O2. Serum Na+ was 120. Serum creatinine rose to 1.42. CXR was notable for worsening multifocal interstitial edema and patchy opacities. TTE was normal. Furosemide and oral urea were given. POD3 she became confused, had worsening hypoxia, and was admitted to the medical ICU for high flow nasal cannula, hypertonic saline, furosemide, dexamethasone, and remdesivir treatment. POD4 hyponatremia resolved, and respiratory status improved. She was discharged POD8, normonatremic with a healthy infant.

Case Two:

Discussion: Respiratory decompensation due to a combination of acute issues (COVID, PEC, and AKI) in this patient with BMI 61 resulted in an ICU admission. We suspect that severe PEC and AKI resulted in pulmonary edema with an intravascular depletion that led to hypovolemic hyponatremia with syndrome of inappropriate antidiuretic hormone secretion (SIADH). Furthermore, hyponatremia may indicate the severity of preeclampsia. (2) This case demonstrates that worsening hyponatremia may be a hallmark of potential respiratory failure in PEC with severe features

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Abstract #: THURS - CR - BS 1 - BR 3 – Hypertension – 15

Presentation of Posterior Reversible Encephalopathy Syndrome in a Pregnant Patient with Preeclampsia with Severe Features

Presenting Author: Mallory Hawksworth, MD

Presenting Author's Institution: Washington University, St Louis - St Louis, Missouri

Co-Authors: Preet Mohinder M. Singh, n/a - Washington University, St Louis

Introduction: Preeclampsia affects up to 5% of pregnancies in North America and is a leading cause of maternal and fetal morbidity and mortality. While this disease impacts multiple organ systems, a particularly severe manifestation involving the central nervous system is posterior reversible encephalopathy syndrome (PRES). PRES is a radiologic finding of edema involving the white matter of the posterior cerebrum, especially the parietal and occipital regions. Symptoms can include headache, vomiting, seizures, altered level of consciousness and vision changes, many of which are also found in patients with preeclampsia and eclampsia.

Case One: We describe a case of a 21-year-old G2P1001 female at 35 weeks and 4 days gestation who was transferred to our tertiary care facility given newly diagnosed preeclampsia with severe features and non-reassuring fetal monitoring. She endorsed a headache over the prior two days and new onset double vision upon arrival to our hospital. She appeared lethargic, but oriented during conversation and while sitting up in preparation for an epidural, she endorsed worsening dizziness and double vision. Neurologic exam was notable for new nystagmus. The epidural was deferred and the patient was taken for head imaging which noted signs concerning for PRES. With the patient's preeclampsia with severe features and suspected development of HELLP, a plan was made for expedited delivery. This case was complicated by the patient's strong desire to avoid a cesarean delivery and difficulty with communication as the patient spoke a Mayan dialect with limited interpreter availability, especially in the overnight hours. Given the patient's progressive altered mental status and likely developing PRES, our anesthesia team did not feel the benefits of neuraxial outweighed the risks. Fortunately, the patient was able to have an unassisted vaginal delivery. Shortly after, the patient became non-responsive to verbal stimuli with withdrawal to some painful stimuli. MRI at this time noted signal abnormality in bilateral basal ganglia, thalami and brainstem which, while atypical, can be seen in PRES. She was transferred to the neuro ICU where her neurologic status improved over the following days. On post-partum day 3 she was transferred out of the ICU after which she had an uneventful remaining post-partum course. She was discharged from the hospital on post-partum day 5. At three weeks post-partum, the patient continued to have a normal neurologic exam.

Case Two:

Discussion: This case highlights the importance of maintaining a broad differential and high index of suspicion for PRES, especially in the presentation of non-specific yet worsening neurologic symptoms. It also demonstrates the importance of tertiary care resource utilization and multidisciplinary collaboration.

References: Tawati DA, Chan W-S. A systematic review of posterior reversible encephalopathy syndrome in pregnant women with severe preeclampsia and eclampsia. Obstetric Medicine. 2023;16(4):236-241. doi:10.1177/1753495X221150302

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 01

Utilizing the Existing Needle Track After Accidental Dural Puncture: Same-site Epidural as Innovation or Risk?

Presenting Author: Rishabh Jindal, MBBS MD

Presenting Author's Institution: Montefiore Medical Center - Bronx, New York

Co-Authors: Sherif Elsayed Ali Ali, MD - Montefiore Medical Center

Introduction: Accidental dural puncture (ADP) occurs in 0.5–1.5% of obstetric epidurals (1). Standard management includes placing an intrathecal catheter or re-siting the epidural, both of which present unique risks. In patients with morbid obesity and spinal pathologies, successful epidural placement can be technically difficult, necessitating individualized approaches (2).

Case One: A 44-year-old G1P0 woman (BMI 62) with a history of super morbid obesity, GDM, L4–L5 disc extrusion, and multi-level degenerative spinal disease presented for induction of labor. At 1 cm cervical dilation, she was experiencing severe sciatica pain. A junior anesthesiologist performed a technically challenging epidural which resulted in ADP. Given the difficulties faced, withdrawing and reattempting epidural placement at a different level would have posed a significant risk of repeat ADP. Additionally, an intrathecal catheter was avoided due to concerns of high spinal block and uterine tachysystole, especially in early labor. To avert these issues, the Tuohy needle was carefully withdrawn incrementally until CSF flow ceased, preserving the original track through the ligamentum flavum and soft tissues. The epidural space was then successfully reidentified at a shallower depth using the loss-of-resistance technique. After confirming negative catheter aspiration, a dilute local anesthetic–opioid infusion was administered under close hemodynamic and sensory monitoring. The epidural provided effective analgesia, and the patient delivered without complications.

Discussion: This case highlights the rationale for same-site epidural placement in a complex obstetric patient. Utilizing the existing needle track minimized additional needle passes while achieving effective labor analgesia. Despite its success in this case, same-site epidural placement after ADP is not widely described, and concerns remain regarding inadvertent subarachnoid catheter migration or misplacement. Further research is needed to evaluate its safety, efficacy, and broader applicability. This case underscores the importance of individualized anesthetic strategies in obstetric patients with complex anatomy and significant pain, encouraging ongoing discussion within the obstetric anesthesia community to refine management approaches for challenging cases.

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Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 02

Seizures after epidural blood patch for post-dural puncture headache

Presenting Author: Jessica Galey, MD

Presenting Author's Institution: University of Maryland School of Medicine - Baltimore, Maryland

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Bhavani Shankar Kodali, MBBS, MD, FASA - University of Maryland School of Medicine

Introduction: Unintentional dural puncture (UDP) is an infrequent complication of epidural anesthesia. A post-dural puncture headache (PDPH) occurs in half of patients with UDP and epidural blood patch (EBP) is the gold standard treatment. EBP is usually well tolerated with the most common adverse effects being back/neck pain, mild fever, and radicular irritation. Serious complications such as arachnoiditis, subdural hematoma, seizure, and cerebral venous sinus thrombosis have been reported but are very rare. We present a case of a patient with UDP and PDPH who underwent EBP and developed seizures.

Case One: A 23yo G3P1011 healthy patient presented at 40w4d in labor. She underwent epidural placement with no dural puncture noted and had an uncomplicated delivery. On postpartum day 1 (PPD1), she developed a positional headache, relieved when supine. She had no other symptoms, and no hypertension or concern for preeclampsia. She received acetaminophen, cosyntropin, and ibuprofen with some relief initially but her pain worsened by PPD2. A CT head showed foci of gas near the basal cisterns, concerning for dural puncture, and a hyperdensity along the superior sagittal sinus concerning for potential dural venous sinus thrombosis. An MRA head was obtained to further evaluate this finding and showed intracranial hypotension but no thrombi. Given her worsening headaches and imaging findings suggestive of UDP, patient elected for EBP on PPD3. The EBP was uncomplicated with 20mL blood injected and improved headache. One hour later she was hypertensive with systolics 130-160's, attributed to reequilibrating intracranial pressure (ICP), that resolved spontaneously soon after. Four hours post EBP, she endorsed dizziness and blurred vision and then seized. The seizure resolved spontaneously after 2-3 minutes. Magnesium (Mg) was started for presumed eclampsia and a repeat CT head was unremarkable. An hour later, she had prodromal dizziness and another seizure, for which she received midazolam. She was transferred to the neuro ICU, started on levetiracetam, and monitored with continuous EEG. She remained normotensive and her labs showed no evidence of preeclampsia so Mg was stopped. She had no further seizures. She was discharged on PPD5 with neurology follow-up scheduled.

Discussion: Seizures during pregnancy and peripartum are often attributed to preeclampsia, but alternative etiologies can occur. In our patient, she had no evidence of preeclampsia. Prodromal dizziness before both seizures suggests decreased cerebral blood flow (CBF) as an etiology. Cerebral autoregulation regulates CBF in the setting of intracranial hypotension following UDP. Increased ICP following EBP could have resulted in alternations in CBF. Readjustment of CBF could explain her quick recovery. Additionally, blood in the spinal fluid is epileptogenic and EBP requires the administration of blood into the neuraxis. The combination of these factors may have led to our patient's seizures.

References: Anaesth Rep. 2022 Feb 24;10(1):e12149.

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 03

"I feel like a vessel burst in my head!": A case of pneumocephalus and pneumorrhachis from accidental dural puncture

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Co-Authors: Kathleen A. Smith, MD - University of North Carolina

Introduction: Pneumocephalus, the presence of intracranial gas, is a rare complication of neuraxial anesthesia1. It may result from accidental injection of air intrathecally from the "loss of resistance" (LOR) technique during epidural placement. Suspect pneumocephalus with a sudden onset explosive headache during epidural placement, particularly with a known accidental dural puncture (ADP).

Case One: A 29-year-old G3P1011 presented for induction of labor. During epidural placement, saline with an air bubble was used for LOR. The patient reported a sudden onset, severe, left-sided and frontal thunderclap headache (HA) midway through the procedure. There was no known ADP. The procedure was aborted, patient flattened, and 50 mcg fentanyl and 1,000 mg acetaminophen were administered intravenously. She remained neurologically intact. Following brief observation, a lumbar epidural was placed one level higher than the initial attempt using saline for LOR. Bupivacaine 0.25% (10ml) was slowly loaded in 2 ml increments due to concern for elevated intracranial pressure. During this time, the patient continued to endorse a severe headache, stating she 'felt like a vessel burst in her head'. A rapid response was called and STAT CTA head and neck revealed moderate intraventricular and subarachnoid pneumocephalus with mild dilation of the lateral ventricles (image 1) and intradural and epidural pneumorrhachis of the cervical and thoracic spinal canal, respectively. Neurology was consulted; the patient was treated with acetaminophen, intravenous fluids, and oxygen. She had a successful vacuum-assisted vaginal birth. Postpartum she developed a postdural puncture HA. Prior to epidural blood patch (EBP) on postpartum day (PPD) 1, a CT head without contrast revealed improved pneumocephalus without other acute abnormalities. She was discharged on PPD 2. On PPD 4, recurrent symptoms prompted a second EBP. The patient reported improved symptoms by PPD 12.

Discussion: A sudden onset HA during epidural placement in the sitting position is suspicious for pneumocephalus secondary to ADP. However, given the lack of CSF noted during the procedure, the anesthesia team felt compelled to rule out more concerning etiologies. Symptoms of pneumocephalus include non-positional, rapid onset, thunderclap HA, nausea, vomiting, seizures, dizziness, cranial nerve palsy, hemiparesis and encephalopathy1. Treatment includes Trendelenburg position, supportive care, and high-flow oxygen, which hastens reabsorption of the air1. Our patient's pneumocephalus nearly resolved within 24 hours, however she suffered a PDPH that required two EBPs. This case reinforces use of saline rather than air during the LOR technique, to reduce the risk of pneumocephalus during epidural placement.

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Pneumocephalus Image_SOAP.pdf

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 04

Persistent Headache After Combined Spinal Epidural

Presenting Author: Olivia Lucas, MD

Presenting Author's Institution: The University of Alabama at Birmingham - Birmingham, Alabama

Co-Authors: Andrew Hackney, MD - UAB Heersink School of Medicine
Annalese Neuenschwander, MD - The University of Alabama at Birmingham

Introduction: Headaches are a common complaint in the postpartum (PP) period. Primary headaches, like migraines, are 20 times more common than secondary headaches in the early PP period, but it is important to identify secondary headaches as they can be attributed to an underlying pathologic process such as post-dural puncture.[1]

Case One: A 31y.o. G5P4 Arabic speaking F at 36w. gestation presents for vaginal bleeding in the setting of placenta previa and four prior cesarean sections (CS.) Delivery plan was CS under combined spinal epidural (CSE). CSE placement was difficult, with concern for (c/f) >1 dural puncture with the spinal needle. 12mg of isobaric bupivacaine,100mcg morphine, and 15mcg fentanyl is injected intrathecally. She is started on a phenylephrine infusion and reports feeling unwell. Vitals show bradycardia to the low 40s and hypotension. There is c/f a high spinal and further evaluation is difficult via the translator. 10mcg of IV epinephrine is administered and the pt. then yells out “my head hurts”. The heart rate and systolic BP are both now in the 170s. With time, the vitals stabilize and an appropriate sensory blockade develops, but the pt. continues to endorse a headache. The CS proceeds without complication. 24 hrs. post-op., the pt. endorses a mild non-positional improving headache. One week post-op. the pt. presents for headache evaluation. She notes the headache improved while inpt., but increased to 10/10 pain after discharge which prompted an ED visit at an OSH. She was told head imaging was unremarkable. She endorses photophobia with diffuse pain that extends to the neck, is non positional, and is unrelieved by medicine. CT head shows “multifocal luminal narrowing of bilateral MCAs, PCAs, and L ACA c/f vasospasm vs. vasculitis.” With the history and imaging, there is c/f reversible cerebral vasoconstriction syndrome (RCVS). The pt. is admitted for further imaging and started on verapamil.

Discussion: RCVS is a rare cause of headache predominantly found in women. It’s described as a headache that reaches peak intensity within 1 min. of a trigger or is severe and recurrent. Cerebral vasoconstriction must be in at least two different arteries on imaging with resolution by 3 months[2]. Although a rare pathology, its triggers are commonly encountered in anesthesia. One study found that vasoactive substances account for the majority of cases at approximately 41% and pregnancy and the PP period account for approximately 20%.[3] Prompt identification is important as ischemic and hemorrhagic injury are not uncommon.

References: [1]Stella CL, Jodicke CD, How HY, et. al.: Postpartum headache: is your work-up complete?. Am J Obstet Gynecol 2007; 196: pp. E1-e7. [2]Burton, T. M., & Bushnell, C. D. (2019). Reversible cerebral vasoconstriction syndrome. Stroke, 50(8), 2253–2258.[3]Song, T.J., Lee, K.H., Li, H, et.al: Reversible cerebral vasoconstriction syndrome: A comprehensive systematic review. European Review for Medical and Pharmaceutical Sciences 2021; 25: 3519-3529.

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 05

Sensorineural Hearing Loss After Labor Epidural Analgesia: A Diagnostic Dilemma

Presenting Author: Kresimir Ukalovic, MD, FRCPC

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Co-Authors: Vit Gunka, MD, FRCPC - BC Women's Hospital & Health Centre
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Introduction: Sensorineural hearing loss (SNHL) results from dysfunction of the inner ear, auditory nerve, or central nervous system. Permanent SNHL has been reported following neuraxial procedures, with the proposed mechanism involving leakage of cerebrospinal fluid and reduced perilymphatic pressure in the cochlea.1 We describe a case of profound postpartum SNHL after labor epidural analgesia (LEA).

Case One: A 35-year-old G3P1 term parturient requested LEA. Her medical history included coiling of an incidentally discovered left internal carotid artery aneurysm during the 1st trimester. A lumbar epidural was inserted on the 2nd attempt with no evidence of accidental dural puncture (ADP), and she was discharged on postpartum day (PPD) 1 after an uncomplicated vaginal delivery. On PPD 5 she woke up with profound left-sided hearing loss, tinnitus, and vertigo. Vital signs and CT angiography of the head/neck were normal, and she was diagnosed with benign paroxysmal positional vertigo. The following day she re-presented with ongoing hearing loss, non-positional occipital headache, neck pain, and resolution of vertigo. Her diagnosis was revised to labyrinthitis, and she was treated with oral prednisone and sent for audiogram which confirmed profound left-sided SNHL. On PPD 13 ENT assessed her with persistent hearing loss, non-positional headache, mild photophobia, photopsia and tinnitus. Intra-tympanic steroid injection was performed. Additional investigations including ANCA, C-reactive protein, and head MRI/venogram were normal. ENT suggested the cause may be secondary to unrecognized ADP and atypical post-dural puncture headache (PDPH), despite no evidence of intracranial hypotension on head MRI. On PPD 14 a trial of epidural blood patch (EBP) failed to relieve her symptoms. After 10 days of prednisone, 3 intra-tympanic steroid injections, EBP (28 mL), and 20 sessions of hyperbaric oxygen therapy the patient reported partial improvement in hearing, confirmed by repeat audiogram.

Discussion: This case of profound unilateral SNHL with non-postural headache, tinnitus and vertigo 5 days after LEA presented unique diagnostic challenges. Although we were skeptical that unrecognized ADP was the cause of SNHL, we believed that a trial of EBP was warranted. In cases of SNHL related to dural puncture, 75% of patients treated with EBP had full hearing recovery compared with 36% of patients who received other therapies,1 and delays in treatment were correlated with poorer outcomes.1,2 Furthermore, if dural puncture results in PDPH, there is a risk of other long-term complications such as chronic headache, subdural hematoma and cerebral venous sinus thrombosis.3 When patients present with atypical symptoms after neuraxial procedures, we recommend early multidisciplinary consults, expedited head imaging and robust follow-up. A high index of suspicion is important to ensure the best outcome.

References: 1. Alwan JLO 2022 2. Chandrasekhar OTO 2019 3. Landau RAPM 2024

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 06

Refractory Postdural Puncture Headache: The Role of Connective Tissue Disorder?

Presenting Author: Katherine Taylor Fortson, MD

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Co-Authors: Marcia Chen, MD - NewYork-Presbyterian Weill Cornell Medicine

Introduction: Postdural puncture headache (PDPH) is a complication of neuraxial anesthesia with an incidence of up to 88% following unintentional dural puncture (UDP) (1). Risk factors include young age, female sex, and pregnancy. It can lead to serious complications including cerebral venous thrombosis and subdural hematoma, chronic headaches, and depression. Recent studies have also suggested an association between connective tissue disorders and PDPH (2).

Case One: A 34-year-old G3P1 at 37w0d with history of migraines and joint hypermobility was admitted for induction of labor for gestational hypertension. Combined spinal-epidural (CSE) placement was complicated by UDP. The epidural catheter was replaced one interspace below the level of UDP, and adequate labor analgesia was achieved. The patient reported a profound positional headache and neck pain shortly after normal spontaneous vaginal delivery. Conservative management (ibuprofen, acetaminophen, caffeine, and IV hydration) was ineffective. Given the debilitating nature of her symptoms, an epidural blood patch (EBP) was performed 4 hours after delivery. The patient experienced relief for only a few hours. A sphenopalatine ganglion block was performed, which provided 8 hours of relief. On PPD1, a second EBP was performed due to recurrent headache. The patient again experienced relief and was subsequently discharged to home on PPD2. On PPD3, she was re-admitted with severe positional headache, as well as neck and arm pain. Physical exam was notable for blurred vision, tinnitus, and shoulder weakness. MRI of the brain and spine were obtained, which showed an extensive CSF leak with an extradural collection from the lumbar spine to C1. The patient underwent a third EBP on PPD5, which provided near complete resolution of her symptoms. She was discharged to home on PPD6 with further improvement. She was seen in the CSF clinic as an outpatient and remains headache free.

Discussion: PDPH is an accepted complication of neuraxial labor analgesia that can be debilitating. Risk factors for PDPH are well documented; however, the factors that predispose some women to develop refractory PDPH are poorly understood. Considering the history of joint hypermobility, the severity of symptoms, and failure of standard treatment with EBP, we hypothesize that an underlying connective tissue disorder may have predisposed this patient to a more significant CSF leak. Recent studies affirm that connective tissue disorders are common among patients with spontaneous CSF leaks. It may be important to consider the possibility of connective tissue disorders in patients with PDPH who fail more than one EBP.

References: 1. Choi PT et al.. PDPH is a common complication of neuraxial blockade in parturients: a meta-analysis of obstetrical studies. Can J Anaesth. 2003 PMID: 12734154 2. Youngblood SC et al.Complications of cerebrospinal fluid drainage after thoracic aortic surgery: a review of 504 patients over 5 years. J Thorac Cardiovasc Surg. 2013 PMID: 23434451

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 07

Intrathecal Catheter Insertion and Management after Unintended Dural Puncture in a Parturient with Fontan Physiology Undergoing Cesarean Delivery

Presenting Author: Andrea Lorico, MD

Presenting Author's Institution: NYP Columbia University Irving Medical Center - Brooklyn, New York

Co-Authors:

Introduction: Unintentional dural puncture (UDP) remains a common complication of neuraxial placement, carrying risk of subsequent post-dural puncture headache (PDPH) or need for epidural blood patch.[7] In this case of UDP during attempted combined spinal epidural insertion for a patient with complex congenital heart disease (CHD) undergoing cesarean delivery (CD), the decision was made to proceed with insertion of an intrathecal catheter (ITC). This can provide rapid-onset, titratable, and effective anesthesia, although the elevated risks of medication error and high spinal must also be considered.[3, 4] The ITC was maintained for 48 hours post-delivery for purposes of pain management, and no PDPH was observed on extended follow up.

Case One: This was a 31-year-old G5P0040 at 30w1d planned for urgent CD secondary to NRFHT, who had presented initially at 22w6d for PPROM. The patient underwent staged repair of her CHD, resulting in Fontan physiology. Reduced-dose CSE was planned with norepinephrine, vasopressin, and phenylephrine available for hemodynamic support. In addition to preload optimization with intravenous fluid, an arterial line and two large-bore peripheral IVs were established. Attempted CSE placement took multiple passes, with LOR to saline obtained without return of CSF via the spinal needle. Although no frank CSF leakage was noted through the epidural needle on the 'successful' attempt, subsequent CSF aspiration was observed via the catheter. A spinal dose of 4.5 mg hyperbaric bupivacaine, 15 mcg fentanyl, and 150 mcg morphine was delivered; the block was sequentially dosed in three increments of 2.25 mg bupivacaine to a level of T4. The case was otherwise uneventful, and the ITC was kept for re-dosing of morphine for pain control for two days.

Discussion: No patient is exempt from procedural complications such as UDP. Growing evidence may suggest that ITC insertion after unintentional dural puncture may reduce the incidence of PDPH,[2, 5] though no consensus has been reached as to whether this is preferable to epidural replacement. Leaving an ITC in place for at least 24 hours to reduce PDPH/EBP rate has been suggested, but the data remains unclear.[6, 7] Lastly, in patients with Fontan physiology, the transpulmonary gradient must be assiduously maintained.[1, 8] While unplanned in this case, an ITC dosed incrementally was useful to avoid a dramatic reduction in preload. It was additionally advantageous for post-operative pain management, although strict safety precautions were followed (labels on door and on catheter, close communication with OB and nursing, only dosed by anesthesia, aseptic technique).

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Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 08

Anesthetic Management in a Parturient with Symptomatic Chiari-1 Malformation

Presenting Author: Mallory Hawksworth, MD

Presenting Author's Institution: Washington University, St Louis - St Louis, Missouri

Co-Authors: Abby Bisch, n/a - Washington University, St Louis
Swarup Varaday, n/a - Washington University, St Louis

Introduction: Arnold Chiari malformation presents a challenge for anesthesia providers as there remains to be a consensus on the optimal management of these patients. Presenting neurologic symptoms can range from asymptomatic to headaches, cranial nerve abnormalities and sensory and motor deficits. A careful review of patients' symptoms and imaging should occur prior to neuraxial, as these techniques can potentially lead to severe morbidity or mortality.

Case One: We present a case of a 36-year-old G7P2224 who presented at 34 weeks gestation for a cesarean section in the setting of symptomatic Chiari-1 malformation with a large syrinx. The patient reported a chronic history of headaches as well as progressive numbness, pain and weakness in her right neck, upper extremity and chest over the past several years. These symptoms significantly worsened during pregnancy, leading to an MRI which noted a Chiari 1 malformation with 1.8 cm of cerebellar tonsillar ectopia as well as a syrinx from C2 through at least T2. Neurosurgery recommended delivery as soon as safely feasible, with plan for surgical decompression in the immediate postpartum period. At 32 weeks and 2 days, the patient presented with worsening right lower extremity weakness and decreased sensation. MRI showed low lying cerebellar tonsils and a large syrinx extending from C2 to the conus medullaris. Multidisciplinary discussion resulted in the decision for cesarean delivery at 34 weeks. With consultation from neurosurgery, a plan was made for general anesthesia to avoid a dural puncture and to allow for close hemodynamic monitoring as well as control of ventilation, all with the goal of maintaining stable intracranial pressure. Prior to surgery, the patient was noted to have a mallampati II airway and asymptomatic neck flexion and extension. Her neurologic exam revealed right sided weakness and absence of sensation. After pre-oxygenation, placement of an arterial line and a BIS monitor, a gentle induction was performed with the goal of balancing hemodynamic stability and an anesthetic depth that would prevent stimulation with intubation. While maintaining cervical neutrality, a video laryngoscope was used for intubation and total intravenous anesthesia was started for maintenance. The patient was ventilated with a target end-tidal carbon dioxide of 30-35. After an uneventful surgery, the neuromuscular block was reversed and the patient was smoothly extubated. Her post-operative neurologic exams remained at baseline.

Discussion: This case highlights the importance of thoughtful planning for a medically challenging patient with a contraindication to the standard neuraxial technique for cesarean anesthesia. It also demonstrates the importance of multidisciplinary planning to provide excellent care in a complex case.

References: Ramsis F. Ghaly, Tatiana Tverdohleb, Kenneth D. Candido, Nebojsa Nick Knezevic. Management of parturients in active labor with Arnold Chiari malformation, tonsillar herniation, and syringomyelia. 19-Jan-2017;8:10

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 09

Arachnoiditis: A rare complication of an epidural blood patch

Presenting Author: Bradley Skene, D.O.

Presenting Author's Institution: Ochsner Clinic Foundation - New Orleans, Louisiana

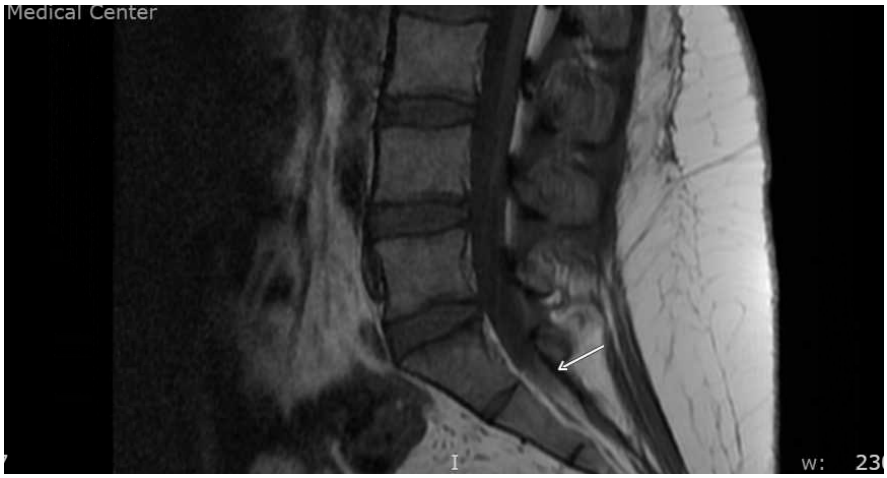
Co-Authors:

Introduction: Complications of the lumbar epidural blood patch (EBP) for post-dural puncture headache (PDPH) can include infection, bleeding, and repeat dural disruption; a rarely reported complication in the literature is the development of arachnoiditis.

Case One: A 28 year old G4P2 woman with a history of pre-eclampsia in previous pregnancy and iron deficiency anemia presented for induction of labor at 39 weeks and 2 days. She requested an epidural for analgesia, which was complicated by accidental dural puncture with Tuohy at L3-4. Epidural placement was successful at L4-5. Her labor course progressed without issue resulting in spontaneous vaginal delivery of a healthy baby girl. On post-partum day 1, the patient endorsed a positional headache, characteristic of PDPH unrelieved with conservative measures. The patient requested an EBP. The anesthesiologist reported having difficulty with obtaining epidural access, and confirmed their location with a 25G spinal needle dural puncture. 18mL of autologous blood was then injected at L3/4 interspace. The patient's headache resolved and she was discharged to home. On post-partum day 11, the patient presented to the obstetric emergency department with a complaint of radicular back pain that starts at the site of the epidural blood patch and radiates superiorly along the spine and also posteriorly down both legs. The pain was worsened with ambulation and unrelieved with acetaminophen or ibuprofen. The patient denied any other neurologic symptoms, including recurrence of headache, weakness, sensory deficits, or bowel and bladder dysfunction. Physical exam revealed no focal neurologic deficits. A lumbar MRI was obtained showing hyperintense material layering within the left dependent portion of the thecal sac at the S1-S2 level, as well as mild clumping and non-dependent positioning of the cauda equina nerve roots at the L5-S1 and S1-S2 levels. These findings suggest a possible intradural hematoma and sequela of arachnoiditis. The patient was discharged with gabapentin 100mg tid and is pending follow-up with neurology.

Discussion: This case report highlights a rare but potentially serious complication of EBP for treatment of PDPH. Most current case reports of arachnoiditis following EBP have involved large volume EBP or repeat EBP (1). In this case, a standard dose of autologous blood injection, less than 20mL, was used on an initial blood patch. Dural puncture with spinal needle may have increased this patient's risk for arachnoiditis and likely recommended to avoid in the future after this complication.

References: (1) Villani LA, Digre KB, Cortez MM, et al. Arachnoiditis, a complication of epidural blood patch for the treatment of low-pressure headache: A case report and systematic review. Headache. 2021;61:244–252. https://doi.org/10.1111/head.14076


Medical Center

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 10

Going with Flow: High-Flow Nasal Cannula in a Super Morbidly Obese Patient During Unscheduled Cesarean Delivery Under Neuraxial Anesthesia

Presenting Author: Shruthimurthy Hassankrishnamurthy, M.B.B.S

Presenting Author's Institution: UTSW - frisco, Texas

Co-Authors: Shalonda cook, MD - University of Texas Southwestern Medical Center

Introduction: Obesity and obstructive sleep apnea (OSA) increase perioperative risks in obstetric patients, including respiratory compromise and airway challenges. Supermorbid obesity further impairs respiratory mechanics. The high-flow nasal cannula (HFNC) delivers humidified oxygen (FiO_2 21–100%) at up to 60 L/min, providing positive end-expiratory pressure (PEEP). This enhances alveolar recruitment, expels carbon dioxide, reduces dead space, and improves oxygenation. Compared to conventional oxygen therapy (nasal cannula, venturi mask), HFNC optimizes respiratory function and reduces airway interventions. While studied in general populations and preoxygenation for elective cesarean delivery (CD) in normal-weight parturients, HFNC's role in super morbidly obese parturients undergoing unscheduled CD under neuraxial anesthesia is underexplored. This case describes HFNC use in a super morbidly obese patient (BMI 58 kg/m²) with OSA during CD under neuraxial anesthesia.

Case One: A 30-year-old G1P0 patient at 39 weeks gestation presented for induction of labor (IOL). Comorbidities included super morbid obesity (BMI 58 kg/m²), moderate persistent asthma, pre-pregnancy OSA with daily CPAP use, chronic hypertension, and anemia. A dural puncture epidural (DPE) was placed for labor analgesia. After a diagnosis of latent-phase arrest (< 6 cm dilation) with moderate-to-strong contractions for >12 hours, an unscheduled CD was performed under extended DPE. HFNC was initiated at 40 L/min with 50% FiO_2 in the operating room and a sniffing position to optimize respiratory mechanics and reduce hypoventilation risk. The patient maintained a stable respiratory rate, and 100% oxygen saturation, and reported no dyspnea during the procedure. HFNC was discontinued postoperatively without complications, and no respiratory events occurred during her hospital stay.

Discussion: This case highlights the benefits of HFNC in super morbidly obese parturients undergoing CD under neuraxial anesthesia. HFNC delivers positive airway pressure, reduces dead space, and improves oxygenation, which is especially valuable for patients with OSA and compromised respiratory mechanics. Additionally, HFNC minimizes the need for invasive airway interventions, improving perioperative safety. Previous studies on HFNC have focused on preoxygenation for elective CD under general anesthesia in non-obese patients. This case suggests its potential for managing high-risk super morbidly obese parturients during unscheduled CD under neuraxial anesthesia, warranting further research and broader clinical application.

References: 1. Bateman NT et al. BMJ. 1998;317:798–801. 2. Park SY et al. J Korean Med Assoc. 2022;65:131–43.

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 11

Complexities in Cesarean Section in patient with Super Morbid Obesity

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Presenting Author's Institution: Case Western Reserve University Masters of Science in Anesthesia, DC Location - Washington, District of Columbia

Co-Authors:

Introduction: Limited guidance exists regarding care for parturients with BMI >80#1,2. We describe a patient with BMI of 94 who underwent Cesarean section (C/S) with a combined spinal-epidural (CSE) technique. We had challenges with positioning, obtaining X-ray, hemorrhage, and post-operative mobilization.

Case One: A 41 year-old G1P0 at 37w3d with BMI of 94, 264 kg, gestational HTN, and fibroids presented for C/S due to unfeasible FHR monitoring due to body habitus. Preoperative multidisciplinary planning and anesthesia consult occurred. The patient had longstanding dyspnea with walking and was able to lie flat. Airway exam was reassuring. Neuraxial anesthesia#1,2 has been performed successfully for C/S in patients with super-morbid obesity and we planned for CSE with epidural volume extension (EVE) to minimize post-spinal hypotension. In holding, two 20g IVs and a radial arterial catheter were placed. An operating room (OR) bed with sufficient weight limit, bed-extenders and air transfer mattress were ready. Eight staff#1 moved the patient to a sitting position over 30 minutes. The patient received neuraxial ultrasound and uncomplicated CSE placement with loss of resistance at 8cm. Intrathecal injection of hyperbaric bupivacaine 9mg, morphine 100mcg, fentanyl 15mcg and epinephrine 100mcg was followed by EVE with 10 mL normal saline for a T4 level. The patient was semi-upright for infant delivery through a Pfannenstiel incision. There was no uterine atony or uncontrolled blood loss. The patient was hemodynamically stable with hemoglobin decrease from 12.2 g/dL to 11.7 g/dL and 2L of IV fluid were given. The QBL was 3.2 L; no transfusion was deemed necessary. Attempts to obtain an in OR x-ray per protocol for C/S in a patient with a BMI ≥ 50 with QBL >1.5L failed since the portable x-ray machine and hospital x-ray room were incompatible with the patient's body habitus. Surgical time was 3.5 hours and delay for x-ray was 2.5 hours. The patient had difficulty mobilizing from the bed and was discharged after day 8 and recommended to have subacute rehabilitation.

Discussion: Safe anesthetic care for C/S in a parturient with a BMI of 94 included preoperative planning for additional staffing, long surgical time, and hemorrhage. We experienced lengthy patient positioning, inability to obtain X-ray, OR time of 6 hours, and slow post-operative mobilization. Consideration of these complexities should accompany future case planning.

References: #1: Reno JL, Cook MI, Kushelev M, Hayes BH, Coffman J. Cesarean Delivery in a Patient With Body Mass Index Over 100: Continuous Spinal Anesthesia in Two Consecutive Deliveries. Cureus. 2021 Jun 14;13(6):e15643. #2: Polin CM, Hale B, Mauritz AA, Habib AS, Jones CA, Strouch ZY, Dominguez JE. Anesthetic management of super-morbidly obese parturients for cesarean delivery with a double neuraxial catheter technique: a case series. Int J Obstet Anesth. 2015 Aug;24(3):276-80.

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 12

Beyond the Scale: Anesthetic Considerations for Super-Super Obese Obstetric Patients

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Co-Authors: Bridget M. Marroquin, MD, MSHPEd - University of North Carolina Chapel Hill
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Introduction: Super-super obesity (BMI >60) in pregnancy leads to increased peripartum complications and challenges for anesthesiologists. Airway management, neuraxial anesthesia (NA), vascular access, monitoring and positioning are often difficult. We present two cases of super-super obese parturients undergoing Cesarean delivery (CD) to highlight perioperative strategies and complications.

Case One: Case 1: A 29-year-old G3P2002 at 31w4d with twin pregnancy complicated by obesity (BMI 99), fetal growth restriction, maternal preeclampsia, asthma, gestational diabetes and obstructive sleep apnea (OSA) presented for CD due to persistent neurologic symptoms in the setting of preeclampsia. Two long catheter large bore IVs and an arterial line were placed with ultrasound. An intrathecal catheter was placed for surgical anesthesia. Divided doses of 0.5% bupivacaine were given, up to 2mg, unfortunately with inadequate anesthesia. The decision was made to proceed with general anesthesia (GA). Intubation attempt with glidescope failed. Oxygen saturation dropped to < 50% and a LMA was placed. With successful return of ventilation, the obstetrics team proceeded with CD. After delivery, the surgical procedure was paused and intubation was achieved fiberoptically through the LMA. The remainder of the surgery proceeded uneventfully, and the patient was extubated at the end of procedure.

Case Two: Case 2: A 33-year-old G4P3003 at 36w3d with obesity (BMI 88), chronic hypertension, and OSA presented for repeat CD. Surgical plan included midline supraumbilical skin incision. Cardiac POCUS was performed preop and US-guided large-bore IVs and arterial line were placed. An epidural catheter was placed in the OR and the patient required 30mL of 2% lidocaine to achieve adequate surgical block. Patient was ramped to optimize respiratory mechanics. The CD was uncomplicated, with minimal blood loss and a stable postoperative course.

Discussion: Super-super obesity in obstetric patients presents significant challenges. US guidance for IV insertion with the use of long catheters ensures lasting, effective vascular access in patients prone to IV infiltration. Arterial line provides more accurate hemodynamic monitoring than automatic cuff. High risk of PPH should prompt proactive blood preparation and PPH protocol review. NA is preferred over GA due to risk of difficult airway management. Migration of a single bolus intrathecal dose can be unpredictable, while epidural and intrathecal catheters facilitate anesthetic titration and extended blockade. Meticulous patient positioning is vital for any necessary airway management. Preparation for non-invasive ventilation may be necessary in patients with severe OSA. Understanding the surgical approach can also change anesthetic and postop pain management. Tailored strategies are crucial for improving outcomes in super-super obese patients.

References: Taylor et al. (2019), Local & Regional Anesth, 12, 111–124

Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 13

Spinal anaesthesia for cesarean section in obese parturient with surgically corrected scoliosis- The challenges and options

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shanti M. Rajendra Kapoor, MD - HAMAD MEDICAL CORPORATION

Introduction: Neuraxial anaesthesia (NA) after surgical correction of scoliosis is challenging due to technical difficulties and decreased efficacy as there is an alteration in the epidural space. But NA should be considered in obese parturients owing to the complications associated with general anaesthesia (GA).

Case One: 24-year-old G2P0 (BMI 40, height 161cm, weight 102 kg) was evaluated in the clinic for elective cesarean section. She had idiopathic thoracolumbar scoliosis, which was surgically corrected by rods/screws from T1 to L4. Consent was taken for Spinal Anaesthesia (SA) after explaining its high failure rate in surgically corrected scoliosis and the possibility of conversion to GA due to patchy block. In the sitting position, SA was performed in the L5-S1 space under ultrasound guidance. 2.6 ml of 0.5% hyperbaric Bupivacaine with 10 mcg Fentanyl administered intrathecally. Upon assessing the block height to cold sensation using Ethyl chloride spray at 3 minutes, the sensory level was found to be T8. Under Trendelenburg position, the level ascended to T6, but the motor block was inadequate. So, GA was given after rapid sequence induction and intubation using video laryngoscopy. Intra and postoperative periods were uneventful.

Discussion: NA is generally avoided in patients with scoliosis correction because of difficulty positioning and entering the space due to spinal fusion. The posterior spinal instrumentation includes fusing the posterior spine with bone grafts. The cutaneous scar extending below the level of fusion also adds to the difficulty. However, recent surgical techniques spare the lower lumbar segments and implants are placed laterally outside the spinal canal. For epidural anaesthesia, perception of loss of resistance is lost due to the surgical disruption of ligamentum flavum. Adhesions and scarring in the epidural space may affect local anaesthetic spread and efficacy. Catheter misplacement and unintentional subdural catheter placement or dural puncture may occur. But SA has been successfully given for C sections in parturients with prior spinal instrumentation. Continuous spinal anaesthesia using intrathecal catheters will avoid the complication of patchy block, but the possibility of accidental overdose, infection and post-dural puncture headache should be born in mind1. Combined spinal epidural (CSE) anaesthesia is a better option as we can top up the epidural, if adequate block is not achieved with intrathecal dose, as in our case. Conclusion As patchy blocks are encountered after scoliosis correction, CSE or continuous spinal anaesthesia can be a better option. Ultrasound facilitates the identification of spaces. Explanation to the patient regarding the need for conversion to GA is mandatory.

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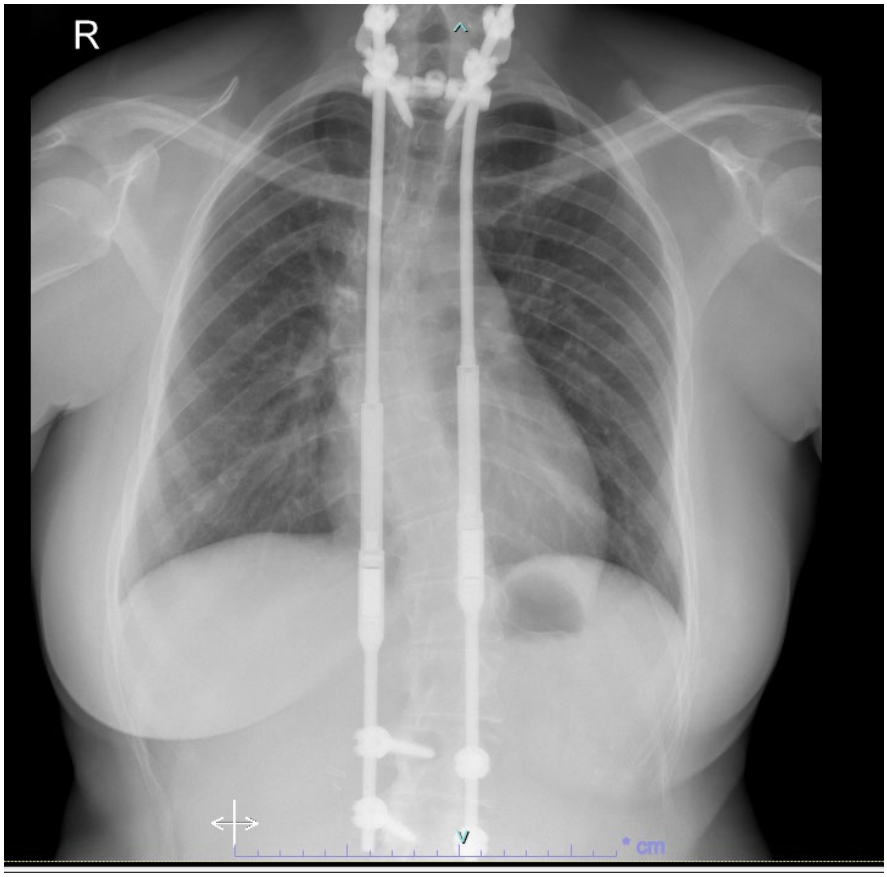
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Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 14

Anesthetic Considerations for Parturient with BMI >100 kg/m^2

Presenting Author: Maria Muravyeva, MD, PHD

Presenting Author's Institution: Medical college of wisconsin - Milwakee, Wisconsin

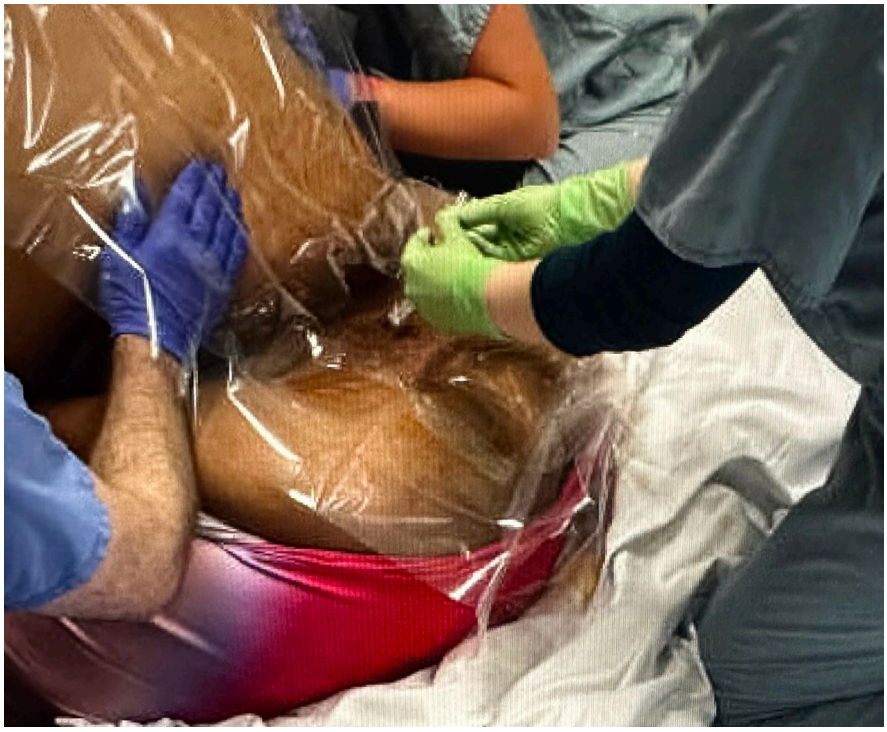
Co-Authors:

Introduction: We report our experience in the management of labor and eventual Cesarean delivery (CD) in a parturient with a BMI of 107 kg/m2. The case required extraordinary preparation to make sure adequate equipment was present for the patient (bariatric bed, bariatric stirrups, high weight OR table) and staff (hydraulic lift and HoverMatt). The OB, Anesthesiology, RN, and surgical technician team had extensive discussions about the best locations for induction, labor, delivery, and possible CD.

Case One: A 28-year-old woman G1P0 at 37 weeks with BMI of 107 kg/m2 (240 kg, 150cm) presented for induction of labor. In preparation for the patients' admission, a bariatric bed was placed in the labor room. Due to the need for stirrups during delivery for access, it was planned to transfer the patient to the OR for stage II of labor. A preprocedural neuraxial ultrasound using an Accuro device allowed accurate identification insertion point. A dural puncture epidural (DPE) was placed at the L3-4 lumbar level (with a 25 G spinal needle for the dural puncture). (Figure 1 – note 2 additional people were required for tissue mobilization and patient positioning. Also the anesthesiologist placed DPE while kneeling on the bed due to the width of the bariatric bed.) A programmed intermittent epidural bolus (PIEB) regimen was used during labor with a mix of 0.1% bupivacaine with 2mcg/ml fentanyl (8ml of bolus every 60 min with a demand bolus of 6 ml available every 20 min). DPE provided adequate labor analgesia for 40 hours. Eventually the patient required an emergent CD. Conversion of labor epidural analgesia to surgical anesthesia was achieved using 20 ml of 2% lidocaine. Postpartum course complicated by surgical site infection.

Discussion: There are very limited case reports describing obstetric and anesthetic management for parturient with BMI > 100 kg/m2. Our case is unique in that we initially planned a vaginal delivery which unfortunately progressed to a CD. To our knowledge, this is the first case report describing a DPE with a PIEB regimen used for a parturient with a BMI >100 kg/m2. This case highlights the usefulness of a preprocedural neuraxial ultrasound. This case also demonstrates the importance of extensive case coordination and planning in our more complex patients.

References: 1-Nivatpumin P, Lertbunnaphong T, Maneewan S et al. Comparison of perioperative outcomes and anesthetic-related complications of morbidly obese and super-obese parturients delivering by cesarean section. Ann Med. 2023 Dec;55(1):1037-1046. 2-Mossie A , Ali S.A. , Tesema H.G. Anesthetic implications of morbid obesity during pregnancy; a literature based review. International Journal of Surgery Open.2022; volume 40, ISSN 2405-8572



Abstract #: THURS - CR - BS 1 - BR 4 - Postdural Puncture Headache & Obesity – 15

A Tale of Two General Anesthetics for Cesarean Section in Super Morbidly Obese Patient with BMI 104 kg/m2

Presenting Author: Paris Thompson

Presenting Author's Institution: Medical University of South Carolina - Charleston, South Carolina

Co-Authors: Latha Hebbar, MD - Medical University of South Carolina

Introduction: Obesity is associated with higher rates of maternal mortality and morbidity including difficult intubation, postpartum hemorrhage (PPH), VTE, and infection. Neuraxial anesthesia is the preferred anesthetic for cesarean delivery (CD), though body habitus may lead to technical challenges. We present two general anesthesia (GA) CD for the same patient with different outcomes.

Case One: 1st CD: 28-year-old G1P0 at 37w5d with Class III Obesity (BMI 102), PMH of chronic HTN, gestational DM, and recurrent back soft tissue abscesses presented after a fall in AFib with RVR. On HD#2 classical CD was indicated for SIPE with severe features. After unsuccessful neuraxial attempts, GA was initiated with RSI and intubation with video laryngoscopy. Initial maintenance included sevoflurane and N2O, followed by N2O discontinuation and increased sevo concentration due to persistent desaturation. The case was complicated by 3.3L EBL, hemodynamic instability requiring arterial and central line placement with high dose norepinephrine infusion and transfusion of 3 PRBCs and 1 cryo, postoperative ventilation with ICU admission. She was discharged from ICU POD#1 and from the hospital POD#3.

Case Two: 2nd CD: 29-year-old G2P1 (BMI 104) presented for a scheduled repeat CD at 37w2d. Due to PMH of PPH and ICU admission, plan included arterial line, large bore IV access, and double neuraxial catheter technique (lumbar CSE & thoracic epidural) due to supraumbilical surgical approach; however, the patient had a large lumbar soft tissue abscess. Due to excessive subcutaneous tissue and inability to confirm absence of additional abscesses, the plan transitioned to GA. After RSI and intubation with video laryngoscopy, TIVA was initiated with a propofol infusion and adjuncts of ketamine, hydromorphone, and midazolam. Propofol infusion rate was set to adjusted body weight. Surgery and emergence were uneventful. EBL was 2L. Patient was extubated to nasal positive pressure (SuperNO2VA,Vyaire Medical) and transitioned to CPAP in PACU. On POD#1, CXR demonstrated pulmonary edema in setting of SIPE; patient was initiated on furosemide and discharged on POD#4.

Discussion: In patients with significant obesity, neuraxial anesthesia is the preferred method for CD due to increased risks including difficult airway, postop ventilation, and PPH. With a double catheter technique, the lumbar CSE would provide a denser surgical block in the thoracic region for a supraumbilical incision and postop pain control with the thoracic epidural. When GA is necessary, TIVA may facilitate optimal recovery by avoiding nitrous oxide and sevoflurane, decreasing the risks of desaturation, PPH, postop ventilation, and unplanned ICU admission. In setting of significant obesity, dosing of propofol infusion could be set to adjusted body weight due to concerns for underdosing with ideal body weight and for prolonged emergence using actual body weight.

References: 1. Hosp Pharm 2019:55(6):400–404 2. Int J Obstet Anesth 2015.04.001.

Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 01

Cesarean Delivery in a Parturient with Multiple Complex Congenital Cardiac Lesions

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Co-Authors: Andrew Hackney, MD - UAB Heersink School of Medicine

Introduction: Congenital cardiac lesions can be rare, complex, and vary in surgical management. Shone's Complex is characterized by a supravalvular mitral ring, parachute mitral valve, subaortic stenosis, and aortic coarctation.1 We present a case of a cesarean delivery in a patient with surgically repaired Shone's Complex and unbalanced partial atrioventricular septal defect (AVSD).

Case One: A 21-year-old G1P0 female with Shone's Complex (subaortic stenosis, aortic coarctation, and parachute mitral valve) and an unbalanced partial AVSD, status post surgical repair and Ross-Konno procedure with subsequent RV-PA conduit replacement, presented with worsening dyspnea at 33 weeks' twin gestation. Her RV-PA conduit was severely stenotic (RVSP 85mmHg, systolic PAP 22mmHg on right heart catheterization). Transthoracic echocardiography showed peak velocity of 4.1 m/s across the conduit, mild RV enlargement, mildly reduced RV function, and moderate mitral stenosis (mean inflow gradient 5.6mmHg) with normal left ventricular ejection fraction. The pregnancy heart team considered the utility of conduit balloon dilation but decided that dilation was not indicated. She was admitted for worsening dyspnea, fetal growth restriction in both fetuses, and evaluation for pregnancy-induced hypertension with plans for cesarean delivery at 34 weeks' gestation. Her antepartum course was complicated by hypervolemia requiring diuresis. Cesarean delivery was performed at 34 weeks' gestation. An arterial line was placed, followed by a dural puncture epidural (DPE) slowly dosed with epidural 2% lidocaine and fentanyl. Intraoperatively, she experienced hemorrhage due to uterine atony. An oxytocin infusion and intramuscular carboprost were administered with improved tone. She remained hemodynamically stable throughout. Epidural morphine was administered at closing. Postoperatively, she received two units of packed red blood cells for acute blood loss anemia and recovered on the labor and delivery unit until postoperative day (POD) 2. She experienced improvement in dyspnea and was discharged on POD4. She is pending cardiology follow-up four months postpartum for further evaluation of her RV-PA conduit stenosis.

Discussion: This case involved multiple congenital heart lesions including Shone's Complex and an unbalanced partial AVSD. The correction of Shone's Complex resulted in an RV-PA conduit, which became severely stenosed. Preoperatively, she was optimized via multidisciplinary planning with our pregnancy heart team. In this case, slowly dosed DPE and judicious crystalloid use allowed us to avoid decreases in systemic vascular resistance and hypervolemia, respectively, while preventing spikes in pulmonary vascular resistance and ensuring adequate anesthesia.

References: 1. Landsem L, Brown N, Cox R, Ross F. Perioperative and anesthetic considerations in Shone's Complex. Seminars in Cardiothoracic and Vascular Anesthesia. 2024;28(1):28-37.

Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 02

Management of pregnancy termination for a patient with Eisenmenger syndrome and Chiari I malformation with associated syringomyelia

Presenting Author: Jacob M. Nieb, MD

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Co-Authors: Jennifer M. Banayan, MD - Northwestern University Feinberg School of Medicine
Nicole H. Higgins, MD - Northwestern University Feinberg School of Medicine
Kaitlyn E. Neumann, MD - Northwestern University - Feinberg School of Medicine

Introduction: Eisenmenger syndrome due to uncorrected congenital heart disease can have a mortality rate of 23-50% (1). We present a woman with newly diagnosed Eisenmenger syndrome and Chiari I malformation undergoing first trimester surgical abortion.

Case One: A 32-year G2P0010 presented with dyspnea and upper extremity numbness concerning for an acute stroke. Her oxygen saturation was 93%. Neurovascular imaging was negative for stroke but revealed cerebellar tonsil herniation consistent with Chiari I and a patent ductus arteriosus. Echocardiography demonstrated a ventricular septal defect with preserved biventricular function. Right heart catheterization showed severe pulmonary hypertension (116/53 mmHg) and Eisenmenger physiology. The patient was found to be pregnant at 6w5d during this evaluation and requested termination. Family planning elected to proceed with scheduled dilation and curettage (D&C) with anesthesia support due to risk of hemorrhage with medication abortion. The obstetric anesthesia service initiated and coordinated care with pulmonary hypertension for medical optimization, congenital cardiology, cardiac anesthesiology, and cardiac surgery. The patient desired to remain awake, and neuraxial anesthesia was initially considered until imaging revealed C5-7 syringomyelia. Alternatively, minimal sedation with a paracervical block was planned given the contraindications to neuraxial anesthesia and cardiopulmonary risks associated with deep sedation/general anesthesia. She was initiated on sildenafil and then presented at 8w5d for scheduled D&C under obstetric anesthesiology support with cardiac surgery, inhaled nitric oxide, and extracorporeal membrane oxygenation on standby in the event of clinical deterioration. Midazolam and fentanyl were administered prior to paracervical block. Ketorolac, additional fentanyl, music therapy, and positive communication were utilized during cervical dilation and suction curettage. The procedure was otherwise uncomplicated and tolerated well by the patient.

Discussion: The combination of syringomyelia and Eisenmenger syndrome posed multiple anesthetic challenges. Pregnancy is described as contraindicated for patients with severe pulmonary hypertension even in the absence of Eisenmenger syndrome (2). This patient's complexity emphasizes obstetric anesthesiology's role to direct care and advocate for patient safety. Furthermore, this case highlights the need for access to pregnancy termination services. Even in a state where access is relatively unimpeded, care coordination required two weeks and more than 20 specialists.

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Figure 1_TTE_Eisenmenger Chiari I D&C_TTE.pdf

Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 03

Management of a Parturient with Unrepaired Tetralogy of Fallot

Presenting Author: Alexander Meshel, MD

Presenting Author's Institution: Icahn School of Medicine at Mount Sinai - New York, New York

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Introduction: Unrepaired Tetralogy of Fallot (ToF) is a rare congenital cardiac anomaly. The strain of pregnancy can lead to significant morbidity and mortality. Patients with unrepaired TOF are considered high risk and pregnancy is generally not recommended.

Case One: Patient is a 26 y.o. G2P1 who presented at 20 weeks with a history of unrepaired ToF. At the time of her presentation, she reported excess fatigue and dyspnea on exertion, similar to baseline. Cardiology was consulted, and a transthoracic echocardiogram was completed showing normal biventricular size and function, unrepaired ToF with secundum ASD with left to right shunt, large anterior malalignment VSD (predominantly left to right shunting), moderate-severe PV stenosis, and dynamic LV outflow tract obstruction. Because the primary pressure gradient in this patient is left to right, she rarely had cyanotic episodes. After interdisciplinary meeting with cardiology, MFM, and anesthesiology the decision was to delivery by cesarean delivery (CD) at 37 weeks. This decision was due to her history of prior CD and concern for poor tolerance of Valsava in addition to a possibly prolonged labor. Upon presentation to the OR, in addition to ASA monitors, a radial arterial line was placed. The anesthesiology team placed an epidural at L4/L5. Following a test dose with 3 mL lidocaine 2%, an additional 5 mL was given 5 minutes later, and a phenylephrine infusion was started at 0.2mcg/kg/min. Within 1 minute of injection, the parturient became hypotensive (MAP 50 nadir) and simultaneously became hypoxic (SpO2 77%). The patient was given 200mcg of phenylephrine and the infusion was increased to 1.0 mcg/kg/min. Within 2 minutes, the patient's MAP normalized and SpO2 improved to 99%. The epidural was slowly loaded with an additional 11mL of lidocaine 2%, and the case proceeded uneventfully. Following the case, she was admitted to the ICU and discharged to home on post-operative day 3.

Discussion: Patients with unrepaired ToF are tenuous. Rapid changes in SVR can temporarily reverse right-to-left shunt leading to hypoxia. The administration of phenylephrine restored the pressure differential by increasing SVR and slowing the heart rate, allowing for greater filling time and improved left ventricular preload, which restored the dominant left-to-right shunt. This case highlights the importance of interdisciplinary collaboration in managing high-risk pregnancies. Parturients with unrepaired disease represent a high-risk group. With careful planning, early consultation with specialists, and prompt intervention in response to hemodynamic changes, it is possible to safely navigate labor and delivery.

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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 04

OBSTETRIC MANAGEMENT OF CARDIAC DISEASE IN ALAGILLE SYNDROME

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Presenting Author's Institution: Ohio State University Wexner Medical Center - Columbus, Ohio

Co-Authors: Renuka Shenoy, MD - Ohio State University Wexner Medical Center
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Introduction: Alagille syndrome (ALGS) is an autosomal dominant disease affecting the hepatic, cardiac, renal, vascular, and skeletal systems, occurring in 1 in 30,000 births. Cardiac disease causes mortality in 15% of ALGS-related deaths. Right-sided cardiac lesions, particularly pulmonary artery stenosis (PAS), are the most common, though tetralogy of Fallot, supravalvular aortic stenosis, and other left-sided lesions are possible. We present a case highlighting the peripartum management of a patient with ALGS.

Case One: A 24-year-old G1P0 with ALGS-related bilateral PAS, chronic hypertension, and biliary diversion presented at 33 weeks with preeclampsia with severe features. Prior to pregnancy, evaluation for pulmonary angioplasty was underway, though this endeavor was paused until after delivery. Echocardiography demonstrated severe left PAS (peak gradient 91 mmHg) and moderate right PAS (peak gradient 43 mmHg) with normal systolic function. Cardiology recommended arterial line and central line placement during the peripartum period to facilitate close monitoring of fluid status and prompt intervention should decompensation occur. Assisted second stage delivery after early epidural placement was planned to prevent large hemodynamic shifts. Magnesium infusion for seizure prophylaxis given severe range blood pressures and betamethasone to promote fetal lung maturity were also recommended. Due to prolonged fetal decelerations and hypotension after epidural placement, an emergent cesarean delivery at 34 weeks was performed under neuraxial anesthesia. Her 48-hour postpartum echo demonstrated stable PAS with left PA peak gradient of 100 mmHg and RPA peak gradient of 48 mmHg. The patient remained asymptomatic and was discharged without complication.

Discussion: Our case reinforces that proper history, physical examination, intravenous access, and hemodynamic monitoring are crucial in management of the uncommon ALGS parturient. Consultation with cardiology, maternal fetal medicine, and anesthesiology prior to induction of labor is paramount. The severity of pulmonary stenosis, presence of cirrhosis and impaired clotting factors, portal hypertension, renal failure, and risk of maternal cholestasis can contribute to maternal and fetal morbidity and mortality, such as preterm delivery or stillbirth. Fetal growth restriction may occur secondary to bile acid toxicity, maternal vascular disease, and aberrant placental growth factors. Timing and mode of planned delivery, as well as usage of neuraxial anesthesia, are important considerations in these patients. Given variable disease penetrance and presentation, individualized evaluation and management should be considered. Care should occur at a facility equipped to manage complications including emergent delivery and cardiac intervention.

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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 05

Primary cesarean section versus induction of labor? The challenges of a complex cardiac case

Presenting Author: Heidi Heyman, MD

Presenting Author's Institution: University of North Carolina - Chapel Hill, North Carolina

Co-Authors: Jennifer N. Tripi, MD - UNC Hospitals at Chapel Hill

Introduction: Heart disease remains a leading cause of maternal mortality in the US (1). Given the peripartum physiologic changes, concomitant heart failure presents a significant threat to both mother and fetus (2). Multidisciplinary care planning is critical to optimize patient outcomes. The urgency and complexity of this case deemed a primary cesarean section (c/s) the safest delivery plan.

Case One: A 39yo G1P0 at 35w6d with asthma, insulin-dependent diabetes, obesity (BMI 53) presented to the ED with new onset dyspnea, 20 lb weight gain, and SIPE with severe blood pressures. Echo revealed LVEF of 20-25% with a severely dilated LV. CARPREGII score was 8, indicative of a >41% risk of a cardiac event. Admission to cardiac ICU (CICU) facilitated medical optimization prior to delivery, including blood pressure management and diuresis, and time for multidisciplinary planning between cardiology, cardiac surgery, obstetrics, and obstetric and cardiothoracic anesthesia. Worsening preeclampsia, anticipated difficult airway making emergent GETA risky, and logistical staffing challenges warranted an urgent c/s as the safest delivery option. An arterial line, central line, and 2 large bore IVs were obtained. In the operating room, an epidural was placed and slowly titrated for surgical anesthesia to minimize hemodynamic compromise. Femoral venous and arterial catheters were placed to allow expedited VA ECMO cannulation if necessary, followed by c/s. Serial TTE exams and CVP were utilized perioperatively. An epinephrine infusion was initiated upon delivery due to postpartum hemorrhage (QBL 1350 mL) from uterine atony requiring increased oxytocin and cytotec administration. She recovered postpartum in the CICU and was discharged one week later.

Discussion: Given the high mortality associated with peripartum heart failure, complex care planning is critical to optimizing patient outcomes. There is ongoing debate regarding the safest mode of delivery in cases such as this. Our institution continues to face logistical challenges to facilitate an induction of labor for such a complex patient, particularly ensuring all care team members are readily available should decompensation occur and having close proximity to an operating room. Super obesity presents additional challenges such as anticipated difficult airway, line placement, ECMO cannulation, and surgical exposure, which may delay life-saving measures for both mother and fetus, and also favors a planned c/s.

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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 06

Case Report: Anesthetic Care of a Patient with Partially Repaired, Anomalous, Cyanotic Congenital Heart Disease Undergoing Dilation and Curettage

Presenting Author: Jonathan Petrillo, MD

Presenting Author's Institution: University of New Mexico Hospital - Albuquerque, New Mexico

Co-Authors: Noah Lucero, Medical Student - University of New Mexico Hospital

Introduction: Surgical advancements in congenital cyanotic heart disease have significantly improved life expectancy, and many affected patients now live well into adulthood.1,2 As parturients and when undergoing non-cardiac gynecological procedures, these patients present unique challenges for the anesthesiologist.

Case One: We present a case of a 31-year-old woman with a history of cyanotic congenital heart disease, partially repaired with a Bidirectional Glenn Shunt in the early 2000's. The patient initially presented requesting evaluation to improve exercise tolerance, but became pregnant during the workup process. After counseling, the patient opted to undergo voluntary termination of pregnancy and presented to the OR for dilation and curettage. In the absence of surgical records, multi-disciplinary preoperative evaluation was undertaken. Cardiac catheterization demonstrated an anterior systemic ventricle with unobstructed flow to the aorta, a small posterior ventricle with poor flow to the pulmonary artery, and a large VSD. Additionally, the SVC had been anastomosed to the pulmonary arteries with pulsatile flow seen in the innominate vein, suggesting forward flow from the posterior ventricle. The presence of a left to right shunt via an ASD appeared to provide oxygenated blood to the anterior ventricle. There did not appear to be a direct connection or valve between the left atrium and the posterior ventricle. Given these findings, anesthetic management was centered on maintaining stability in the patient's pulmonary vascular resistance to preserve shunt dynamics and avoid pulmonary over-circulation in the presence of a patent posterior ventricle-pulmonary artery connection. A MAC anesthetic was selected to meet these goals, and an arterial line was placed. EtCO2 measurement was utilized but no supplemental oxygen was delivered. The patient tolerated the anesthetic and surgery without complication.

Discussion: This case demonstrates the possibility of encountering complex congenital heart disease in the obstetric population while highlighting the importance of multidisciplinary preoperative assessment and planning. In this specific case, utilization of supplemental oxygen, as is standard in the care of single ventricle patients, may have resulted in a rapid decline of systemic pressures from pulmonary over-circulation. In such a situation, no emergency algorithm would have suggested to discontinue supplemental oxygen. It is essential to understand the exact cardiac anatomy and state of surgical repair in such patients to create an appropriate anesthetic plan.

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Case Report Image, no PHI.pdf

Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 07

Management of Hypertrophic Obstructive Cardiomyopathy During Cesarean Section

Presenting Author: Rachel Pedreira, MD, MS

Presenting Author's Institution: Stanford Department of Anesthesia, Perioperative, and Pain Medicine - Palo Alto, California

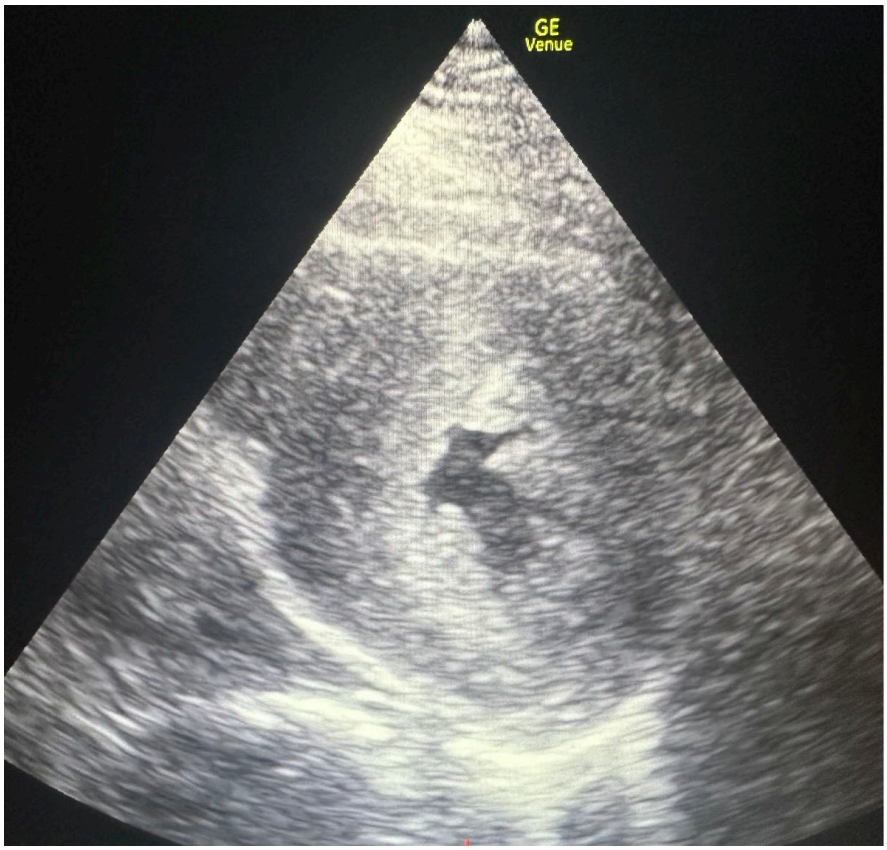
Co-Authors: Jordan Abrams, MD - Stanford Medicine Division of Obstetric Anesthesiology

Introduction: Hypertrophic obstructive cardiomyopathy (HOCM) is the most common genetic cardiac condition in the United States, with a prevalence of 1:200-1:500, however, data is minimal regarding intrapartum management (1,2). Physiologic changes of pregnancy and disease heterogeneity make peripartum management challenging. Key considerations revolve around ensuring adequate preload, stroke volume, and cardiac output to support uteroplacental perfusion and hemodynamic stability (3).

Case One: We present a case of a 36-year-old G2P1 patient with a 5-year history of HOCM (WHO class 2-3), paroxysmal ventricular tachycardia, and chronic arterial hypertension who was admitted to the antepartum unit for expectant management of superimposed pre-eclampsia with severe features at 35w4d. Her pregnancy was also complicated by a history of cervical insufficiency treated with a rescue cerclage. Maternal cardiac MRI demonstrated significant left ventricular hypertrophy with 2.5cm septal thickening. Second trimester echocardiography had estimated left ventricular ejection fraction at 65-70%. Continuous wearable cardiac monitor (ZioPatch) placement earlier in pregnancy demonstrated an episode of non-sustained ventricular tachycardia. She had been recommended for implantable cardiac defibrillator placement but declined. Given her cardiac history, evolving pre-eclampsia refractory to IV anti-hypertensives, and a prior cesarean delivery the obstetric team recommended urgent repeat cesarean section at 35w5d. Focused cardiac ultrasound (FCU) was performed during pre-operative anesthesia evaluation to assess for interval changes in cardiac function. Left ventricular end diastolic volume was markedly reduced (FIgure 1) and the decision was made to place a pre-induction arterial line for blood pressure monitoring and to perform a combined spinal epidural with an opioid only spinal dose. Additionally, defibrillator pads were placed and a magnesium sulfate infusion was continued. The epidural catheter was slowly dosed using 3-5ml boluses of 2% lidocaine while a phenylephrine infusion was simultaneously titrated to maintain normal mean arterial pressures. After delivery of a viable fetus, the patient had a 2 liter postpartum hemorrhage due to uterine atony and cervical bleeding after cerclage removal. She received 2 units of packed red blood cells and multiple uterotonic medications. FCU was performed intermittently throughout the case to ensure hemodynamic stability and adequate resuscitation. The patient was transferred to a telemetry unit in stable condition.

Discussion: Patients with HOCM require careful peripartum management, especially in the setting of superimposed pre-ecclampsia. Use of opioid-only spinal dosing and slow loading of epidural local anesthetic provides hemodynamically stable neuraxial anesthesia for cesarean delivery. Additionally, this case demonstrates the utility of FCU for bedside hemodynamic assessment in parturients undergoing urgent surgery.

References: 1. 35427704 2. 35086660 3. 33222809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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 08

Obstetrics patient with left ventricular noncompaction cardiomyopathy undergoes elective cesarean section under general anesthesia

Presenting Author: Feras Alhourani, MD

Presenting Author's Institution: Maimonides Medical Center - Brooklyn, New York

Co-Authors: Shaheer Alam, MD - Maimonides Medical Center
Tommy Nguyen, MD - Maimonides Medical Center

Introduction: Pregnancy poses unique challenges for patients with left ventricular noncompaction cardiomyopathy (LVNC), a rare genetic disorder affecting myocardial function. This case highlights the multidisciplinary management of a 20-year-old pregnant patient with LVNC, emphasizing cardiac monitoring, tailored treatment, and successful delivery.

Case One: 20y G2P1 Female w/ PMH of PTSD, borderline personality, anxiety & depression, not on any medication due to pregnancy diagnosed with LV noncompaction cardiomyopathy at 17 weeks gestation after 20 month old daughter was diagnosed with the same condition. Patient also has family history of cardiomyopathy. Initial TTE findings showed an EF 41-45%, global cardiomyopathy, LV hyper-trabeculations ratio of 5:1 & Ebstein's anomaly. As pregnancy progressed EF continued to decrease to 35% and developed dyspnea, which was not relieved with furosemid. Holter monitor showed sinus tachycardia and started on Carvedilol 3.124mg. Patient remained euvolemic without signs of CHF during pregnancy and was followed closely by cardiology and MFM until delivery. Patient underwent cesarean section at 37 weeks under general anesthesia and TIVA with arterial line requiring low dose norepinephrine and epinephrine. Intraop TEE showed improved EF to 41-45% after delivery of baby. Post-partum period was unremarkable.

Discussion: Left ventricular noncompaction cardiomyopathy (LVNC) is a rare genetic disorder where the left ventricle develops abnormally, resulting in a thick, sponge-like myocardium due to incomplete compaction of myocardial fibers. LVNC is defined by a trabecular recess-to-myocardial layer ratio greater than 2.3, with our patient’s echocardiogram showing a 5:1 ratio. This condition is often asymptomatic and diagnosed later in life, but pregnancy-related hemodynamic changes can worsen symptoms. Our patient developed dyspnea around 24 weeks gestation due to increased blood volume and preload, which resolved post-delivery. A study on pregnant women with LVNC found that 25% developed increased trabeculations but remained asymptomatic with stable ejection fractions. This case highlights how LVNC can progress during pregnancy but still result in a safe delivery without heart failure or arrhythmias, emphasizing the importance of multidisciplinary management.

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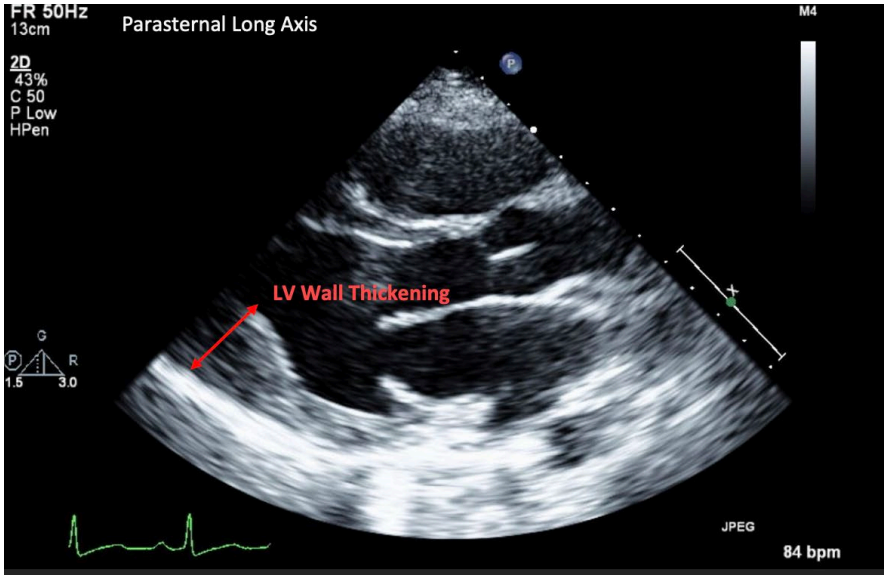
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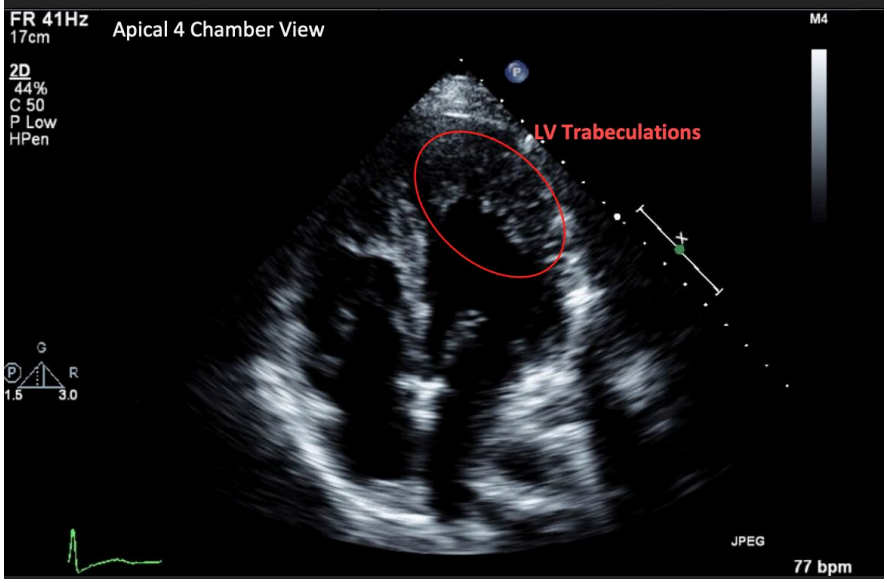
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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 09

Anesthetic Management of Unrepaired Atrial Septal Defect with Pulmonary Hypertension: Hemodynamic Precision in High-Output Physiology of Pregnancy

Presenting Author: Rishabh Jindal, MBBS MD

Presenting Author's Institution: Montefiore Medical Center - Bronx, New York

Co-Authors:

Introduction: Atrial septal defects (ASDs) chronically overload the right ventricle (RV) through left-to-right shunting, potentially leading to pulmonary hypertension (PH) driven by high cardiac output rather than elevated pulmonary vascular resistance (1,2). Pregnancy intensifies this physiology via increased blood volume, compounding the risk of RV dysfunction, arrhythmias, and paradoxical embolism (3). Managing gestational hypertension requires precise systemic vascular resistance (SVR) control: lowering SVR reduces left-to-right shunting but risks right-to-left shunt reversal if right atrial (RA) pressure surpasses left atrial (LA) pressure. Conversely, excessive SVR elevation increases LA-to-RA gradients, worsening RV volume overload.

Case One: A 29-year-old primigravida with a large secundum ASD, moderate-to-severe RV dilation, and tricuspid regurgitation presented at term with gestational hypertension. Echocardiography showed RV systolic pressure of 51 mmHg, indicating PH. Management prioritized maintaining SVR to prevent right-to-left shunting while limiting excessive left-to-right flow. Phenylephrine stabilized blood pressure without significantly increasing pulmonary flow. An early incremental-dose epidural minimized hemodynamic swings, preventing pain-induced catecholamine surges and Valsalva-driven RA pressure spikes. Restrictive fluid management prevented RV overload, and air filters on IV lines reduced paradoxical embolism risk. After failed labor induction, cesarean delivery proceeded with strict preload and SVR control.

Discussion: ASD with PH presents two hemodynamic risks: ●Excessive SVR Reduction: Lowers left-to-right flow but may allow RA pressure to exceed LA pressure, causing transient right-to-left shunting and hypoxemia. ●Excessive SVR Elevation: Increases the LA-to-RA gradient, worsening RV volume overload and pulmonary hypertension. Phenylephrine's selective α_1-mediated vasoconstriction maintains SVR without significantly increasing pulmonary pressures, balancing these risks. Early epidural analgesia helps stabilize hemodynamics by reducing pain-driven sympathetic activation and limiting RA pressure fluctuations. Restrictive fluid protocols further protect RV function, preventing excessive preload. In ASD with PH, careful SVR management is essential. Key strategies include maintaining SVR with α_1-agonists, using early epidural analgesia to limit RA pressure surges, and restricting fluids to prevent RV overload. A coordinated, multidisciplinary approach is critical. Postpartum ASD repair is essential for reducing long-term morbidity. Further research should refine vasopressor, fluid, and neuraxial anesthesia guidelines for this high-risk population.

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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 10

Transpositon of the Great arteries in the obstetric patient

Presenting Author: Kirsten Ponsart, DO

Presenting Author's Institution: Metrohealth Medical Center - Lakewood, Ohio

Co-Authors: Marcos Izquierdo, MD - Metrohealth Medical Center

Introduction: Transposition of the great arteries is a rare cyanotic congenital heart defect affecting 1 in 3,500 to 1 in 5,000 births and accounts for 4% of all congenital heart defects. In patients with this heart defect the right ventricle flows into the aorta and the left ventricle gives rise to the pulmonary artery. Surgical repair of this transposition has shown a great long-term survival rate. With more patients surviving into childbearing years, pregnancy in this population has become more prevalent and carries the potential for both maternal and fetal complications. These patients are at increased risk for right ventricular failure, arrythmias, and tricuspid and aortic regurgitation. Fetal complications include increased risk of prematurity, fetal loss, and neonatal mortality. Understanding the physiology and risk for potential complications is vital to the appropriate anesthetic management of these patients.

Case One: Our patient was a 33-year-old G3P1011 at 36 weeks 3 days presenting for a cesarean delivery of dichorionic diamniotic twins. Past medical history was significant for transposition of the great arteries s/p arterial switch repair on day 3 of life. EKG on admission showed sinus tachycardia. TTE with LVEF of 55% (stable from last exam), repaired D-TGA with arterial switch, RV function low-normal, moderate aortic regurgitation, dilated ascending aorta at 3.9cm, and mild pulmonary hypertension. The anesthetic management of this patient consisted of placing a CSE in the operating room with a low dose of 0.75% Bupivacaine, intrathecal morphine, and fentanyl. Blood pressure and heart rate were treated with IM and IV ephedrine and a phenylephrine drip to promote forward flow through the heart and maintain low systemic vascular resistance. Special consideration was taken to maintain adequate ventilation and oxygenation. It is important to avoid acidosis and worsening of the patient's pulmonary hypertension and the potential for right heart failure. Fortunately, our patient had a successful cesarean delivery with no immediate maternal or fetal complications.

Discussion: This case demonstrates the complexities in the anesthetic management of transposition of the great arteries with an arterial switch in the obstetric patient. Understanding the physiology and being aware of the potential complications is important to the anesthetic management of these patients.

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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 11

Multidisciplinary Approach for Managing a Patient with Fontan Circulation for Tricuspid Atresia and Placenta Accreta: A Case Report

Presenting Author: Geoffrey Elder, MD

Presenting Author's Institution: Univeristy of Ottawa - Ottawa, Ontario

Co-Authors: Reda Hafiane, MD - University of Ottawa
Elizabeth Miller, MD, FRCPC - University of Ottawa

Introduction: Improving surgical technique and long-term medical management has led to a significant reduction in morbidity for patients with congenital heart disease(CHD). However, patients remain at risk of significant hemodynamic compromise during pregnancy as well as during delivery and anesthetic management. The physiologic changes and stress of pregnancy complicate safe obstetrical anesthetic care in parturients with CHD.1 We present a case of a pregnant patient with Fontan circulation(FC) and known placenta previa(PP). A multidisciplinary team(MDT)approach was taken to navigate the complexity of her peripartum care. Early planning allowed for safe and hemodynamically stable management of her care, including prompt hysterectomy when faced with severe postpartum hemorrhage (PPH) during her Cesarian Section (CS).

Case One: Granted consent, we present a case of a 22-year-old primigravida born with tricuspid atresia, Atrial septal defect and ventricular septal defect who had undergone Fontan repair. Transthoracic echocardiography (TTE) revealed good LV function, an atretic RV and good flow through the FC, with abdominal ultrasound showing PP. To develop a comprehensive peripartum plan, an MDT meeting was convened with a decision for an elective CS at 36 weeks. Management of possible PPH was discussed given the devastating impact of hypovolemia on FC. With limited options, it was decided that any placental adherence would require hysterectomy. At 33+5weeks gestation, the patient experienced her 3rd episode of antepartum hemorrhage. While bleeding resolved and she remained stable, a decision was made to proceed with her CS at 34 weeks. In addition to standard ASA monitors, arterial line and central venous line were inserted. The anesthetic technique was a titrated epidural with lidocaine2% and opioids. The patient was placed in the left lateral tilt position to avoid aortocaval compression which would be devastating in this patient. Intraoperative TTE was used to continuously monitor the cardiac output and volume status, with norepinephrine infusion being titrated accordingly. After delivery of the baby and administering carbetocin-100mcg-IV, the obstetrician identified significant placental adherence. A prompt decision was made to proceed with hysterectomy as discussed by the MDT. Adequate resuscitation was done with PRBCs, crystalloids and vasopressors to maintain hemodynamic stability. Total blood loss was 1 litre. Postoperatively, the patient was admitted to ICU for postpartum and cardiac care.

Discussion: A CS can be life-threatening for patients with repaired CHD. Their reliance on preload makes PPH a particular challenge that demands diligent planning. The combination of these pathologies is rare and our case report emphasizes the importance of a MDT approach to ensure better maternal and fetal outcomes.

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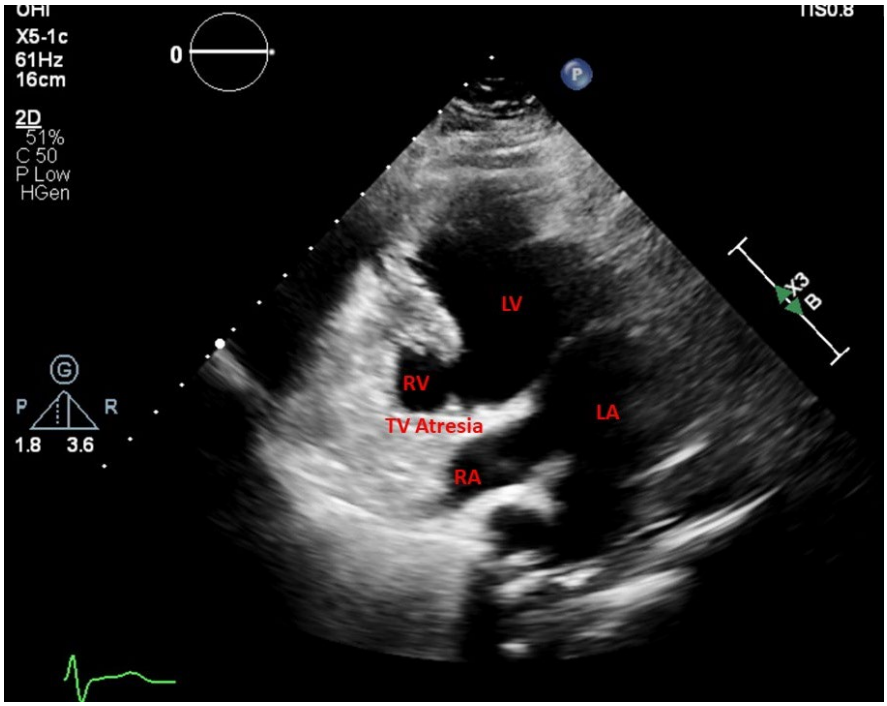
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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 12

Management of Cesarean Delivery in a Patient with Fontan Circulation

Presenting Author: Ashley Radee, MD

Presenting Author's Institution: NYU Langone Health - NEW YORK, New York

Co-Authors: Jeffrey Bernstein, MD - NYU Langone Health
William Liao, MD - NYU Langone Health

Introduction: Outcomes have improved for patients with congenital heart disease and single ventricle physiology, with 15 year post-Fontan survival of 93% for those with a systemic left ventricle (2). As more reach adulthood and become pregnant, the hemodynamic changes of pregnancy (increased circulating volume, decreased vascular resistance, hypercoagulability) present challenges in management. Fontan circulation places individuals at mWHO risk class III, a 20-27% maternal cardiac event rate (3). Case reports of pregnancy post-Fontan range from uncomplicated to severe morbidity (arrhythmias, heart failure) and neonatal demise (1). Interdisciplinary teamwork is essential.

Case One: A 31-year-old with history of tricuspid atresia s/p palliation (right Blalock-Thomas-Taussig shunts, bidirectional Glenn, and Fontan) and cirrhosis with mild portal hypertension became pregnant via IVF. An interdisciplinary team meeting initially planned induction of labor at 34-37 weeks with an assisted second stage. However, at 30w6d, the patient was found to have fetal growth restriction and abnormal umbilical artery dopplers (UAD). A repeat study at 32w showed a thickened placenta and UAD with intermittent absent/reversed end diastolic flow, leading to patient's admission for Cesarean delivery (CD). At 32w3d, the patient was taken for CD in a cardiac OR with cardiac anesthesia and CT surgery aware in case mechanical circulatory support was required. A left radial arterial line was placed, followed by an epidural catheter. A dose of lidocaine 2% with epinephrine was given epidurally over 8 minutes as phenylephrine was titrated to avoid rapid changes in blood pressure. Operative course was uncomplicated. Patient recovered uneventfully for 1 day in CICU and was discharged POD3.

Discussion: After Fontan, blood return to pulmonary circulation is passive. Abrupt changes in preload and afterload common in the peripartum period and neuraxial anesthesia can cause cardiovascular collapse; slow epidural dosing is preferred to spinal anesthesia as a result. General anesthesia also poses risks given potential hemodynamic instability from induction and positive pressure ventilation. Patients with single ventricle physiology in the peripartum period are ideally managed in a setting capable of mechanical circulatory support in case of hemodynamic instability.

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Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 13

Atrial Switch: Delivering Now But Not Forever

Presenting Author: Jessica Klein

Presenting Author's Institution: Vanderbilt University School of Medicine - Nashville, Tennessee

Co-Authors: Kait Brennan, DO, MPH - Vanderbilt University Medical Center
Patrick Hesketh, MD - Vanderbilt University Medical Center

Introduction: The atrial switch surgery was the first procedure to allow individuals born with dextro-transposition of the great arteries (dTGA) to survive infancy. Patients with dTGA have an aorta arising from the right ventricle (RV) and a pulmonary trunk exiting the left ventricle (LV). In 1957, Senning completed the first successful atrial switch operation using an autologous atrial baffle to route venous blood directly into the LV, allowing the RV to systemically circulate oxygenated blood. In 1963, Mustard used a synthetic baffle instead of the atrial tissue used in Senning's procedure. These atrial switch operations remained the chief treatment for dTGA for three decades before being replaced by the Arterial Switch Operation (ASO). First described in 1976, the ASO keeps the LV as the systemic ventricle and shows superior outcomes in treating dTGA. With the introduction of the atrial switch operation, individuals with dTGA could survive into adulthood and become pregnant. For typical patients, cardiac output increases by 50% during pregnancy and by an additional 40% in labor. Due to the intrinsic limitations of the RV compared to the LV, patients post-atrial switch are at high risk of heart failure. We describe the management of a parturient with a history of atrial switch and resulting RV dysfunction.

Case One: A 41-year-old G5P3104 presented for an obstetric anesthesiology consult at 34w0d. The patient was born with dTGA and treated with an atrial switch in infancy. A transthoracic echo showed severe systemic RV enlargement, moderate RV dysfunction, and a well-visualized, non-stenotic atrial baffle. Her past medical history included atrial fibrillation with rapid ventricular response treated with metoprolol. Anticoagulation was maintained throughout pregnancy with 90mg BID low molecular weight heparin. The patient was induced at 37w0d. Standard monitors for labor were recommended with the addition of continuous 5 lead telemetry and an arterial line prior to neuraxial analgesia. An early epidural was recommended, and a dural puncture epidural was placed after spontaneous rupture of membranes. The patient vaginally delivered a healthy infant without complication and was discharged on postpartum (PP) day 3.

Discussion: Parturients who have undergone an atrial switch for management of dTGA are at increased risk of cardiac complications. These include arrhythmias, development of heart failure, or worsening of existing systemic ventricular dysfunction. Anesthetic recommendations for vaginal delivery in this patient population include: continuous telemetry due to the increased risk of intrapartum and PP arrhythmias, consideration of invasive blood pressure monitoring in the setting of neuraxial analgesia, early placement of neuraxial analgesia to blunt the sympathetic response associated with pain during labor, and close monitoring of volume status in the PP period.

References: Sources – PMID: 1. 15172322 2. 957754 3. 1467047

Abstract #: THURS - CR - BS 1 - BR 5 - Cardiac 1 - Congenital & Acquired – 14

Twin Gestation with Maternal History of Repaired Tetralogy of Fallot

Presenting Author: Sydney Labat, MD

Presenting Author's Institution: Ochsner Clinic Foundation - New Orleans, Louisiana

Co-Authors: Melissa Russo, Department of Anesthesiology - Ochsner Clinic Foundation

Introduction: Tetralogy of Fallot (ToF) is a congenital cardiac anomaly characterized by pulmonary stenosis, VSD, overriding aorta, and right ventricular hypertrophy. ToF patients undergo repair early in life and exhibit excellent survival into reproductive years. Women with repaired ToF can undergo a safe delivery without major cardiovascular events; however, factors that contribute to higher risks of intrapartum complications include severe valvular stenosis, poorly tolerated arrhythmia, and significant ventricular dysfunction. High risk patients require a comprehensive anesthetic plan that accounts for the physiologic changes that occur during delivery. We present a case of a 28 yo with repaired ToF and associated high risk factors undergoing twin delivery.

Case One: 28 yo G1P0 at 34w6d presented for preterm IOL secondary to repaired maternal ToF with high risk factors and dichorionic-diamniotic twin gestation. Risk factors included recent endocarditis, right heart failure, severe pulmonary valve stenosis s/p valvuloplasty at 12wga, and episodic supraventricular tachycardia. Anesthetic plan included arterial line placement for hemodynamic monitoring and early epidural placement to mitigate the sympathetic surge that occurs with labor. After confirmation of appropriate cessation of anticoagulation, epidural was placed successfully without hemodynamic instability. The patient then underwent operative vaginal delivery in order to facilitate an assisted second stage of labor. Minimal maternal pushing effort allowed in order to avoid maternal risk of extended valsalva. Successful forceps delivery of both Fetus A and Fetus B performed. Patient remained hemodynamically stable throughout delivery and was discharged on PPD4. She then returned 5 days later with postpartum hemorrhage requiring suction D&C under GETA, transfusion of blood products and placement of JADA. Patient was discharged on POD2. Four months later, the patient underwent pulmonary valve replacement without complication.

Discussion: This case evaluates the complexity of anesthetic peripartum care in a patient with repaired ToF, recent endocarditis, right heart failure, and pulmonic stenosis. Anesthetic plans included early analgesia to control tachycardia and right heart strain, euvolemia, close hemodynamic monitoring, and preemptive pharmacologic agent selection in the event of instability. This case examines the need for meticulous multidisciplinary planning with regards to caring for laboring patient with ToF and highlights the complications that can occur postpartum in the anticoagulated, CHD patient.

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 01

Dysfibrinogenemia – A wild ride on the carousel of clotting.

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Introduction: Congenital fibrinogen disorders (CFDs) pose significant clinical challenges due to lack of consensus guidelines, variable genotype-phenotype correlation and low prevalence. We report an obstetric case of congenital dysfibrinogenemia through cesarean delivery with multi-specialty care planning. Fibrinogen plays a pivotal role in both pro- and anti-coagulation balance. During gestation, fibrinogen contributes to the maintenance of the placenta, the development of maternal-fetal circulation and trophoblast proliferation. Obstetric patients with CFDs are at increased risk for adverse complications including IUFD, retroplacental hematoma, postpartum hemorrhage and thrombosis (1).

Case One: A 21-year-old primigravida at 32-weeks gestation with fetal growth restriction was referred for consult. She reported an unknown bleeding disorder with heavy menses but no post-surgical complications or thrombosis. Initial hematologic work up was notable for low fibrinogen activity (93 mg/dL), prolonged PT (14) (9.1-12.0 sec), elevated INR (1.4 ref= 0.9-1.2) but normal PTT, Factor VII and vitamin K levels. Elevated anti-fibrinogen level (545 mg/dL ref=149-353 mg/dL) confirmed the diagnosis of dysfibrinogenemia, rather than hypofibrinogenemia. A multispecialty plan was created for hemostasis and labor analgesia. The patient presented prior to her scheduled induction of labor due to non-reassuring fetal testing and was taken urgently for cesarean delivery under general anesthesia. Pre-operative thromboelastography (TEG) was obtained which resulted normal (image 1). She was given a 1g loading dose of tranexamic acid prior to incision. Her intraoperative and postoperative courses were uncomplicated.

Discussion: Management of parturients with dysfibrinogenemia is challenging due to the paradoxical risk of both bleeding and thrombosis (2). We currently lack consensus guidelines regarding the safe utilization of neuraxial anesthesia for CFD. We utilized our institution's standard fibrinogen assay (Clauss) and a send-out immunologic assay (quantitative) for diagnosis in this case. Though viscoelastography is not routinely utilized to assess the risk of epidural hematoma formation as a result of neuraxial anesthesia (3), it may be a viable option for patients with CFD as evidenced by our patient's normal TEG and clinical course. Our case highlights the importance of a multidisciplinary approach in the care of dysfibrinogenemia in pregnancy and the continued need for further evidence-based guidelines, particularly regarding the use of TEG and neuraxial procedures in these patients.

References: PMID: 37172732 PMID: 2822844 PMID: 33861047

Shah TEG image dysfibrinogenemia.pdf

Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 02

Anesthetic Management with Continuous Spinal Anesthesia for Cesarean Section in a Pregnant Woman with a Giant Uterine Fibroid: A Case Report

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Co-Authors: MINGJUN XU, MD - BEIJING OBSTETRICS AND GYNEOLOGY HOSPITAL, CAPITAL MEDICAL UNIVERSITY

Introduction: Cesarean delivery in pregnancies complicated by large uterine fibroids carries a high risk of massive hemorrhage, necessitating meticulous perioperative anesthetic management to maintain hemodynamic stability. We report a case of cesarean delivery performed under continuous spinal anesthesia(CSA) in a patient with a large uterine fibroid.

Case One: A 29-year-old primigravida at 7+ weeks of gestation was found to have a hypoechoic nodule measuring approximately 12.2 × 7.8 × 7.9 cm protruding from the right lower uterine segment on ultrasound. Subsequent routine prenatal visits at our hospital revealed progressive enlargement of the uterine fibroid. At 32+ weeks of gestation, pelvic MRI showed the placenta located on the right anterior uterine wall, and a large solid mass measuring approximately 16.6 × 11.9 × 21.6 cm was identified on the right lateral wall of the lower uterine segment, protruding externally from the uterine body. The patient was diagnosed with a singleton pregnancy at 35 weeks complicated by a large uterine fibroid.After multidisciplinary consultation, an elective cesarean section was scheduled. To prevent postpartum hemorrhage, an intra-aortic balloon occlusion was performed preoperatively.preoperatively. CSA was selected, combined with intraoperative cell salvage. The anesthetic level was initially raised to T10 for the placement of ureteral stents via microcatheter-guided drug administration. A midline left paramedian longitudinal incision was made in the lower abdomen under ultrasound guidance. A curved uterine incision was performed above the umbilical level, at a thin segment of the placenta while avoiding the fibroid. The anesthetic level was raised to T4 with additional medication to proceed with the cesarean section.Significant uterine bleeding occurred following fetal delivery, resulting in maternal hypotension, which was promptly managed with cell salvage. The total blood loss was approximately 1400 mL, and the patient received 500 mL of autologous blood, 800 mL of plasma, and other supportive treatments. The neonate had Apgar scores of 10 at 1, 5, and 10 minutes. Postoperatively, the patient was transferred to the ward, and CSA was used for pain management. Visual analog scale scores remained below 3 for two days postpartum. The patient was discharged on postoperative day 5 without complications.

Discussion: For surgeries with a high risk of bleeding due to pregnancy complicated by large uterine fibroids, the combined use of CSA and intraoperative cell salvage techniques can be considered to provide optimal perioperative anesthesia management.

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 03

Management of Postpartum Hemorrhage and Anaphylaxis in Teen Pregnancy: A Case Report

Presenting Author: Nicholas Kraus, MD

Presenting Author's Institution: UCLA - Los Angeles, California

Co-Authors: Christopher Lee, MD - UCLA

Introduction: A 15-year-old G1P0 at 40 weeks and 6 days gestation presented for labor induction due to late-term pregnancy. Her pregnancy was complicated by psychosocial factors, including teen pregnancy, foster care, depression, trauma/violence history, and physiologic factors such as severe obesity (BMI >40), iron deficiency anemia, and asthma.

Case One: Labor was uneventful. Multiple discussions with the patient and her support system covered analgesia options, including neuraxial techniques, IV analgesics, nitrous oxide, and non-pharmacologic methods (relaxation, massage, breathing). She opted for an unmedicated delivery, which the medical team respected. After 12 hours, she reached full cervical dilation, but prolonged fetal heart rate deceleration led to an operative vaginal delivery. She delivered vaginally over three contractions in the OR, and postpartum oxytocin was administered. Postpartum, uterine atony was noted. She did not tolerate bimanual massage despite IV narcotics. Methergine, misoprostol, tranexamic acid, and additional oxytocin were given to improve uterine tone. Bedside ultrasound revealed intrauterine clots. Due to ongoing bleeding, a massive transfusion protocol was initiated, and additional large-bore IV and arterial access was obtained. Total EBL was 3150 mL. She received 3 units of pRBCs and 3 units of FFP. For pain control and uterine evacuation, general anesthesia was induced with propofol (200mg) and succinylcholine (100mg), followed by successful intubation. Rocuronium (30mg) was given 20 minutes later for muscle relaxation. The patient then developed hypotension, refractory to norepinephrine drip and boluses. A diffuse urticarial rash raised concern for anaphylaxis versus transfusion reaction. She received epinephrine bolus and drip, dexamethasone, diphenhydramine, and famotidine, leading to hemodynamic improvement. She remained intubated in the ICU overnight on an epinephrine drip, was extubated and transferred to postpartum the next day, and was discharged on postpartum day 3 with a pediatric allergy follow-up.

Discussion: This case underscores how social determinants impact severe maternal morbidity (SMM), which is higher in teens, those over 40, Medicaid recipients, and individuals in low-income areas. Teen pregnancies carry increased risks of hypertension, preterm birth, transfusion, and infection, worsened by delayed prenatal care. Neuraxial analgesia is underused among Black and Hispanic women due to cultural and systemic factors. Obstetric anesthesiologists play a key role in care coordination to reduce SMM in high-risk patients.

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 04

REBOA to the Rescue: Management of Massive Hemorrhage following Catastrophic Uterine Rupture

Presenting Author: Travis Cuddy, MD

Presenting Author's Institution: Virginia Commonwealth University Medical Center Department of Anesthesiology - Richmond, Virginia

Co-Authors: Lawrence Jones, MD - Virginia Commonwealth University Medical Center Department of Anesthesiology
Victor Saxena, MD - Virginia Commonwealth University Medical Center Department of Anesthesiology

Introduction: Postpartum hemorrhage (PPH) is a major cause of maternal mortality. Uterine rupture is an emergency that can result in massive PPH and hemorrhagic shock, where anesthesiologists play a critical role in resuscitation. If attempts to halt pelvic hemorrhage fail, all rescue options must be considered, including resuscitative endovascular balloon occlusion of the aorta (REBOA).

Case One: A 36-year-old G2P1 with a history of one prior caesarean section (CS) presented at 40w gestation for TOLAC. Immediately after VBAC, brisk vaginal bleeding was seen. A manual exam suggested uterine rupture. The patient was taken emergently to the OR. She arrived in distress with gross pallor, HR 146 bpm, BP 131/76 mmHg. After RSI and intubation, two 16g IVs were secured. A left radial arterial line was placed. Initial labs showed Hb 11.5, lactate 1.5, platelets (Plt) 154, fibrinogen (Fbg) 518. Laparotomy confirmed extensive uterine rupture. Hysterectomy could not be immediately performed due to distorted anatomy and active hemorrhage. Massive transfusion protocol was started. Despite administration of 8 units of packed red blood cells, 8 units of fresh frozen plasma, 4 units of platelets, and 1 unit of cryoprecipitate, vasopressor requirements increased. Coagulation in the field remained grossly abnormal. Trauma surgery was consulted and placed a REBOA device. Its balloon was placed in the infrarenal aorta and inflated until blood pressure distal to the balloon was 25 mmHg, rapidly bringing central SBP to 140. Improved surgical visualization and hemostasis followed. Total occlusion time was 23 minutes. Vitals stabilized as transfusion continued. Upon completion, blood loss was 6.6 L. Labs showed Hb 13.9, lactate 3.6, Plt 72,000, Fbg 296, and thromboelastogram within normal limits. The patient required no vasopressors postoperatively and was extubated five hours later.

Discussion: REBOA, first introduced in trauma settings, has seen increasing use in obstetrics. Two main indications have emerged: (1) prophylaxis to limit bleeding during CS and (2) rescue therapy in life-threatening PPH. The former is well-defined in placenta accreta spectrum [1], but therapeutic utility in PPH is less clear due to limited case series. REBOA deployment is described by three aortic “zones” (Fig. 1). For pelvic hemorrhage, the balloon is placed in zone 3. Importantly, placement in zone 2 should be avoided due to risk of gut ischemia. Complications include aortic rupture, reperfusion injury, and bowel and/or limb ischemia. These can be mitigated by limiting occlusion time and balloon pressure. In this case, REBOA was essential in hemorrhage control and facilitated effective resuscitation.

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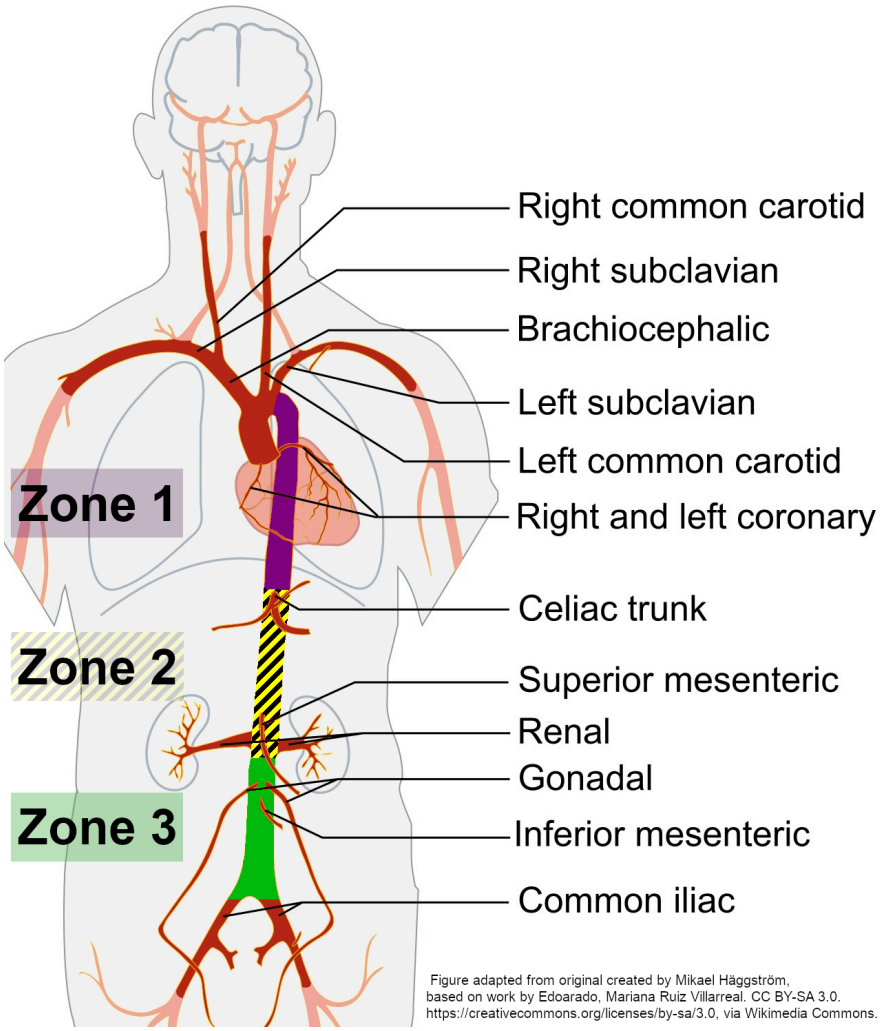

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 05

Intraoperative Cell – Salvage during Cesarean Delivery: a case report

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Introduction: Postpartum hemorrhage (PPH) remains a leading cause of maternal death worldwide. The use of cell salvage during cesarean delivery (CD) has often been avoided, due to fears of inducing amniotic fluid embolism. We present a case where intraoperative cell salvage was used to save a parturient's life during CD complicated by massive hemorrhage.

Case One: A 34 y.o. parturient, G3P2, with a previous two cesarean deliveries (CD), was admitted at 19+6 weeks gestation (EGA) with premature rupture of membranes. She had also had 2 previous episodes of vaginal bleeding. She had been told at 10 weeks EGA that hers was a high-risk pregnancy with suspected placenta accreta in the scar from the previous CD, but she wanted to continue the pregnancy. A decision was made three days after admission to perform a CD due to new vaginal bleeding. Due to the high-risk nature of her condition, general anesthesia was induced. Unfortunately, the infant expired shortly after delivery. During surgery, she suffered a massive bleeding (5500ml). Cell salvage was used from the beginning of the procedure and 2892ml autologous blood was returned to patient. Invasive monitoring (central line and arterial line) was placed, and she was transferred after the delivery in stable condition to the Intensive care unit (ICU). Two hours later she experienced further bleeding due to uterine atony and was returned to the operative room. During the second surgery, also under general anesthesia, vasoactive medication was required to support unstable blood pressure. A hysterectomy was performed with an additional 3000ml blood loss. Cell salvage was again used, and 730ml of her own blood was returned. The patient received a total of 3622 ml autologous blood, 2780ml allogenic red blood cells, 2405ml of FFP, 870 ml cryoprecipitate and 330 ml of platelets. She was transferred to the ICU in stable condition and spent 24h on mechanical ventilation. The remainder of her hospitalization was unremarkable, and she was discharged from the hospital to home on postoperative day 10.

Discussion: Despite two episodes of massive hemorrhage, the patient did not develop any signs of adverse post-transfusion reaction. Cell salvage has been strongly recommended by recent reviews for parturients with predictably high blood loss, such placenta accreta spectrum disorder (1), as well as routine CD, to decrease postpartum anemia (2).

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 06

A Race Against Time: Managing Uterine Rupture and Massive Hemorrhage in a case with Placenta Accreta Spectrum

Presenting Author: Yasmine Habli, MD

Presenting Author's Institution: University of Texas Health Science Center Houston - Houston, Texas

Co-Authors:

Introduction: Post-partum hemorrhage is the leading cause of maternal-fetal mortality and morbidity. Placenta accreta spectrum (PAS) disorder is associated with risk factors such as advanced maternal age, prior cesarian sections (CS) and placenta previa which may lead to massive hemorrhage and uterine rupture. Effective management requires a multidisciplinary approach, early recognition and activation of massive transfusion protocol (MTP) with outcomes impacted by blood product availability and healthcare system efficiency.

Case One: A 36-year-old G4P3 with 3 prior CS presented at 32w6d. Prenatal imaging suggested placenta increta with posterior previa, increased vascularity and bridging vessels involving the bladder. She was transferred to our facility actively contracting and underwent an urgent C-hysterectomy. A 16 G and 18 G PIV were placed, along with a radial arterial line. Cell saver and 4 packed red blood cells (PRBC), 4 fresh frozen plasma (FFP), 1 platelet were available the OR. Upon opening the abdomen, complete uterine rupture with intra-abdominal acute severe hemorrhage was noted. The placenta delivered spontaneously but severe hemorrhage ensued due to placental adherence to the lower uterine segment and bladder. The patient was intubated via RSI, MTP was activated and a right IJ Cordis was placed. Persistent bleeding raised concerns for disseminated intravascular coagulation (DIC). Due to profuse and uncontrollable bleeding and delays in blood product availability, albumin 5% was administered as a temporizing measure while the surgeons held pressure until blood products arrived to the OR. Estimated blood loss was 20 liters, requiring MTP with 37 PRBC, 37 FFP, 4 jumbo platelets, 7 cryoprecipitate, 2.45L cell saver and 2g of tranexamic acid (TXA). The abdomen was packed, and the patient was stabilized and transferred to the ICU. She underwent re-exploration and closure and was successfully extubated on day 2. The neonate was admitted to the ICU and discharged in good condition.

Discussion: This case highlights the complexity of managing PAS with massive hemorrhage. Uterine rupture and DIC require rapid recognition and response. Swift MTP activation, timely delivery of blood products and judicious use guided by arterial blood gas analysis along with temporizing measures are vital. Thromboelastography aids in early coagulopathy correction. Advanced resuscitation measures like cell saver and pharmacologic adjuncts like TXA mitigate morbidity. However, systemic challenges such as delays in blood product delivery and limited access to pro-hemostatic agents highlight the need for healthcare system improvements.

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 07

Pulse Oximetry Derangement After Intraoperative Blood Transfusion

Presenting Author: Fallon Babcock, MD

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Co-Authors: Stuart Hart, MD - Ochsner Clinic Foundation
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Introduction: Pulse oximetry is an essential modality for the monitoring of intraoperative oxygenation. The device is well-known to utilize plethysmography, evaluating changes in light attenuation caused by pulsatile inflow of arterial blood1. This renders transmission pulse ox susceptible to falsely low derangement, while potentially deriving valuable information on the status of extremity perfusion2. The occurrences of falsely low pulse ox readings secondary to alterations in arterial perfusion pressure have been reported in several unique circumstances; though, it has been rarely cited as a result of blood transfusion. We present a case of temporary acute limb ischemia in the distal upper extremity (UE) following transfusion of prbcs during a postpartum hemorrhage.

Case One: A 37 yo G6P2 presented after repeat C/S complicated by PPH secondary to uterine atony. 10hrs post-delivery she was taken to the OR for exlap under general anesthesia due to symptomatic bleeding despite resuscitation. Intraop, a 3rd unit of blood was initiated via pressure bag into an 18G PIV in the L forearm, infusion warmer yet to be assembled. Seven minutes following initiation of prbcs, there was a swift desaturation from 100% to 47% with no derangements in waveform. Mild hypotension was noted. Epinephrine was administered for concern of impending hemodynamic compromise, and bag ventilation ensued. Six minutes after desaturation, pts distal UE was notable for pallor and a dusky, mottled appearance. The UE was cold to the touch with lack of a palpable radial pulse. Ultrasound exam revealed a constricted radial artery with pulsatility visible on doppler. The blood was immediately stopped, and warming blankets were applied to the UE. Transfusion reaction panel was obtained and later noted to be negative. Normalization of color and temperature began promptly; with full recovery achieved prior to emergence.

Discussion: False desaturations on pulse oximetry due to alterations in arterial perfusion pressure are well reported. A similar case exists of acute UE ischemia secondary to a Raynaud's attack precipitated by blood transfusion when rates exceeded critical levels3. Our pt did not have a history of Raynaud's disease nor symptoms; although, her mother has Raynaud's. In our case, false desaturation on pulse ox provided the benefit of prompt diagnosis of acute reversible UE ischemia, with the cost of effecting anesthetic management when major cardiovascular compromise was postulated.

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 08

Left Broad Ligament Hematoma Following Cesarean Section in a Parturient with history of Aortic and Mitral Valve Replacements on Anticoagulant

Presenting Author: KASIM NOORUL ASYIKEEN, MD

Presenting Author's Institution: Hospital Tunku Azizah, Kuala Lumpur, MALAYSIA - Setapak, Kuala Lumpur

Co-Authors:

Introduction: We present a case of a 39-year-old woman with a history of rheumatic heart disease (RHD) and mechanical heart valves (MHVs) who developed a left broad ligament hematoma post-cesarean section, likely secondary to anticoagulation therapy.

Case One: A 39-year-old woman, gravida 3, para 2, with a history of RHD requiring MHVs of the aortic and mitral valves, underwent an elective cesarean section at 39 weeks gestation. Anticoagulation therapy with warfarin was bridged with low-molecular-weight heparin perioperatively. The patient underwent high-risk elective cesarean section surgery via low-dose sequential combined spinal epidural (CSE) anesthesia. Following surgery, she was admitted to the intensive care unit for continued care. Bridging therapy with clexane-warfarin was initiated on post-op day 3. However, on post-op day 7, she requested discharge against medical advice. The latest international normalized ratio (INR) was 1.9 before discharge with oral warfarin. On the following day (postoperative day 8), she presented with sudden onset of left lower abdominal pain and difficulty passing urine. Pelvic ultrasound revealed a large left broad ligament hematoma measuring approximately 15 x 10 cm. An immediate decision was made for re-exploration. During surgery, the bleeding site was identified and secured. She received four units of fresh frozen plasma intraoperatively (preoperative INR 2.9). Following surgery, the patient was managed conservatively in the maternal high-dependency unit. Anticoagulation therapy was adjusted to minimize the risk of further bleeding. The hematoma was monitored with serial pelvic ultrasounds. Her condition stabilized on postoperative day 15, and she was discharged home with close outpatient follow-up.

Discussion: Post-partum hemorrhage is a significant cause of maternal morbidity and mortality. In patients with mechanical heart valves, the risk of bleeding is increased due to anticoagulation therapy. This case highlights the challenges of managing anticoagulation in this patient population. Balancing the risk of bleeding with the risk of thromboembolic events requires careful clinical judgment and close monitoring. This case emphasizes the importance of a multidisciplinary approach in the management of post-partum complications in patients with complex medical histories. Close collaboration between obstetricians, cardiologists, hematologists, and radiologists is crucial for optimal patient outcomes.

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 09

Massive Transfusion during Cesarean Hysterectomy in a patient with Placenta Accreta Spectrum under CSE Double-Segment Technique

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Introduction: Intraoperative preparation for massive hemorrhage is a critical aspect of anesthetic care for patients with placenta accreta spectrum (PAS). A multidisciplinary approach, incorporating obstetric anesthesiologists, gynecological oncologists, urologists, neonatologist, radiologists, and critical care specialists and has been associated with improved clinical outcomes. Thirty percent of PAS patients managed with neuraxial technique require conversion to general anesthesia (GA) due to excessive blood loss. The combined spinal-epidural (CSE) double-segment technique has been associated with lower rates of GA conversion.

Case One: We present a case of massive hemorrhage during a cesarean hysterectomy in a 40-year-old patient at 38+2 weeks of gestation with PAS, managed under regional anesthesia. Standard monitoring was applied, including an arterial line, three large-bore IVs, and a CSE double-segment technique with a thoracic epidural at T10-T11, followed shortly by spinal anesthesia L3-L4 with 12.75 mg of bupivacaine, 15 mcg fentanyl, and 100 µg of epimorphine

Discussion: A supraumbilical incision was performed, and delivery was uneventful. Planned, bilateral salpingectomy and bilateral internal iliac artery ligation were completed. However due to extensive adhesions, surgical dissection was challenging leading to hemorrhage at the level of the placenta/lower uterine segment, which triggered Code hemorrhage and activation of the massive transfusion protocol, including: 7 units of packed red blood cells (PRBC), 6 units of fresh frozen plasma (FFP), 1 unit of platelets, 4L of crystalloids, 1L of colloids and 6g of fibrinogen. Additionally, 8.5L of blood loss was processed through a cell saver, with 5L of autologous blood transfused back to the patient. Persistent hemorrhage from the posterior bladder required an urgent urology consultation, resulting in meticulous hemostasis and bladder repair. The total estimated blood loss was 10.5L. The epidural catheter were utilized intraoperatively with top ups of bupivacaine 0.25% and lidocaine 2%. Remarkably, the patient remained hemodynamically stable. Conversion to GA was contemplating and discussed with the patient, but the patient opted to remain awake. After surgery patient was transferred to the ICU for postoperative monitoring. Patient controlled epidural analgesia (PCEA) was maintained for 36 hours. She was subsequently discharged on postoperative day 3 with a favorable outcome.

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Consent.pdf

Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 10

Case report: inadvertent intramyometrial injection of ergotamine for post-partum hemorrhage

Presenting Author: Amir Siddiqui, MD, FRCPC

Presenting Author's Institution: Mount Sinai Hospital - Vancouver, British Columbia

Co-Authors:

Introduction: Ergotamine is a second-line uterotonic commonly used in cases of postpartum hemorrhage secondary to uterine atony.1 It is typically intramuscularly due to the risk of hemodynamic instability, including hypertension and myocardial infarction (MI).2 We present a case of inadvertent intramyometrial (IMM) injection of ergotamine resulting in prolonged postoperative patient discomfort.

Case One: A healthy 35-year-old gravida 2 para 0 patient at 38-weeks gestation underwent an elective cesarean delivery for maternal choice. Her medical history was unremarkable. Spinal anesthesia was performed with a 27-gauge needle at the L3-L4 interspace, delivering 13.5 mg of 0.75% hyperbaric bupivacaine, 10 mcg fentanyl, and 100 mcg morphine. During uterine incision, the surgical team inadvertently incised through the placenta, resulting in brisk bleeding. After fetal delivery, carbetocin 100 mcg IV was administered alongside surgical efforts to control the hemorrhage. Despite this, the patient lost over 2000 ml of blood and became hemodynamically unstable. A brief episode of junctional rhythm on electrocardiogram resolved with resuscitation using Lactated Ringer's solution while awaiting blood products. Hemodynamics stabilized after surgical bleeding control; however, IMM ergotamine was requested instead of IMM carboprost as a second-line uterotonic. Postoperatively, the patient experienced abdominal cramping unrelieved by analgesic medications, raising concerns for uterine dehiscence. Bedside ultrasound was unremarkable, and the IMM administration of ergotamine was identified by a second attending obstetrician. Given the junctional rhythm and case reports of IMM ergotamine causing myocardial ischemia, 24-hour telemetry monitoring was initiated, and cardiology was consulted. No significant cardiac concerns were revealed. Despite this, the patient had intense abdominal pain for 12 hours postoperatively despite aggressive analgesia with acetaminophen, ketorolac, and IV fentanyl and morphine.

Discussion: Ergotamine induces tetanic contractions on the uterus through its action on smooth muscle. The myometrium's vascularity may potentiate sustained, strong contractions with IMM ergotamine, leading to severe patient discomfort. While IMM ergotamine has been associated with MIs and uncontrolled hypertension, there is limited literature on its potential to cause abdominal discomfort. This case highlights the route of administration of ergotamine should be limited to intramuscular use, and that physicians must recognize and manage adverse effects of medication error early.

References: 1. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin: Clinical Management Guidelines for Obstetrician-Gynecologists Number 76, October 2006: postpartum hemorrhage. Obstet Gynecol. 2006;108(4):1039-1047. 2. Jain S, Baghel K. Myocardial ischaemia secondary to intramyometrial injection of methylergonovine maleate. Indian J Anaesth. 2016;60(4):290-292.

Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 11

2 Scars and A Little Lady: Managing a Cesarean Scar Pregnancy

Presenting Author: Kimberly Mendoza, MD, PhD, MPH

Presenting Author's Institution: University of Colorado Anschutz Medical Campus - Aurora, Colorado

Co-Authors: Cristina L. Wood, MD MS - University of Colorado, Department of Anesthesiology

Introduction: Cesarean scar pregnancy (CSP) is a rare form of ectopic pregnancy that is implanted on or in a scar from a prior cesarean birth. CSP can lead to severe fetal and maternal morbidity (uterine rupture, maternal hemorrhage) and mortality. There are two types of CSP, type 1 ("on-the-scar") and type 2 ("in-the-niche"). CSP can precede and share common histology with placenta accreta spectrum (PAS) and account for 6% of abnormally implanted pregnancies among patients with prior cesarean delivery (CD). Management and treatment require a multi-disciplinary approach with obstetric anesthesia, maternal-fetal medicine, gynecology-oncology, urology, and neonatology. This report presents the case of a 41-year-old G17P0-3-13-3 who presented at 22w0d gestational age (GA) for expectant management with full fetal interventions.

Case One: A 41-year-old G17P0-3-13-3 presented at 22w0d GA for inpatient monitoring for CSP desiring expectant management and full fetal interventions. Past medical history is significant for hypertension, obesity (BMI >50), history of cerclage, recurrent pregnancy loss, migraines, asthma, lupus and antiphospholipid antibody syndrome. MRI prior to admission was significant for concern for PAS involving the lower uterine segment and a uterine window. The patient was extensively counseled regarding the risks of expectant management for CSP and expressed a strong desire to continue the pregnancy. Patient remained hospitalized for maternal and fetal monitoring. Her delivery was scheduled at 29w5d and coordinated with a large multidisciplinary team. Operative course included a cesarean hysterectomy, bilateral salpingectomy and cystoscopy with bilateral ureteral stent insertion. Estimated blood loss was 5.5 L and patient received 5.4 L of crystalloid and 11 units of blood products. The post operative course was uncomplicated and she was discharged on post-operative day 4. A follow up visit was scheduled for wound vac and stable removal and blood pressure check.

Discussion: CSP is a pregnancy that is implanted on or in a previous cesarean scar; although, the mechanism for implantation remains unclear. If inadequately managed, CSP can lead to severe fetal and maternal morbidity and mortality. CSP can be diagnosed with a transvaginal ultrasound with color Doppler evaluation during the first or second trimester and definitively diagnosed during surgery. Management includes surgical or medical termination or expectant management and may require adjuvant therapies, such as, uterine artery embolization or systemic methotrexate. Ultimately, shared decision making and counseling is imperative between the patient and medical teams for the safest outcome.

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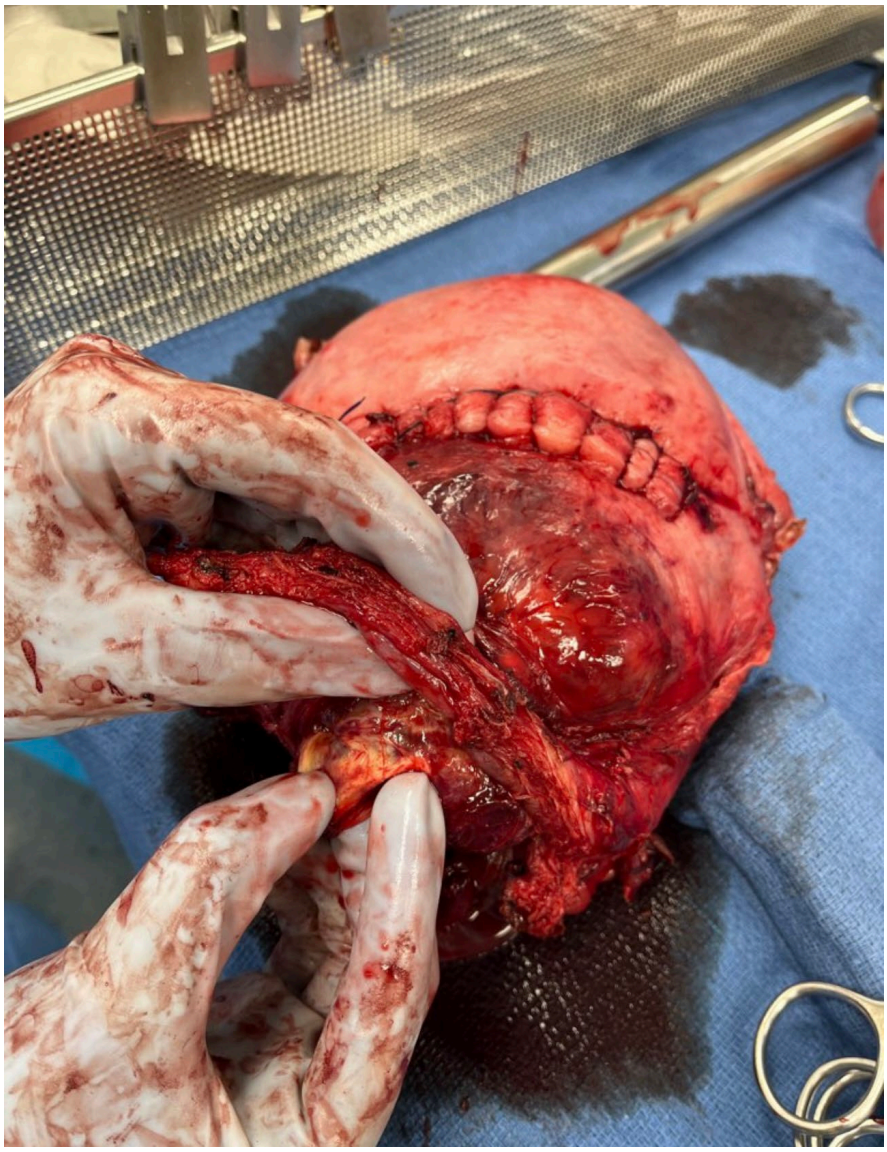

Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 12

Shoulder Pain: An Atypical Presentation of Uterine Rupture

Presenting Author: Casi Blanton, Medical Doctor

Presenting Author's Institution: Indiana University School of Medicine - Indianapolis, Indiana

Co-Authors: Adam Warrick, Medical Doctor - Indiana University School of Medicine
Jacob Wood, n/a - Indiana University School of Medicine

Introduction: Uterine rupture is a rare, life-threatening complication of pregnancy requiring immediate recognition and intervention. It is associated with significant maternal and fetal comorbidity, occurring in over 30% of cases. Maternal mortality rates range from 1-13% and fetal mortality rates are even higher at 74-92%.1 Recognizing atypical presentations of uterine rupture is critical for timely intervention and improved patient outcomes.

Case One: A 43-year-old G6P2032 with a history of type 2 diabetes, cesarean delivery followed by a VBAC, advanced maternal age, and consanguinity presented for cesarean section under epidural anesthesia due to failure of descent and recurrent fetal decelerations. A 36-week ultrasound revealed an estimated fetal weight at the 96th percentile and an abdominal circumference >99th percentile. She declined recommendations for a scheduled cesarean delivery or induction of labor. Upon arrival in the operating room, the patient was noted to have stable vital signs with a pulse of 99 bpm and a blood pressure of 134/93 mmHg. She denied abdominal discomfort, and the fetal heart rate remained reassuring. However, she now endorsed a new complaint of increasing left shoulder pain. Following incision, a 4 cm rupture with protrusion of the infant's shoulder was revealed; the infant was precipitously delivered through an extension of the uterine defect. The laceration was repaired, and the infant was stable. Approximately 30 minutes after arrival to the recovery unit, the patient became hypotensive and massive transfusion protocol was activated at bedside due to concern for ongoing bleeding. The patient emergently returned to the operating room for exploration where significant hemorrhage was confirmed necessitating a hysterectomy. The procedure was tolerated well, and the patient was transferred to the OB ICU where she was extubated the same day. She discharged home on post-operative day 5 in stable condition

Discussion: This case highlights the importance of early recognition and intervention in obstetric emergencies, particularly in high-risk patients. An otherwise silent uterine rupture presenting with referred shoulder pain—a rare presentation in the literature—is increasingly recognized as an atypical manifestation of this life-threatening complication. Finally, this case highlights the value of a coordinated, multidisciplinary approach to managing obstetric emergencies, as well as the need for anesthesiologists to remain vigilant for uncommon presentations of uterine rupture.

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Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 13

Successful regional anesthesia for management of uterine rupture, emergent cesarean delivery, and massive postpartum hemorrhage

Presenting Author: Daniel An, MD MS

Presenting Author's Institution: Cedars Sinai Medical Center - Los Angeles, California

Co-Authors:

Introduction: Uterine rupture, where transmural injury of the uterine wall occurs with or without intraperitoneal movement of the fetus and/or placenta, is a feared and dangerous complication of trial of labor after cesarean (TOLAC). Risk factors include multiparity, advanced maternal age, connective tissue disorders, oxytocin infusion, and most significantly, TOLAC, which increases the risk 15-fold compared to a scheduled repeat cesarean delivery.

Case One: A 35-year-old female G2P1 with history of CD for breech presentation and gastroesophageal reflux disease presented at 40+2/7 weeks gestation with premature rupture of membranes. She was admitted for induction of labor and TOLAC. A labor epidural was inserted and soon replaced due to inadequate analgesia. On hospital day 2, the patient had not reached the active phase despite augmentation with oxytocin and had a category 2 fetal heart rate tracing for recurrent late decelerations. The tracing suddenly devolved to sustained fetal bradycardia with heavy vaginal bleeding and complete loss of fetal station, prompting concern for uterine rupture. She was taken to the operating room emergently for repeat CD and was given an epidural bolus en route. In the operating room, the patient was transiently non-responsive but regained consciousness without specific intervention and before advanced airway management could be performed. The patient was able to confirm an appropriate bilateral level of anesthesia to pinprick, and the surgical team proceeded with delivery. A complete uterine rupture was identified, with the fetus, placenta, and approximately 2 liters of blood within the abdominal cavity. The fetus, previously cephalic, was found in breech presentation and was delivered along with the placenta. Intraoperative consultation was provided by gynecologic oncology and urology, the latter assisting with repair of a bladder dome cystotomy. The patient underwent massive transfusion, and after hemostasis the estimated total blood loss was 3,851 cc. Postoperatively, the patient remained hemodynamically stable with a routine course. She was discharged on postpartum day 2.

Discussion: High clinical suspicion and a prompt multidisciplinary response are crucial where uterine rupture is suspected. A well-functioning labor epidural may facilitate management under regional anesthesia if compatible with the patient's hemodynamics and if dense local anesthetic is administered without delay.

References: 1. Guise JM et al. Vaginal birth after cesarean: new insights. Evid Rep Technol Assess (Full Rep). 2010 Mar;(191):1-397. PMID: 20629481. 2. Togioka BM, Tonismae T. Uterine Rupture. [Updated 2023 Jul 29]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK559209/

Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 14

Anesthesia considerations for twin c-section affected by maternal super-morbid obesity

Presenting Author: Adetola Ojo

Presenting Author's Institution: Michigan State University College of Human Medicine - Byron Center, Michigan

Co-Authors: Allison Cropsey, n/a - Michigan State University College of Human Medicine

Introduction: According to the NCHS, over 50% of pregnant people in the United States are overweight or obese. Obesity in pregnancy poses unique anesthetic challenges such as patient positioning and monitoring, difficult needle placement and airway management, and association with additional comorbidities such as sleep apnea and cardiovascular disease, all which lead to an risk of anesthesia-related complications and maternal mortality. Due to the multifactorial risks, advance planning is vital for optimization of patient safety. Pre-operative anesthetic planning and postoperative care can be utilized to minimize risk of complications and improve patient outcomes. There is limited literature on the anesthetic care of parturients diagnosed with super-morbid obesity (BMI >50). This population is growing and documentation of the clinical decision making process and preparation is increasingly needed.

Case One: Patient is a 31yo G5P0040 female at 30w6d gestation with dichorionic diamniotic twins. Her pregnancy was complicated by chronic hypertension with superimposed preeclampsia with severe features, gestational diabetes mellitus, and class IV obesity (BMI 81.95). Other significant past medical history includes severe obstructive sleep apnea managed with nightly CPAP and recent pregnancy loss at 15 weeks gestation.

Discussion: At 12 weeks gestation, early delivery was planned at 36 weeks gestation by MFM due to chronic hypertension and class III obesity. Throughout her pregnancy, her blood pressures were closely monitored at home and in clinic and cHTN was only fairly managed and accuracy was questioned due to cuff use. In the third trimester, pregnancy was complicated by severe weight gain and edema. The patient was admitted at 30 weeks gestation for preeclampsia without severe features. Anesthesia did a preoperative consult at 31 weeks gestation, during which airway and IV lines were assessed and a combined spinal-epidural block with intrathecal morphine was recommended. Ultrasound guided placement of an additional IV was considered, and caution with morphine dosage was advised for obesity and severe OSA. 2 weeks later, the patient ruled in for preeclampsia with severe features and underwent a cesarean section. The procedure was performed to plan: anesthesia was obtained and respirations were supported with her home CPAP and head elevation. Prophylactic tranexamic acid was administered and both babies were delivered. Post-procedure was complicated by difficulty with fundal checks but pain was well controlled with PO oxycodone. Patient was discharged postoperative day 5. Despite multiple comorbidities, careful analgesic considerations contributed to a successful outcome.

References: Lamon AM, Habib AS. Managing anesthesia for cesarean section in obese patients: current perspectives. Local Reg Anesth. 2016 Alanis MC, Goodnight WH, Hill EG, Robinson CJ, Villers MS, Johnson DD. Maternal super-obesity (body mass index > or = 50) and adverse pregnancy outcomes. Acta Obstet Gynecol Scand. 2010

Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 15

Back for Blood? Considerations for Safe Neuraxial Placement in a Parturient with Known Vertebral Hemangiomas

Presenting Author: Natalie C. Campbell, MD

Presenting Author's Institution: University of North Carolina - Durham, North Carolina

Co-Authors: Jennifer N. Tripi, MD - UNC Hospitals at Chapel Hill

Introduction: Vertebral hemangiomas are the most common spine tumor with an incidence of 10-12% in the general population (1). They are commonly located in the thoracic and lumbar spine. While typically asymptomatic, they may expand during pregnancy with devastating consequences. In parturients with other known vertebral hemangiomas, it is important to rule out the presence of lumbar hemangiomas with imaging to ensure safety of neuraxial anesthesia.

Case One: A 39-year-old G5P2113 at 29w6d with a history of migraines and abnormal bleeding presented to OB triage for rule out preterm labor. The patient had two prior vaginal deliveries notable for uncomplicated epidural placements and one post-partum hemorrhage secondary to laceration which did not require transfusion. Workup for abnormal bleeding was notable for vWF and factor VIII activity of 117% and 200%, respectively. Eight years prior, her migraine workup revealed incidental findings of multiple cervical and thoracic hemangiomas. No lumbar imaging was completed at that time. She desired epidural placement for labor analgesia. Given her history of cervical and thoracic hemangiomas, outpatient lumbar MRI was completed to evaluate for presence of lumbar hemangiomas. MRI was negative, reassuring the safety of neuraxial anesthesia. Patient ultimately had an uncomplicated vaginal delivery via epidural analgesia.

Discussion: Physiological changes of pregnancy can expand existing hemangiomas via increased blood flow to vertebral venous plexi through several mechanisms. There is a 30-50% increase in circulating blood volume, compression of the IVC from the gravid uterus, and an increase in abdominal pressure from valsalva during the second stage of labor (2). Additionally, estrogen influences growth of endothelium, thus expanding hemangiomas. Consequences of vertebral hemangioma expansion include compression of spinal cord, vertebral fractures, epidural hematomas, and spinal cord ischemia (1). Given these risks, we argue lumbar hemangiomas contraindicate neuraxial placement. We recommend that parturients with cervical or thoracic hemangiomas should have lumbar imaging completed prior to neuraxial placement. Additionally, consider discussing mode of delivery with obstetric colleagues, as risk of complications from hemangioma expansion during valsalva may indicate cesarean section as a safer option.

References: 1.Kato, Kyle, et al. "Vertebral hemangiomas: a review on diagnosis and management." Journal of orthopaedic surgery and research 19.1 (2024): 310. 2.Chryssoula Staikou, M. D., et al. "Undiagnosed vertebral hemangioma causing a lumbar compression fracture and epidural hematoma in a parturient undergoing vaginal delivery under epidural analgesia: a case report." Canadian Journal of Anesthesia 62.8 (2015): 901.

Abstract #: THURS - CR - BS 1 - BR 6 - Postpartum Hemorrhage – 16

Neuraxial Anesthesia in a Postpartum Hemorrhage Patient with Cystic Fibrosis and Vitamin K Deficiency Coagulopathy

Presenting Author: Tanvee Singh, MD

Presenting Author's Institution: Columbia University - New York, New York

Co-Authors: Brian Waldman, MD - Columbia University

Introduction: Cystic fibrosis (CF) is a genetic disorder with multiorgan involvement resulting from impaired membrane chloride transport. Patients present with recurrent debilitating pulmonary infections and altered pancreatic function. This, in combination with antibiotic exposure-induced gut flora dysbiosis, may lead to vitamin K (vitK) deficiency. Unrecognized coagulopathy can exacerbate postpartum hemorrhage (PPH) or cause epidural hematoma. We discuss the management of a postpartum CF patient in whom coagulopathy was diagnosed after neuraxial anesthesia was performed.

Case One: A 25-year-old G2P0 at 37w2d with CF (W1282X homozygote), hypothyroidism, and diet-controlled gestational diabetes presented in labor. Her antepartum course was notable for CF exacerbation at 34w and recurrent exacerbation with Influenza A at 36w. She remained on piperacillin-tazobactam on presentation. Her precipitous vaginal delivery without analgesia was complicated by a 3rd-degree tear. Bleeding persisted despite attempted bedside repair and vaginal packing. After 4 hours estimated blood loss was 750mL and she was taken to the operating room (OR) for definitive repair. Uncomplicated spinal anesthesia was performed (27g whitacre; hyperbaric bupivacaine 0.75% 1.4mL, fentanyl 15mcg, and morphine 0.05mg). Intraoperative quantitative blood loss was 1.6L and 2u pRBC were transfused; phenylephrine, methylergonovine, tranexamic acid, and piperacillin/tazobactam were administered. The patient left the OR without ongoing bleeding or pressor requirement. Initial post-operative lab values (table 1) demonstrated an intrinsic pathway coagulopathy. After discussion with hematology, this coagulopathy was attributed to vitK deficiency in the setting of baseline malabsorption and recent beta-lactam antibiotic use causing decreased vitK production by gut microflora. She was transfused an additional 1u pRBCs, 2u FFP, and given vitK 10mg IV. Neurological checks were performed hourly, and recovery of motor and sensory function occurred appropriately.

Discussion: Pregnancy in CF patients doubled between 2019 and 2020, reaching 675 pregnancies in 2023. The possibility of vitK deficiency warrants increased vigilance in this population. While the diagnosis of CF related vitK deficiency coagulopathy in our case occurred in the setting of PPH after neuraxial anesthesia was already performed, the correct diagnosis allowed for appropriate follow-up care.

References: - Jagannath VA, Price AI. Vitamin K supplementation for cystic fibrosis. Cochrane Database Syst Rev. 2020 Jun 4;6(6):CD008482. - https://www.cff.org/sites/default/files/2024-09/2023-Patient-Registry-Annual-Data-Report.pdf

Table 1: Pre-operative and post-operative laboratory values demonstrating an intrinsic pathway coagulopathy.

	Pre-operative labs	Post-operative labs (initial)	Post-operative labs (repeat)	Post-operative day 1 labs
Hemoglobin	14.0	7.8	7.6	8.9
Platelets	526	357	411	248
International Normalized Ratio (INR)	1.1	8.2	9.3	1.4
Prothrombin time (PT)	16.4	92.4	104.1	16.4
Activated partial thromboplastin time (aPTT)	28.3	41.7	44.2	28.5
Fibrinogen	803	469	442	434

Note: Rotational thromboelastometry (ROTEM) confirmed an intrinsic pathway coagulopathy.

Program Material
Friday, May 2, 2025

Abstract Breakout Session #2 (Breakout Rooms)
Room 1: Cesarean Delivery
Room 2: Neuraxial Labor Analgesia
Room 3: Teams & Tech
Room 4: Blues, PDPH + BP
Room 5: Blood & Co.
Room 6: ERAC, Opioids, Pain

Opening Remarks
Holly Ende, MD & Jill Mhyre, MD

Gertie Marx Research Competition (Main Stage)
Moderator: Ruth Landau, MD
Judges: Rich Smiley, MD; Jull Myhre, MD; Feyce Peralta, MD; Caitlin Sutton, MD; David Berman, MD; Anton Chau, MD

1. Adjuvant Analgesic, Anxiolytic, and Sedative Medications Administered During Cesarean Delivery: A Retrospective Report from the Multicenter Perioperative Outcomes Group Research Consortium - Eric Chen, MD
2. Frequency of Adherence to Obstetric Anesthesia Best Practices for Cesarean Delivery: A Multicenter Retrospective Cohort Analysis, Presenting Author – Jordan Francke, MD, MPH
3. Efficacy and Safety of Dexmedetomidine or Sufentanil in Combination With Ropivacaine With Dural Puncture Epidural Technique For Labor Analgesia: A Randomized Controlled Trial - Yongxin Liang
4. Rac1 Facilitates YAP1 mediated Piezo1 overexpression in the uterus contributes to myometrium contraction and inflammation-associated preterm birth – Yanmei Bi
5. Comparison of Dexamethasone vs Ondansetron as the First-Line Antiemetic to Prevent Postoperative Nausea and Vomiting after Cesarean Delivery – A Double-Blinded Randomized Controlled Trial -Maria Patrocinio, MD
6. The Effect of Sufentanil for Combined Spinal-Epidural Anesthesia on Fetal Heart Rate During Labor Analgesia - Jian Xu

Concurrent Sessions

Oral Research Presentations #1 (Main Stage)
Moderator: Lisa Leffert, MD

1. A randomized controlled trial using programmed intermittent epidural bolus with 0.15% versus 0.075% ropivacaine in labor epidural analgesia: effect on analgesic requirement and obstetric outcomes – Tao Han, MD
2. Incidence of new onset of persistent pain after cesarean delivery and associated risk factors – Mary Yurashevich, MD, MPH
3. A multicenter assessment of postpartum recovery using the STanford Obstetric Recovery checKlist (STORK) – Moe Takenoshita, BSc, MBBChir, MRCS
4. Post-Cesarean Opioid Use and Pain Scores Among Opioid Dependent Patients before and after Implementation of a Modified Enhanced Recovery Protocol – Lindsey Gleason, BA

Concurrent Sessions

Tech-Enhanced Teaching: Leveraging New Technologies for Better Patient Outcomes (Breakout Room)

- C8 App: Handheld Learning Can Improve Patient Care - Dan Katz, MD
- Painless Push: Teaching Patients Improves Outcomes - Allison Lee, MD
- POCUS: What Every OB Anesthesiologist Should Know - Clemens Ortner, MD
- Podcasts: New ways to learn in 2025 - Antonio Gonzalez-Fiol, MD

Fred Hehre Lecture

Leadership Lessons and Clinical Pearls
Intro: Yemi Olufolabi, MD
Speaker: Medge Owens, MD

Sol Shnider Clinical Track #1

1. The Role of AI in Medicine
   Speaker: Mike Burns, MD
2. Wrangling the Experts: OB Anesthesia Legends Debate Approaches to Controversial Cases and Topics
   Moderator: Brendan Carvalho, MD
   Presenters: Rich Smiley, MD; Jill Mhyre, MD; Paloma Toledo, MD

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 01

A case series of the anesthetic management of post-uterine transplant cesarean delivery

Presenting Author: James Miranda, MD

Presenting Author's Institution: Hospital of the University of Pennsylvania - Philadelphia, Pennsylvania

Co-Authors: Kathleen O'neill, MD - Hospital of University of Pennsylvania

Abstract :
Title: A case series of the anesthetic management of post-uterine transplant cesarean delivery

James Miranda, MD, Kathleen O'Neil MD, Allison Lee, MD

Background: Uterine transplant is an emerging novel treatment for absolute uterine factor infertility (AUFI), estimated prevalence 1:500 reproductive age women).[1] Per United Network for Organ Sharing (UNOS) data, 41 uterine transplants were performed in the U.S., from 2016-2023.[1] Pregnancy is achieved using in vitro fertilization (IVF) with frozen embryos. Cesarean delivery (CD) is mandatory given the aberrant structural integrity of the neovagina in patients with AUFI and uncertainty regarding how/if labor progresses following uterus transplant. Following CD, hysterectomy of the transplanted uterus may follow, depending on the desire for additional pregnancies (max 2 deliveries under current guidelines). Given the rarity of these cases and limited data to inform best practices, we share our experience managing 7 deliveries following uterine transplant.

Methods: Data were collected via retrospective chart review.

Results: Between 2019 and 2024, 7 deliveries involving 5 patients with uterine transplants were conducted (Table). Those undergoing planned hysterectomy were delivered in the main operating room. Mean gestational age was 34 weeks and 5 days, with a range from 30 - 37 weeks 6 days; 4 deliveries occurred prior to 37 weeks. Five of the 7 gestations were complicated by preeclampsia with severe features. Neuraxial anesthesia was performed for all (5 epidural, 1 spinal, 1 combined spinal epidural), with conversion to general anesthesia for 3 patients who also underwent hysterectomy. Multimodal analgesia was provided for all; 4 patients also received postoperative epidural infusion. Two patients who had a hysterectomy received an arterial line. Estimated blood loss ranged from 700-2000mL with a mean of 1100 mL.

Discussion: Uterine transplantation in the U.S. is < 10 years old and the and the management of these cases is rapidly evolving. Close multidisciplinary collaboration, inclusive of MFM, neonatology and anesthesiology services, is essential for optimizing maternal and fetal outcomes at the time of delivery in uterus transplant recipients. These cases are high risk, with nearly 40% of gestations reported to experience major obstetric complications and 60% having pre-term delivery.[2] Higher rates of preeclampsia and fetal growth restriction are also observed, the former posited to be associated with the effects of immunosuppression, renal disease and IVF.[2] Attention to the effects of immunosuppression and possible interaction with anesthetic agents are key. Preparation for major hemorrhage is crucial, along with the availability of leukocyte-poor irradiated blood products.[3] Hysterectomy of the transplanted uterus may be complex due to adhesions.

References:
References:

1. JAMA Surg. 2022 Sep 1;157(9):790-797.
2. PLoS One. 2020 Apr 29;15(4):e0232323.
3. Cureus. 2021 Mar 16;13(3):e13920.

A case series of the anesthetic management of post-uterine transplant cesarean delivery.SOAP 2025 Maternal Demographics and Outcomes Ut Tx.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 02

Enhancing operating room efficiency and patient outcomes: The impact of preoperative neuraxial ultrasound in cesarean deliveries

Presenting Author: Pamela Sarue, MD

Presenting Author's Institution: University of Miami - Miami, Florida

Co-Authors: Patricia Pozo, Medical Student - University of Miami
Fouad Souki, MD - University of Miami

Abstract :

The operating room (OR) is a pivotal financial hub in modern healthcare, accounting for up to 40 % of hospital costs and generating 60–70 % of revenue. Optimizing OR efficiency is crucial for financial sustainability, patient safety, OR throughput, and satisfaction among patients, surgeons, and staff. This Quality Improvement (QI) project aims to evaluate whether pre-procedure neuraxial ultrasound can enhance obstetric OR efficiency by reducing the time and attempts needed for epidural placement. The secondary objective is to assess improvements in patient comfort, safety, and satisfaction. Conducted at a tertiary hospital in Miami from January to March 2022, the study included 98 parturients undergoing elective cesarean delivery. Patients were randomized into two groups: one receiving preoperative ultrasound ($n = 49$) and the other not ($n = 49$). Key metrics recorded included patient demographics, procedural times, number of attempts, pain scores, and patient satisfaction. The ultrasound group demonstrated significant improvements in OR efficiency: shorter epidural placement times (median 9 vs. 13 min, $p < 0.001$), fewer attempts (median 1 vs. 2, $p < 0.001$), reduced anesthesia ready times (median 22 vs. 31 min, $p < 0.001$), and decreased total OR times (median 122 vs. 140 min, $p = 0.004$). Patients in the ultrasound group reported less back pain (median score 0 vs. 1, $p < 0.001$) and higher satisfaction (median score 10 vs. 9, $p < 0.001$). Preoperative neuraxial ultrasound significantly improves OR case duration and enhances patient outcomes in obstetric anesthesia. While the study's single-site data and lack of blinding are limitations, the findings support larger, multi-institutional studies to confirm these benefits and explore further efficiency improvements.

References:

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Table 1
Summary of measure of interest for patients receiving an ultrasound for epidural placement vs. those not receiving an epidural ($n = 98$).

Measure	*Group*				
	*Ultrasound ($n = 49$)^*		*Non-Ultrasound ($n = 49$)*	*p-value*	
	mean ± SD	*median (IQR)*	*mean (SD)*	*median (IQR)*	
BMI	32.43 ± 6.21	31.48 (29–35)	31.82 ± 4.97	31 (29–34)	*0.751*
Age at Surgery (years)	32.58 ± 4.02	31.98 (29.57–35.40)	32.78 ± 4.44	33.22 (30.25–35.81)	*0.82*
Height (cm)	162 ± 5.8	162 (158–166)	162.4 ± 6.55	162 (159–166)	*0.677*
Weight (kg)	85.23 ± 17.03	82 (74–95)	84.81 ± 15.74	82 (75–95)	*0.842*
No. of Attempts	1.49 ± 1.06	1 (1–2)	2.49 ± 1.89	2 (1–3)	< 0.001*
Reported Backpain (Scale)	0.286 ± 0.65	0 (0–0)	1.86 ± 2.04	1 (0–3)	< 0.001*
Patient Satisfaction (Scale)	9.33 ± 1.16	10 (9–10)	7.92 ± 2.23	9 (7–10)	< 0.001*
Duration of Epidural Placement (min)	8.61 ± 3.88	9 (6–10)	14.59 ± 7.05	13 (10–19)	< 0.001*
In-Room Anesthesia Ready Time (min)	23.37 ± 6.69	22 (19–28)	37.61 ± 28.07	31 (27–36)	< 0.001*
In-Room Sitting-Up Time (min)	3.67 ± 2.29	3 (2–4)	5.9 ± 3.22	5 (4–7)	< 0.001*
Total OR Time (min)	126.4 ± 29.01	122 (108–144)	144.7 ± 35.77	140 (121–164)	0.004*
Sitting-Up Anesthesia Ready Time (min)	19.69 ± 5.91	18 (16–25)	31.71 ± 27.4	25 (22–32)	< 0.001*

* Denotes statistically significant p-value. ^Height (cm) has $n = 48$ for Ultrasound group.

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 03

PATIENT EXPERIENCE DURING ROUTINE CESAREAN DELIVERY - an interview study

Presenting Author: Fernanda S. SL Oliveira, MD

Presenting Author's Institution: Mount Sinai Hospital, University of Toronto - toronto, Ontario

Co-Authors: Kristi Downey, Msc - Mount Sinai Hospital
zeev friedman, MD - mount sinai hospital, university of toronto
Ronald George, MD FRCPC - Mount Sinai Hospital, University of Toronto
Lada Kordich, MD - Mount Sinai Hospital
Afsheen Nasir, MD - Mount Sinai Hospital

Abstract :

Background: Cesarean delivery is the most common surgical procedure performed worldwide, with 21% of all childbirths occurring via Cesarean delivery. Ninety-four percent of patients undergoing routine Cesarean delivery had neuraxial anesthesia worldwide. This allows patients to experience childbirth alongside their support person. Despite higher maternal satisfaction, there is a high incidence of anxiety associated with being awake while undergoing this procedure. Few studies have explored patients' experiences during routine Cesarean delivery. Studies have been limited to reducing maternal anxiety or pain and have not focused on the maternal experience. Data regarding patients' experiences, specifically related to anesthetic management during Cesarean delivery, is lacking.

Objective: This prospective patient-centred multidisciplinary study aims to explore patients' experiences with anesthetic management before, during and after routine Cesarean delivery.

Methods: After ethics approval and written informed consent, patients who underwent routine, uncomplicated Cesarean delivery underwent a semi-structured interview to obtain baseline demographics and triangulation data and to explore patients' experiences, thoughts, feelings, expectations and concerns regarding their anesthetic management. The study team, which was not involved in the patients' anesthetic management, conducted the interviews. Interviews were audiotaped, transcribed verbatim, and qualitatively analyzed using the thematic analysis approach. Themes were established in an iterative process, and differing views were resolved by discussion amongst the study team.

Results: Twenty-five patients were included, and saturation was reached. Indications for routine Cesarean delivery were: repeat Cesarean delivery, fetal malpresentation, and maternal request. Five themes were discovered in the thematic analysis: (i) Management of physical responses to the surgical impact and anesthesia; (ii) Emotions and their management; (iii) Reassurance through communication; (iv) Effectiveness of the organization; and (v) Team unity. Fear of neuraxial anesthesia and surgical impact was mitigated with effective communication, the presence of a support person, and bonding with the newborn. Pain was not an issue, but the ineffective management of physical responses, such as pressure, to anesthesia and surgery were mentioned as distressing factors.

Conclusions: Overall patients had a positive experience during neuraxial anesthesia for the elective procedure. If we value the patients' experience, anesthetic teams should focus on effective communication with the patient to better address distressing factors during surgery,

emotional management to decrease anxiety, and effective organization of anesthesia and surgery. This study highlights some potential areas for improvement. Future studies will explore the patient experience with anesthetic management in urgent or emergent Cesarean deliveries.

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 04

Risk of Emergent Cesarean Delivery at the time of External Cephalic Version

Presenting Author: Megan Howell, DO

Presenting Author's Institution: The University of Kansas Medical Center - Kansas City, Kansas

Co-Authors: Melissa Bavitz, MD - The University of Kansas Hospital
Sharon Fitzgerald, PhD, MPH - The University of Kansas
Angela Martin, MD - The University of Kansas Medical Center
Grace Shih, MD - The University of Kansas Medical Center

Abstract :

Background The rate of emergency cesarean section (ECS) from a complication related to an External Cephalic Version (ECV) procedure has not recently been evaluated. In prior studies, the ECS rate was estimated to be 0.43% after ECV in low-risk populations. Compared to scheduled cesarean section, ECS is associated with increased length of stay, infections (1), and higher rates of postpartum depression (2, 3). This study aims to review rates of ECS at the time of ECV and identify variables associated with ECS.

Study Design This was a retrospective cohort of patients ≥ 18 years old in a 10-year period (2013 to 2023) who delivered a live infant at The University of Kansas Hospital via an ECV procedure. Patients with a contraindication to vaginal delivery or multiple gestation were excluded.

The primary outcome was ECS at the time of ECV. Maternal demographics and pregnancy complications were collected along with use of terbutaline, use of neuraxial anesthesia during ECV, and location of ECV, and several other variables (table 1).

Descriptive statistics were used to analyze the study sample. Bivariate logistic regression determined which factors were associated with an ECS. Variables with a $p < 0.20$ in the bivariate regression were included in a multivariate model. The ECS rate was calculated by the number of risk factors present.

Results The overall ECS rate at the time of ECV in our high-risk population was 17%. Significant risk factors included gestational age ≥ 39 weeks, no terbutaline use, and neuraxial anesthesia(table 1). Maternal hypertensive disorders were higher in the ECS group with a p-values of < 0.02, and therefore it was considered a risk factor for ECS. We analyzed those variables associated with an increased risk of ECS at time of ECV (gestational age, maternal HTN, use of neuraxial anesthesia, and use of terbutaline) to determine the cumulative ECS risk. The ECS rate in patients with 0 risk factors was 1.72%, 1 risk factor was 11.76%, 2 risk factors was 25.58%, and 3 risk factors was 37.50%.

Conclusion We found several risk factors associated with ECS at the time of ECV including use of regional anesthesia. This deserves further investigation. One hypothesis is that regional anesthesia increased the rate of hypotension and/or fetal bradycardia leading to more ECS, however it was not feasible to look at procedure blood pressure with our study design. A second hypothesis is that neuraxial anesthesia allowed for increased force by physicians performing ECV, leading to increased fetal distress. After further investigation, we will create a guideline for more accurate patient counseling to decrease the rate of an ECS and ultimately perinatal morbidity at a high acuity academic center.

References:

1. JNMA J Nepal Med Assoc. 2013;52(192):563-566.

2. Int J Gynaecol Obstet. 2018;143(3):374-378.

3. Association between mode of delivery and postpartum depression, a systemic review. 2021;55(6):588-601.

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SOAP Table.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 05

Association of patient and clinical characteristics with regional anesthesia without additional medication administration among patients who underwent cesarean delivery: a single center study

Presenting Author: Rachel Hoffman, B.S.

Presenting Author's Institution: Baylor College of Medicine - Temple, Texas

Co-Authors: Diana Villazana-Kretzer, D.O., Ph.D. - Baylor Scott & White Medical Center-Temple
Robert White, M.D., M.S. - Weill Cornell Medicine

Abstract :

Introduction: The American Society of Anesthesiologists Statement on the Use of Adjuvant Medications and Management of Intraoperative Pain During Cesarean Delivery provides guidance on treating inadequate analgesia during cesarean delivery (CD).[1] The primary aim of our study was to determine which variables were associated with regional anesthesia for CD without the use of additional medication.

Methods: Our institutional review board approved this study. Patients who had CD at our hospital from July 1, 2022 to June 30, 2024 who identified as Black or African American only, Hispanic, or White or Caucasian only were included in the final analysis. White race served as the reference category. A study investigator retrieved data from our electronic medical record and entered it into REDCap.

Results: 1730 patients had cesarean deliveries during the study period including 322 Black, 562 Hispanic, and 733 White patients, and were included in the final analysis. Compared to White patients, Black patients had a higher incidence of emergency obstetric indication for cesarean delivery and a lower incidence of receiving regional anesthesia without additional medication. A multivariate logistic regression designed to predict the occurrence of regional anesthesia without additional medication found that emergency obstetric indication was independently associated with regional anesthesia without additional medication (aOR 0.298; 95% CI 0.235-0.378; $p< 0.001$). Black versus White race was not independently associated with regional anesthesia without additional medication (aOR 0.759; 95% CI 0.569-1.013; $p=0.061$).

Discussion: In our bivariate analysis, patients who identified as Black had a statistically and clinically significant lower incidence of regional anesthesia without additional medication for CD when compared to White patients. However, Black race was not independently associated with a decreased chance for regional anesthesia without additional medication in our multivariate logistic regression. Bivariate associations of variables and pain during cesarean delivery should be further examined with multivariate logistic regression analysis. Limitations of this study include that only a few variables were collected for each patient and that it was conducted at a single center.

References:

1. https://www.asahq.org/standards-and-practice-parameters/statement-on-the-use-of-adjuvant-medications-and-management-of-intraoperative-pain-during-cesarean-delivery Accessed on January 23, 2025

Table 1 racial disparities.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 06

Association of patient and clinical characteristics with prolonged cesarean delivery operative time: a single center retrospective study

Presenting Author: Manuel Jagan, B.S.

Presenting Author's Institution: Baylor College of Medicine - Temple, Texas

Co-Authors: Diana Villazana-Kretzer, D.O., Ph.D. - Baylor Scott & White Medical Center-Temple
Robert White, M.D., M.S. - Weill Cornell Medicine

Abstract :
Introduction: The primary aim of this study was to evaluate the association of patient and clinical factors with prolonged cesarean delivery operative times in a single-center population, addressing gaps in the current understanding of risk factors associated with operative duration.

Methods: Our institutional review board approved this study. Patients who had cesarean deliveries at our hospital from July 1, 2023 to June 30, 2024 were included in the study. A study investigator retrieved data from our electronic medical record and entered it into REDCap. We selected patients in the upper and lower quartiles of operative time for comparison and patients in the second and third quartiles of operative time were excluded from the final analysis. We performed a bivariate analysis between the two cohorts and then performed a multivariate logistic regression with variables of interest to determine which characteristics were associated with a longer operative time.

Results: 933 patients had cesarean deliveries at our hospital during the study period. 233 and 222 patients comprised the shorter and longer operative time cohorts, respectively. This preliminary analysis examined 50 and 51 patients in the shorter and longer operative time cohorts, respectively. Patients in the longer operative time cohort had a higher weight, body mass index, gravidity, and parity and were more likely to have had a prior cesarean delivery, prior abdominal surgery, and a tubal ligation at the time of cesarean delivery compared to patients in the shorter operative time cohort. Complete data for the cohorts is presented in Table 1. A multivariate analysis designed to predict placement into the longer operative cohort with the covariates of race/ethnicity, insurance type, area deprivation index, body mass index (BMI), history of cesarean delivery, history of prior abdominal surgery, hypertension of any kind, and tubal ligation performed at time of cesarean delivery determined that BMI was the only variable that independently predicted placement into the longer operative cohort (5 unit increase in kg/m^2) (aOR 2.12; 95% CI 1.40-3.51; $p< 0.01$).

Discussion: BMI was the only variable that was independently associated with longer operative times. Patients in the longer operative time cohort also had higher gravidity, parity, and were more likely to have a history of prior cesarean delivery or abdominal surgery. These findings are consistent with previous studies linking increased BMI to longer operative times.[1] Notably, race and socioeconomic status were not associated with prolonged operative times. A limitation of this study was that it was conducted at one institution and represents an incomplete dataset.

References: 1.Girsen AI et al. Body mass index and operative times at cesarean delivery.

Obstet Gynecol 2014;124:684-689

Table 1 .pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 07

Association of patient characteristics with failed activation of labor epidural catheters for intrapartum cesarean deliveries: a retrospective single center study

Presenting Author: Ritesh Dontula, B.S.

Presenting Author's Institution: Baylor College of Medicine - Irving, Texas

Co-Authors:

Abstract :

Introduction

A previous meta-analysis found that an increased number of rescue analgesia boluses, urgency, and non-obstetric anesthesiologist providing care were associated with failed labor epidural catheter activation.[1] The primary aim of our study was to determine risk factors for failed activation of indwelling labor epidural catheters at our hospital.

Methods

This study was approved by our institutional review board. Patients who had cesarean deliveries from July 1, 2019 – December 31, 2023 at our hospital who had activation of an indwelling labor epidural catheter for an unscheduled intrapartum cesarean delivery were included. A study investigator retrieved patient demographic, physical, and clinical data from our electronic medical record. Failed activation was defined as conversion to general anesthesia with an endotracheal tube. At our hospital, anesthesiologists either activate indwelling labor epidural catheters for intrapartum cesarean delivery or remove them in the operating room and perform a new neuraxial anesthetic technique. We performed a bivariate analysis comparing patients who did and did not have failure of labor epidural catheter activation along with a multivariate logistic regression to determine which variables were associated with activation failure.

Results

There were 455 and 415 patients who had activation and removal of labor epidural catheters, respectively. Patients who had failed activation were younger, had lower parity, and were more likely to have had a labor epidural catheter replaced for poor function. A multivariate logistic regression found that epidural catheter replacement (adjusted odds ratio (aOR) 3.03, 95% CI 1.21-7.63; p=0.02) and emergency obstetric indication for cesarean delivery (aOR 5.12, 95% CI 2.25-11.67; p< 0.01) were associated with failure of activation. Number of rescue boluses during labor was not associated with failure of activation (aOR 0.99, 95% CI 0.95-1.04; p=0.69).

Discussion

A previous meta-analysis determined that increased number of rescue analgesia boluses was associated with activation failure.[1] However, we did not find an association between number of

rescue analgesia boluses and failure. We attribute this finding to our practice of removing poorly functioning labor epidural catheters in the operating room and attempting a new neuraxial technique. We did, however, find an association between prior replacement of a poorly functioning catheter and activation failure and this may be a surrogate marker for technical difficulty. A limitation of our study is our practice of frequently removing less than optimal labor epidural catheters in the operating room for intrapartum cesarean deliveries and this may make our results less generalizable to other institutions.

References:

1. Bauer ME, et al. Risk factors for failed conversion of labor epidural analgesia to cesarean delivery anesthesia: a systematic review and meta-analysis of observational trials. Int J Obstet Anesth. 2012;21:294-309

Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 08

Association of patient demographic, physical, and clinical characteristics with prolonged bladder catheterization time following cesarean delivery: a single center study

Presenting Author: Jacqueline Schuster, M.D.

Presenting Author's Institution: Baylor Scott & White Medical Center-Temple - Temple, Texas

Co-Authors: Joanna Stacey, M.D. - Baylor Scott & White Medical Center-Temple

Abstract : **Introduction**: Prolonged bladder catheterization following cesarean delivery is a clinical concern associated with increased risks of urinary tract infections, patient discomfort, delayed recovery, and prolonged hospital stays.1 The primary aim of the study is to identify patient characteristics associated with prolonged bladder catheterization.

Methods: Our institutional review board approved this study. Patients who had cesarean delivery with single injection spinal or combined spinal anesthesia and who did not attempt labor from January 1, 2023 to December 31, 2023 were screened. Patients in the top one third and bottom one third of bladder catheterization times were included in the final analysis. Patients in the middle third of bladder catheterization times were excluded from analysis.

Results: These results represent 40% of the intended data collection. 49 and 44 patients were in the longer and shorter bladder catheterization time cohorts, respectively. Patients in the longer bladder catheterization time cohort received a lower dose of intrathecal morphine and had their cesarean delivery performed earlier in the academic year compared to patients in the shorter bladder catheterization cohort. Complete data for the cohorts are presented in Table 1. We performed a multivariate regression analysis designed to predict placement in the longer bladder catheterization cohort that used the covariates of height, month of academic year, anesthesia technique, intrathecal morphine, and quantitative blood loss. We determined that a two month increase in month of academic year dose was the only variable independently associated with placement into the longer bladder catheterization cohort (aOR 0.18 (95% CI 0.09-0.36; p< 0.01).

Discussion: We found that having a cesarean delivery two months later in the academic year was associated with an approximately 80% reduction in the chance of being in the longer bladder catheterization cohort. This may be due to an improvement in technique or resident education as the academic year progressed. Limitations of this study include incomplete intended data collection and that two residency cohorts were represented in the study.

References: 1. Macones GA, et al. Guidelines for postoperative care in cesarean delivery: Enhanced recovery after surgery (ERAS) society recommendations (part 3). American Journal of Obstetrics and Gynecology 2019;221:247.e1-247

Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 09

Prenatal care and cervical insufficiency surveillance stratified by race: a single-center retrospective study

Presenting Author: Marissa Rosa, B.S.

Presenting Author's Institution: Baylor College of Medicine - Temple, Texas

Co-Authors: Diana Villazana-Kretzer, D.O., Ph.D. - Baylor Scott & White Medical Center-Temple

Abstract :

Introduction: Preterm birth (PTB) occurs before 37 weeks gestation and contributes significantly to maternal and neonatal morbidity and mortality. Given these negative implications, PTB prevention is an opportunity to improve health outcomes. Historically, prior PTB has been used to predict future PTB risk, but more than 50% of PTB cases occur in nulliparous women, leading to greater use of obstetrical history and cervical length screening (CLS). Furthermore, ACOG recommends CLS and monitoring in individuals with a PTB history.[1] However, this recommendation requires early access to prenatal care, which is often challenging for women of color, who are more likely to experience barriers to accessing prenatal care. As such, we propose a retrospective study hypothesizing that Hispanic or Black patients will have lower rates of recommended levels of care (e.g., CLS) compared to White patients.

Methods: Our institutional review board approved this study. The final analysis included patients who delivered at our hospital from January 1, 2023, to December 31, 2023, and identified as Black, Hispanic, or White. A study investigator retrieved data from our electronic medical record and entered it into REDCap.

Results: These results represent approximately 50% of the intended data collection. 990 patients delivered, and 154, 322, and 452 patients identified as Black, Hispanic, or White, respectively. There were 53 (11.7%) White patients who had initial prenatal appointments after 24 weeks gestation, which was less than 35 (22.7%) Black patients ($p< 0.001$) and 71 (22.0%) Hispanic patients ($p< 0.001$). Among patients who had initial appointments before 24 weeks gestation, Black and Hispanic patients had their initial prenatal appointment at a greater gestational age than White patients. Additionally, Hispanic patients had initial ultrasounds at a greater gestational age than White patients, and both Black and Hispanic patients were more likely to have their first ultrasound exam in the emergency department compared to White patients. Among patients with histories indicating the need for CLS, transvaginal ultrasounds were performed at similar frequencies stratified by race. Complete results for patients who had initial prenatal visits before 24 weeks gestation are included in Table 1.

Discussion: This study found that Black and Hispanic patients are more likely to access prenatal care later and seek prenatal care (i.e., ultrasounds) at emergency departments compared to White patients. Although TVUS rates did not vary by race or ethnicity for those with histories indicating CLS, fewer than half of patients with PTB histories received recommended PTB screenings. These findings align with existing literature indicating women of color have delayed access to prenatal care and highlight the need for improved PTB risk identification.

References: 1. Prediction and Prevention of Spontaneous Preterm Birth: ACOG Practice Bulletin, Number 234. (2021). Obstet Gynecol, 138(2), e65–e90.

Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 10

Labor epidural catheter administration of lidocaine for intrapartum cesarean delivery: incidence of exceeding recommended dosages based on ideal body weight at a single center

Presenting Author: Taylor Hartshorne, B.S.

Presenting Author's Institution: Baylor College of Medicine - Temple, Texas

Co-Authors: Michael Fettiplace, M.D., Ph.D. - University of Illinois at Chicago
Russell McAllister, M.D. - Baylor Scott & White Medical Center-Temple

Abstract :
Introduction: The incidence of exceeding recommended lidocaine dosing guidelines[1] for patients who have activation of indwelling labor epidural catheters for intrapartum cesarean deliveries is unknown. We conducted a retrospective observational chart review to determine the incidence of potential lidocaine toxicity based on ideal body weight (IBW).

Methods: Our institutional review board approved this study. Patients who had administration of lidocaine through an epidural catheter for intrapartum cesarean deliveries at our hospital from July 1, 2019 to June 30, 2024 were included in our study. Patients who received epinephrine or bicarbonate with lidocaine were excluded. A study investigator retrieved data from our electronic medical record and entered it into REDCap. We considered a patient who received more than 4.5 mg/kg based on ideal body weight to have exceeded recommended dosing guidelines.[1]

Results: 503 patients were included in the final analysis. 417 (83%) and 235 (47%) patients received more than 4.5 mg/kg and 7.0 mg/kg of lidocaine administered through their epidural based on IBW, respectively. Patients in the high lidocaine dose cohort were less likely to have an emergency obstetric indication for cesarean delivery, less likely to have conversion to general anesthesia, had a lower parity, and a longer time from last epidural catheter placement to entering the operating room and time from entering the operating room to skin incision compared to patients in the low dose cohort. Complete data for the cohorts are presented in Table 1.

Discussion: Our findings suggest that lidocaine toxicity poses a risk for a broad patient population and occurs with considerable frequency. Most patients in our study exceeded the recommended lidocaine dose of 4.5 mg/kg without epinephrine and almost half exceeded the 7.0 mg/kg dose with epinephrine.[1] Surprisingly, a high body mass index was not associated with increased risk of exceeding recommended lidocaine dosing guidelines based on IBW. Inverse correlation between high lidocaine dose and emergency obstetric indication for cesarean delivery suggests that patients with an emergency obstetric indication for cesarean delivery had prompt conversion to general anesthesia after a brief attempt at epidural catheter activation. Our study was not sufficiently powered to detect the incidence of local anesthetic toxicity. Future work in lidocaine dosing for labor epidural activation may involve seeking multidisciplinary consensus to use lidocaine that contains epinephrine unless contraindicated and to potentially administer a higher dose of lidocaine based on IBW than what is currently recommended.

References: 1. Pfizer. Lidocaine Hydrochloride Injection, USP 2% Single Dose Vial Dosage

and Administration. https://www.pfizermedicalinformation.com/lidocaine Accessed on January 19, 2025

Table 1 epi last.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 11

Survey on Post-Cesarean Section Analgesia in Mainland China: Clinical Database Project by the Chinese Medical Association Obstetric Anesthesia Group

Presenting Author: NA ZHAO, MD

Presenting Author's Institution: BEIJING OBSTETRICS AND GYNECOLOGY HOSPITAL, CAPITAL MEDICAL UNIVERSITY - BEIJING, Beijing

Co-Authors: mengbi jiang, MD - Three Gorges Univ, Inst Anesthesiol & Crit Care Med; Yichang Cent Peoples Hosp
HONGBAO TAN, MD - The Fourth Hospital of Changsha(Integrated Traditional Chinese and Western Medicine Hospital of Changsha, Changsha Hospital of Hunan Normal University)
Xin Xin, n/a - Department of Anesthesiology, Zhengding Union Hospital
LI YUAN, MD - Affiliated Hospital of Qingdao University
GUOSHENG ZHAO, MD - BEIJING OBSTETRICS AND GYNECOLOGY HOSPITAL, CAPITAL MEDICAL UNIVERSITY

Abstract :
Background: Post-cesarean section pain ranges from moderate to severe and is crucial for effective postpartum recovery. The vast geography and economic disparities across different regions lead to considerable variations in the standards and quality of post-cesarean analgesia. This study conducts a prospective survey to explore these variations and enhance understanding of analgesic practices following cesarean sections.

Methods: With ethical approval, this study draws on data from the "Survey of the Status and Related Complications of Obstetric Anesthesia in Mainland China," managed by the Chinese Medical Association Obstetric Anesthesia Group. As of November 31, 2024, the database has collected data from 2,492 cesarean sections across 29 hospitals, including general and specialized maternity hospitals. It records details on analgesia methods, medication formulations, analgesic efficacy from day 1 to 3 post-operation, and adverse reactions.

Results: Patient Controlled Analgesia (PCA) pumps were the primary method of post-cesarean section analgesia, used in 2,226 cases, with 77.76% using intravenous and 22.10% using epidural routes. Subarachnoid space routes were rarely used (3 cases). Epidural morphine was administered to 16.87% of women undergoing cesarean sections. Detailed postoperative pain scores and additional analgesic requirements are documented in Table 1. The incidences of nausea and vomiting in PCA users were 4.69%, and skin itching was 3.28%.

Intravenous PCA formulations typically included sufentanil with adjunct analgesics (like buprenorphine and dexmedetomidine), and antiemetics, whereas epidural formulations mainly used sufentanil with ropivacaine or ropivacaine alone.

The average dosage of epidural morphine was 1.9 ± 0.29 mg, peaking at 3 mg. Patients receiving epidural morphine experienced significantly lower pain scores during rest from day 1 to 3 post-operation, with no notable difference in movement pain or additional analgesic needs on days 1 and 2 post-operation. Epidural morphine was associated with an increased incidence of adverse reactions, including itching, nausea, and vomiting.

Non-steroidal anti-inflammatory drugs (NSAIDs) were the preferred postoperative rescue analgesics, with diclofenac, flurbiprofen ester, and indomethacin being the top choices. Only 11 patients received nerve block analgesia, specifically through transversus abdominis plane block.

Conclusion: In Mainland China, PCA pumps, especially via the intravenous route, are predominant for managing post-cesarean pain. However, there are significant differences in analgesic techniques and medication usage across the nation. Despite the recommendations for morphine in various guidelines, its use is limited in many regions. This observation highlights the need for further standardization of obstetric anesthesia practices nationwide.

References: None.

Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 12

Validation of the Chinese Version of the ObsQoR-10 questionnaire for the evaluation of recovery after delivery: A Prospective Observational Study

Presenting Author: NA ZHAO, MD

Presenting Author's Institution: BEIJING OBSTETRICS AND GYNECOLOGY HOSPITAL, CAPITAL MEDICAL UNIVERSITY - BEIJING, Beijing

Co-Authors:

Abstract :

This prospective observational study was designed to validate the reliability, validity, and cultural adaptability of the Chinese version of the Obstetric Quality of Recovery-10 (ObsQoR-10) questionnaire for assessing postpartum recovery among parturients in mainland China. A total of 106 post-anesthesia parturients were recruited from the Beijing Obstetrics and Gynecology Hospital affiliated with Capital Medical University. Their postpartum recovery was evaluated using the ObsQoR-10 questionnaire.

The results demonstrated that the Chinese version of ObsQoR-10 exhibited a positive correlation with the Global Health Numerical Rating Scale (GH-NRS) ($r = 0.505$, $P < 0.001$). The questionnaire achieved a Cronbach's alpha coefficient of 0.810 and an Intraclass Correlation Coefficient (ICC) of 0.875, both indicating excellent internal consistency and reliability. Additionally, the Kaiser-Meyer-Olkin (KMO) value was 0.733, and Bartlett's test of sphericity was significant ($\chi^2 = 496.416$, $df = 45$, $P < 0.001$), confirming the high construct validity of the questionnaire.

Notably, parturients scored relatively higher in independent activities and emotional state but lower in the ability to independently care for their newborns. This discrepancy may be attributed to cultural practices and differences in postpartum analgesic regimens. Despite limitations such as a relatively small sample size and single-center design, this study has confirmed that the Chinese version of ObsQoR-10 is a reliable and valid tool for assessing the quality of postpartum recovery in post-anesthesia parturients in mainland China. It provides a foundation for optimizing clinical practices related to obstetric anesthesia.

Future research should focus on expanding the sample size and conducting multicenter studies to further refine the assessment items of the ObsQoR-10 questionnaire. This will enhance its accuracy in reflecting the recovery status of parturients and better accommodate the unique clinical and cultural contexts in mainland China.

References:

产妇姓名：

产妇产后恢复质量调查表(24 小时)

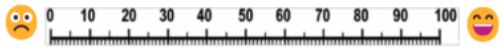
编号：_____

日期：_____/_____/_____时间：_____:____

请问您过去 24 小时感受如何？请打分（打分范围：0-10 分）

		非常不同意									非常同意
		0	1	2	3	4	5	6	7	8	9	10
1	我曾经感到过疼痛											
2	我有过恶心或（和）呕吐											
3	我有过头晕的症状(根据时间和程度综合评判)											
4	我有过发抖的情况(根据时间和程度综合评判)											
		非常不同意									非常同意
		0	1	2	3	4	5	6	7	8	9	10
5	我感觉舒适											
6	我能独立活动											
7	我能在无人帮忙的情况下自己抱孩子（主观认为自己是否有能力，不一定有行动）											
8	我能在无人帮忙的情况下自己喂奶主观认为自己是否有能力，不一定有行动）											
9	我可以自己一个人上厕所											
10	我感觉情绪可以自控											

注：各个题目采用 0-10 分计分方式，前四个问题在最后计分时需将患者实际评分进行转换，换算公式为 10-患者实际评分=最终计分；后六题计分为患者实际评分，最后得分为每道题分数相加，总分为 0-100 分，分值越高，产后恢复质量越好。

感觉健康情况很差  **感觉健康情况很棒**

请你根据以上标尺↑给过去 24 小时内的自我情绪状态评分：_____

注：使用全球健康数值评定量表(GH-NRS)来衡量产妇的总体健康状况，该量表用 100 毫米的线表示，在每一端标有锚点，从“感觉健康情况很差”到“感觉健康状情况很棒，以及“悲伤”或“快乐”的程式化面部表征。

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 13

Toggling with the Tone: How does parity affect required MAC during fetoscopic myelomeningocele repairs?

Presenting Author: Claire Naus, MD

Presenting Author's Institution: Texas Children's Hospital/Baylor College of Medicine - Houston , Texas

Co-Authors: Rebecca M. Johnson, MS - Baylor College of Medicine
David Mann, MD DBe - Baylor College of Medicine/Texas Children's Hospital

Abstract :

Background: Profound uterine relaxation is a key anesthetic consideration during mid-gestation open fetal interventions, such as fetal myelomeningocele (MMC) repairs, with early protocols calling for very high levels of volatile anesthesia (2-3 MAC) in the intraoperative period.[1,2] Advances in surgical technique have led to fetoscopic approaches that require significantly less uterine relaxation[3,4] and have actually raised questions of whether too much relaxation may lead to overdistension of the uterus in these cases. Studies[5,6] showing that the myometrium has “memory” led us to hypothesize that, when holding other tocolytics constant, the amount of volatile anesthetic for adequate uterine relaxation may differ for nulliparous and parous patients.

Methods: We performed a retrospective study to examine the relationship between volatile anesthesia requirement and parity. We reviewed the anesthetic records of all patients undergoing fetoscopic MMC repair at our institution over a four-year period from January 2020 through January 2024. A two-sided, unpaired t-test was used to compare the maximum MAC values between nulliparous (P0) patients and parous (P≥1) patients. Data are presented as means for each group, and statistical analysis was performed with GraphPad Prism 10 with $p < 0.05$ considered significant.

Results: During the study period, we completed 100 fetoscopic MMC repairs. 36 patients were nulliparous (P0), and 64 patients had delivered one or more babies previously (P≥1). We found that the maximum MAC required for adequate uterine relaxation was significantly higher for the nulliparous patients compared to those who had previously given birth with an average maximum MAC of 1.32 for the P0 patients and 1.18 for the P≥1 patients (CI -0.227 to -0.046, $p=0.003$).

Discussion: An ideal tocolytic approach is one that provides enough (but not too much) uterine relaxation during key surgical steps, such as port placement, while minimizing the total dose to avoid potential associated deleterious effects, including hemodynamic instability for both fetal and maternal patients as well as the theoretical risk of anesthetic neurotoxicity. Our findings demonstrate that parity may be an important factor in predicting the amount of tocolytic medications, such as volatile anesthesia, required for optimal uterine relaxation during fetoscopic MMC repairs.

References:

1. Ferschl M et al. *Anesthesiology*. May 2013;118(5):1211-23.
2. Hoagland MA et al. *Paediatr Anaesth*. Apr 2017;27(4):346-357.
3. Belfort MA et al. *Obstet Gynecol*. Apr 2017;129(4):734-743.
4. Manrique S et al. *Eur J Anaesthesiol*. Mar 2019;36(3):175-184.
5. Cahill AG et al. *JAMA Netw Open*. Jun 1 2022;5(6):e2214707.
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SOAP_MAC&Parity.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 14

The Super Obese Parturient: Hemodynamic Risks And Cesarean Section Outcomes – A Retrospective Cohort Study

Presenting Author: Sijules Abongwa, DO

Presenting Author's Institution: University of Alabama at Birmingham - Birmingham, Alabama

Co-Authors: Ayesha Bryant, MD - 1251283
Michael Froelich, M.D.,M.S. - University of Alabama at Birmingham
Andrew Hackney, MD - UAB Heersink School of Medicine

Abstract :

Background: Obesity during pregnancy is associated with several anesthesia risks including difficult intravenous access, complex airway management, challenging neuraxial placement, and increased rates of neuraxial anesthesia failure.[1]Cesarean deliveries performed under neuraxial anesthesia in morbidly obese (BMI >40) are associated with prolonged operative times, higher sensory block levels, and an increased incidence of maternal hypotension.[3] There is paucity of data quantifying these concerns in super obese parturient with BMI >50. Such data are critical for optimizing anesthetic strategies and minimizing perioperative complications in this high-risk population.

Methods: This retrospective cohort study consists of data from 600 patients who underwent scheduled cesarean deliveries at a large academic medical center under neuraxial anesthesia. Data were stratified into six BMI categories; 100 patients in each group: Normal weight (18.5–24.9), Overweight (25–29.9), Obese Class I (30–34.9), Obese Class II (35–39.9), Obese Class III (≥40-49.9), and Super-obese (≥50). Primary outcomes included hemodynamic instability determined by maximum and minimum arterial blood pressure variability over time, vasopressor use, total surgical time, time from uterine incision to delivery, and estimated blood loss (EBL). The chi-square test, ANOVA, Kruskal-Wallis test, and multivariate regression analysis were performed using SPSS.

Results: Super Obese individuals were prone to more hemodynamic instability after neuraxial administration, they required 30% higher total phenylephrine usage and demonstrated ($p < 0.05$, Figure 1). Total phenylephrine dose, and maximum and minimum blood pressure variance remained statistically significant on multivariate analysis. A significant linear relationship was observed between BMI and prolonged surgical time ($p < 0.01$), with super-obese patients averaging a 25% longer than those with normal BMI. Time from uterine incision to delivery increased with BMI ($p < 0.05$), with the super-obese group demonstrating delays associated with higher neonatal morbidity risks. Estimated Blood Loss increased with BMI class, with super-obese patients exhibiting a 40% higher mean EBL than normal BMI counterparts ($p < 0.05$).

Conclusion: Super obese individuals are at significant risk for several perioperative complications and tailored anesthetic and surgical management strategies should be employed to mitigate risks in obese populations.

References:

1. Nivatpumin P, Lertbunnaphong T, Maneewan S, et al. Comparison of perioperative outcomes and anesthetic-related complications of morbidly obese and super-obese parturients delivering by cesarean section. Ann Med. 2023;55(1):1037-1046.
2. Marcio Luiz Benevides, Anne Karoline Coutinho Borges, Luiz Fernando et al. Body Mass Index and Clinical Outcomes During Cesarean Section Under Spinal Anesthesia. Int J Anesth Clin Med. 2022;10(2):44-51.

SOAP abstract Super Obesity Figure 1.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 15

A retrospective analysis of obstetric anesthesia for postpartum tubal ligation procedures

Presenting Author: Naida M. Cole, MD

Presenting Author's Institution: The University of Chicago - Chicago, Illinois

Co-Authors: Allyson Dewey, BS - The University of Chicago Pritzker School of Medicine
Chuanhong Liao, MS - The University of Chicago
Sarah Nizamuddin, MD - The University of Chicago
Caroline Thomas, MD - University of Chicago

Abstract :

Background:

Prior studies suggest high neuraxial anesthetic failure rates in patients undergoing postpartum tubal ligation (PPTL).[1,2] One recent retrospective analysis found 9% of labor epidural catheter reactivations and 6% of de novo spinal anesthetics failed, necessitating repeat neuraxial block or conversion to general anesthesia.[3] While the etiology of high neuraxial anesthesia failure for PPTL is unknown, failure rates are higher than for cesarean delivery. We hypothesized that rates of neuraxial anesthesia failures may differ by institution. We aim to shed more light on rates of neuraxial anesthesia failures, contributory factors, and their potential effects on patient safety.

Methods:

This was a retrospective analysis of patients undergoing PPTL after vaginal delivery at a single academic institution between 2013-2023. Demographic, obstetric, and anesthetic characteristics were compared in patients with successful and failed neuraxial blocks. The primary outcome was the failed neuraxial block rate (i.e. neuraxial block replacement or conversion to general anesthesia).

Results:

Of 549 patients who underwent PPTL, 527 (96%) were performed under successful neuraxial anesthesia. 504 (91.8%) were performed after successful labor epidural catheter reactivation and 23 (4.2%) after de novo spinal anesthetic block. Of the 22 neuraxial block failures, 14 (64%) were unsuccessful epidural catheter reactivations and 9 (36%) were de novo spinal anesthetics. Nine patients (1.6%) required general anesthesia. Neuraxial block failure was associated with lower weight/BMI (failed neuraxial block median (weight, BMI): 76.8 kg, BMI 25 (kg/m2); successful de novo spinal 82.1kg, BMI 33; successful epidural catheter reactivation 85.3, BMI 32, $p < 0.05$) (Table 1). There were no significant differences in race or ethnicity, maternal age, gestational age, height, gravidity, or insurance status amongst patients with failed versus successful neuraxial blocks.

Discussion:

Neuraxial anesthesia failure rates at a single institution over 10 years for PPTL (4%) were lower than previously reported. We postulate that population characteristics such as patient weight or BMI, practice variability, and epidural dosing strategies may, in part, explain differences in neuraxial failure rates across institutions. Limitations to this study include lack of assessment of rates of deep sedation for PPTL. Future analysis of this data is planned to

explore potential contributory factors to failed neuraxial anesthesia for PPTL and will include both the assessment of deep sedation rates and rates of umbilical sparing, caused by alternative embryological innervation of the umbilicus, which can be resolved with subcutaneous local anesthesia around the umbilicus.

References:
1. Viscomi PMID 7576672
2. McKenzie PMID 28985581
3. Ansari PMID 38508961

Table 1.2.pdf

Abstract #: FRI - RA - BS 2 - BR 1 - Cesarean Delivery – 16

The Effect of Sugammadex Administration During Cesarean Section on Lactation Success in Term or Near-Term Pregnant Patients

Presenting Author: Shayna Levine, MD

Presenting Author's Institution: McGaw Medical Center of Northwestern University - Chicago, Illinois

Co-Authors: Hande Bilen, MD - Emory University School of Medicine
Ines Debbiche, BS - Northwestern University Feinberg School of Medicine
Preet Mohinder M. Singh, n/a - Washington University, St Louis

Abstract :

Introduction

Although sugammadex is widely accepted as superior to neostigmine for reversal of neuromuscular blockade, simulation-based modeling suggests that sugammadex may bind to progestogen, a synthetic form of progesterone, with questionable impact on breastfeeding.[2] For this reason, the Society for Obstetric Anesthesia and Perinatology (SOAP) released a statement in 2019 recommending avoidance or cautious use of sugammadex in patients at or near term pregnancy.[3] The LATCH scoring system is an internationally validated tool that provides a numerical assessment of breastfeeding, with a score greater than seven corresponding with successful breastfeeding and majority intake of breast milk.[1] We hypothesized that sugammadex exposure during cesarean would not negatively impact breastfeeding success.

Methods

We performed a retrospective chart review of pregnant women exposed to sugammadex during cesarean delivery from January 2019 through January 2024 at our institution. Inclusion criteria were pregnant women undergoing cesarean delivery under general anesthesia who received sugammadex. Exclusion criteria included preterm delivery (< 37 weeks gestational age), NICU admission, patients under 18 years of age, gestational or pre-existing diabetes, polycystic ovarian syndrome, and obesity defined as a body mass index greater than 40 kg/m^2. The primary outcome was breastfeeding success measured by LATCH scores. We also collected subjective assessments of breastfeeding success from lactation consult and nursing notes. Additionally abstracted data included demographics, medical and surgical history, obstetric outcomes, delivery and procedural data, and complications. Descriptive statistics were performed using SPSS 24 (IBM Inc, Chicago, IL).

Results

Out of approximately fifteen thousand cesarean deliveries screened for inclusion, sixty-three patients receiving general anesthesia and sugammadex were identified, of which thirty had at least one LATCH score documented in their medical record prior to discharge. Fifteen patients were ultimately analyzed after screening for exclusion criteria. The mean latch score in the remaining patients was 8.07 (SD 1.19).

Conclusions

This study represents, to our knowledge, the first dataset describing lactation success in patients exposed to sugammadex. Although limited by small sample size and unreliable reporting of LATCH scores, our results did not suggest an adverse impact of sugammadex on breastfeeding, and also identified postpartum LATCH scoring as an area for quality improvement.

References:
1.Altuntas, Nilgun, et al. “LATCH Scores and Milk Intake in Preterm and Term Infants: A Prospective Comparative Study.” *Breastfeed Med*, vol. 10, no. 2, 2015, pp. 96–101
2. EMA. Annual report of the European Medicines Agency. 2008.
3. Willett AW BA, Togioka B, Bensadigh B, Hofer J, Zakowski Z. SOAP statement on sugammadex during pregnancy and lactation. April 22, 2019.

Final_SugammadexSOAPabstract.pdf

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 01

Comparison the Dose-response of Ropivacaine for Labor Analgesia Initiation with Dural Puncture Epidural and Standard Epidural Techniques: A Prospective Randomized Dose Allocation study.

Presenting Author: Haiya Yan, n/a

Presenting Author's Institution: Ningbo University Affliated Women and Children Hospital - Ningbo, Zhejiang

Co-Authors: Fei Xiao, n/a - Jiaxing University Affiliated Women and Children Hospital

Abstract :

Background: The dural puncture epidural (DPE) technique, has been shown a greater anesthetic drug-sparing effect in some studies. However, the dose-response relationship of ropivacaine for labor analgesia when initiating with the DPE technique remains unclear. In this study, we assessed and compared the dose-response relationship of ropivacaine for labor analgesia when initiated with either the DPE technique or the standard epidural technique in parturients.

Methods: Two hundred and fifty parturients requiring neuraxial labor analgesia were recruited and randomly allocated to receive either the DPE technique or the standard epidural technique as the initial analgesia modality. A loading dose of 20 mL of the study medication was administered, followed by an assessment of the NRS pain score 20 minutes post-administration. Effective analgesia was defined as achieving an NRS pain score < 3 within 20 minutes following the administration of the initial dose. The ED50 and ED90 values of epidural ropivacaine for labor analgesia were determined using probit analysis, and comparisons were made utilizing the relative median potency ratio.

Results: The ED50 and ED90 values of ropivacaine for labor analgesia were 19.2 mg (95% CI: 17.0-21.8 mg) and 31.1 mg (95% CI: 27.1-39.2 mg) when using the standard epidural technique, respectively. In contrast, these values were 18.6 mg (95% CI: 16.4-21.1 mg) and 30.5 mg (95% CI: 26.6-38.3 mg) when using the DPE technique. The relative median potency ratio for ropivacaine in patients initiated with DPE verse standard epidural technique was -0.6 (95% CI -4.0- 2.6), which showed no difference in potency between two groups.

Conclusion: Our findings indicate that there is no evidence of a dose-sparing effect when using the dural puncture epidural technique as an initial component in epidural labor analgesia.

References:

1. Wilson SH, Wolf BJ, Bingham K, et al. Labor analgesia onset with dural puncture epidural versus traditional epidural using a 26-gauge whitacre needle and 0.125% bupivacaine bolus: a randomized clinical trial. *Anesth Analg* 2018;126:545–51.

2. Cappiello E, O'Rourke N, Segal S, et al. A randomized trial of dural puncture epidural technique compared with the standard epidural technique for labor analgesia. *Anesth Analg* 2008;107:1646–51.

3. Chau A, Bibbo C, Huang C- C, et al. Dural puncture epidural technique improves labor analgesia quality with fewer side effects compared with epidural and combined spinal epidural techniques: a randomized clinical trial. *Anesth Analg* 2017;124:560–9. 4. Song Y, Du W, Zhou S, et al. Effect of dural puncture epidural technique combined with programmed intermittent epidural bolus on labor analgesia onset and maintenance: a randomized controlled trial. *Anesth Analg* 2021;132:971–8.

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 02

Effect of Epidural Catheter Design on Analgesic Efficacy During Programmed Intermittent Epidural Boluses: A Randomized Double-Blinded Controlled Trial

Presenting Author: Weijia Du

Presenting Author's Institution: Obstetrics and Gynecology Hospital of Fudan University - Shanghai, Shanghai

Co-Authors:

Abstract :

Background: Our previous *in viro* study[1] and subsequent clinical trial[2] demonstrated that drug distribution and analgesic efficacy differ between single- and multi-orifice catheters under various rates of programmed intermittent bolus administration. This study aimed to compare analgesic outcomes between single- and multi-orifice epidural catheters at a 360-mL/h delivery rate during programmed intermittent epidural bolus (PIEB). We hypothesized that single-orifice catheters would improve labor analgesia and reduce ropivacaine consumption.

Methods: From July to September 2023, 102 parturients were randomized to receive labor analgesia via either single- or multi-orifice catheters. Epidural analgesia was initiated and maintained with a solution of 0.1% ropivacaine with 0.3 μg/mL of sufentanil. The PIEB volume was 10 mL administered every 45 min at a delivery rate of 360 mL/h. The primary outcome was ropivacaine consumption per hour, calculated as the total amount of ropivacaine administered divided by the duration of labor analgesia (mg/h).

Results: Median ropivacaine consumption per hour was not significantly different: 12.6 mg/h (11.6–13.2 mg/h) for single-orifice vs. 12.8 mg/h (12.3–13.3 mg/h) for multi-orifice catheters (difference 29 %; 95% confidence interval, –10.2 to 68.2%; P = 0.241, Figure 1). No significant differences were found in patient-controlled epidural analgesia (PCEA) boluses requested and delivered, time to first PCEA bolus request and the number of clinician-administered boluses. However, adequate analgesia at 20 min was higher with single-orifice catheters (84.0% vs. 63.5%, difference 22.5 %; 95% confidence interval: 9.2%–35.1%, P = 0.019). Median times to adequate analgesia were 8 min (4–16) vs. 15 min (9.5–22.5) for single- and multi-orifice catheters (P = 0.002). Pain scores differed only at 6 and 18 min. There were no differences in the incidence of motor or unilateral block, side effects, maternal satisfaction and catheter-related complications between the two groups.

Conclusions: Single-orifice catheters did not enhance analgesia quality during labor maintenance under a 360-mL/h delivery rate of PIEB but were linked to more rapid analgesic onset than multi-orifice catheters.

References:

1、Du W, Song Y, Zhao Q, Xu Z, Liu Z. The effect of open-end versus closed-end epidural catheter design on injection pressure and dye diffusion under various programmed intermittent epidural delivery rates: an in vitro study. Int J Obstet Anesth 2022;51:103252.

2、 Yi J, Li Y, Yuan Y, Xu Z, Song Y, Ye B, et al. Comparison of labor analgesia efficacy between single-orifice and multi-orifice wire-reinforced catheters during programmed intermittent epidural boluses: a randomized controlled clinical trial. Reg Anesth Pain Med 2023;48:61-6.

Fig 1.pdf

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 03

Comparison of Analgesia Efficacy between Single-Orifice and Multi-Orifice Wire-Reinforced Catheters for Labor Analgesia with the Dural Puncture Epidural Technique: A Randomized Controlled Trial

Presenting Author: Weijia Du

Presenting Author's Institution: Obstetrics and Gynecology Hospital of Fudan University - Shanghai, Shanghai

Co-Authors:

Abstract :

Background: Single-orifice catheters outperformed multi-orifice catheters in terms of faster analgesic onset, lower local anesthetic consumption, and reduced patient-controlled epidural analgesia (PCEA) with conventional labor epidural analgesia[1]. However, whether this effect persists in dural puncture epidural (DPE) technique remains unclear. This prospective, double-blind, randomized study was designed to compare analgesic outcomes between single-orifice and multi-orifice wire-reinforced catheters after a DPE for labor analgesia.

Methods: Between August 30, 2024, and October 27, 2024, healthy, nulliparous women with singleton pregnancies, cervical dilation of 2–5 cm, and requesting neuraxial analgesia were randomized to receive either single-orifice or multi-orifice catheters. Epidural analgesia was initiated and maintained with 0.1% ropivacaine and 0.3 μg/mL sufentanil, with programmed intermittent epidural boluses (PIEB) set to 8-mL administered every 40 min at a rate of 360 mL/h. In addition to the programmed bolus, all study participants received PCEA boluses (8 mL) with a 20-min lockout interval between PCEA or PIEB/PCEA boluses. The primary outcome was the percentage of parturients in the two groups with adequate analgesia 20 min after the initial bolus. Adequate analgesia was defined as a numerical rating scale score ≤3 during two consecutive uterine contractions, with no request for additional analgesia.

Results: Of the 142 randomized parturients, 68 were included in the analysis. Single-orifice catheters achieved adequate analgesia significantly faster than multi-orifice catheters (hazard ratio [HR]: 1.726; 95% CI, 1.182–2.521; *P*=0.002). The median time (interquartile range) to adequate analgesia was 11 (7.3–15) and 14 (10–21) min for the single-orifice and multi-orifice catheters, respectively (*P*=0.0031; Figure 1). Bilateral S_2 sensory blockade at 20 min was observed more frequently in the single-orifice catheter group than in the multi-orifice catheter group (94.1% vs. 82.4%, *P*=0.03). No statistically significant differences were found between groups in terms of ropivacaine consumption, PCEA use, physician intervention, motor block, pain score at full cervical dilation, side effects, or maternal satisfaction.

Conclusion: Single-orifice catheters provided quicker analgesic onset and more sacral blockade than multi-orifice catheters during DPE initiation, while analgesic outcomes during the maintenance period were balanced between the two groups.

References: [1]Yi J, Li Y, Yuan Y, et al. Comparison of labor analgesia efficacy between single-orifice and multi-orifice wire-reinforced catheters during programmed intermittent epidural boluses: a randomized controlled clinical trial[J]. Reg Anesth Pain Med, 2023, 48(2):61-66.

Figure 1.pdf

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 04

PATIENT EXPERIENCE DURING NEURAXIAL LABOR ANALGESIA - an interview study

Presenting Author: Fernanda S. SL Oliveira, MD

Presenting Author's Institution: Mount Sinai Hospital, University of Toronto - toronto, Ontario

Co-Authors: sunti barahi, MD - Dalhousie University
Kristi Downey, Msc - Mount Sinai Hospital
zeev friedman, MD - mount sinai hospital, university of toronto
Ronald George, MD FRCPC - Mount Sinai Hospital, University of Toronto
Afsheen Nasir, MD - Mount Sinai Hospital

Abstract :

Background: Pain management for vaginal delivery is predominantly achieved via neuraxial analgesia. Various factors play a role when patients request labor analgesia: preexisting knowledge and perceptions of epidurals, the timing of administration, tolerance to pain, parity, age, cultural background, procedural fear, and the information provided by the care team. The patient may already have significant pain the first time a healthcare provider introduces neuraxial analgesia. This perceived urgency for pain relief likely reduces the quality of provider-patient communication. There is limited evidence describing patients' experiences and perspectives throughout the process of neuraxial labor analgesia.

Objective: This prospective, patient-centred multidisciplinary study aims to explore patients' experiences with anesthetic management before, during, and after neuraxial labor analgesia procedures.

Methods: After ethics approval and written informed consent, patients who underwent uncomplicated vaginal delivery with neuraxial labor analgesia were interviewed. Patients who experienced mild postpartum hemorrhage were also included in the study. Data was collected using a questionnaire to obtain baseline demographics and triangulation data and a semi-structured interview exploring patients' experiences, thoughts, feelings, expectations, and concerns regarding their anesthetic management. The study team, which was not involved in the patients' anesthetic management, conducted the interviews. Interviews were audiotaped, transcribed verbatim, and qualitatively analyzed using the thematic analysis approach. Themes were established in an iterative process and differing views were resolved by discussion in the study team.

Results: Twenty-five patients were interviewed. Data analysis is currently ongoing, and the following preliminary results are based on 9 analyzed patient interviews. Three themes were identified: (i) Reassuring and transparent communication; (ii) Emotions and their management; (iii) Physical experiences and control. Patients reported that their main concerns before neuraxial labor analgesia were fear of pain during the procedure, ineffective pain control, fear of complications, and not being able to feel the delivery. Reassuring and transparent communication between the care team and the patient and the presence of a support person or a supportive care team were mentioned as mitigating factors. The results of the full data set will be presented at SOAP 2025.

Conclusions: Patients opting to have neuraxial labor analgesia experience significant anxiety centred around pain and procedural complications. Anesthesiologists providing obstetric anesthetic care to patients should focus on reassuring and transparent communication and adopt a patient-centred approach to managing patients' emotions. Physical experiences should be mitigated by effective communication and a supportive care team.

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 05

Timing and rate of conversion from nitrous oxide to neuraxial analgesia during labor

Presenting Author: Jacob M. Nieb, MD

Presenting Author's Institution: McGaw Medical Center of Northwestern University - CHICAGO, Illinois

Co-Authors: Preet Mohinder M. Singh, n/a - Washington University, St Louis

Abstract :

Background

Nitrous oxide (N_2O) has been used for labor analgesia for more than a century, and its popularity has grown since its approval in 2011.[1] Conversion from N_2O to neuraxial analgesia has been reported to range from 40 to 63.2%.[1,2] To better characterize N_2O as a labor analgesic, this study retrospectively analyzed the rate of conversion, time interval between request and conversion, and predictors of either conversion or successful delivery with N_2O. We hypothesized that women who requested N_2O at greater cervical dilation would be more likely to deliver without neuraxial analgesia while also utilizing N_2O for a shorter duration than women who required conversion to neuraxial analgesia.

Methods

We performed a retrospective chart review of laboring women who received N_2O for labor analgesia between January 2018 and November 2024 at our institution. The primary outcome was conversion from N_2O to neuraxial analgesia. Abstracted data included cervical dilation at time of N_2O initiation, duration of N_2O utilization, duration between N_2O initiation and delivery, patient demographics, medical and obstetric history, obstetric outcomes, mode of delivery, fetal outcomes, and complications. Patients were excluded if they only utilized N_2O after delivering for laceration repairs or placental extractions. Intergroup differences were analyzed using the unpaired t-test and chi-square test. Statistical analysis was performed using SPSS 24 (IBM Inc, Chicago, IL).

Results

N_2O was utilized in 869 deliveries. 40.7% of these women delivered vaginally with N_2O alone, 47.6% delivered vaginally after converting to neuraxial analgesia, and 11.6% required cesarean delivery. The mean cervical dilation at N_2O initiation was significantly greater in women who delivered with N_2O alone (7.48) than in women who converted to neuraxial analgesia (4.92, $p < 0.001$). The mean N_2O utilization duration was longer for women who delivered with nitrous alone compared with women who converted to neuraxial analgesia (152 min vs 114 min respectively, $p = 0.002$). Notably, there was a strong association between conversion and eventual need for operative vaginal delivery ($p < 0.001$).

Conclusions

This study represents the largest analysis to date evaluating risk factors associated with both successful delivery with N_2O and conversion to neuraxial analgesia. Lower cervical dilation at time of N_2O initiation was associated with conversion, which was furthermore

strongly associated with need for operative vaginal delivery. This finding suggests that conversion may portend dysfunctional labor.

References:

1. Sutton CD, Butwick AJ, Riley ET, Carvalho B. Nitrous oxide for labor analgesia: Utilization and predictors of conversion to neuraxial analgesia. *J Clin Anesth*. Aug 2017;40:40-45.

2. Richardson MG, Raymond BL, Baysinger CL, Kook BT, Chestnut DH. A qualitative analysis of parturients' experiences using nitrous oxide for labor analgesia: It is not just about pain relief. *Birth*. Mar 2019;46(1):97-104.

		n	Mean	Standard Deviation	*p* (95% CI)
Age	*Nitrous*	355	31.67	5.58	0.08 (-0.1, 1.5)
	Nitrous-Neuraxial	414	40.96	5.78	
BMI	*Nitrous*	348	30.34	4.70	0.004* (-1.9, -0.3)
	Nitrous-Neuraxial	412	31.44	5.96	
Total Nitrous Time (min)	*Nitrous*	354	152	212	0.000* (13.5, 62.7)
	Nitrous-Neuraxial	414	114	111	
Nitrous Start to Delivery Time (min)	*Nitrous*	355	129	127	0.000* (-396, -338)
	Nitrous-Neuraxial	414	496	264	
Gestational Age (days)	*Nitrous*	355	274.3	12.4	0.05 (-3.9, -0.7)
	Nitrous-Neuraxial	414	276.6	9.6	
EBL	*Nitrous*	350	280	247	0.54 (-41, 21)
	Nitrous-Neuraxial	411	290	183	
APGAR at 1 min	*Nitrous*	355	8.1	1.2	0.01* (0.05, 0.42)
	Nitrous-Neuraxial	413	7.9	1.4	
APGAR at 5 min	*Nitrous*	355	8.9	0.7	0.66 (-0.07, 0.11)
	Nitrous-Neuraxial	413	8.8	0.5	
Birth Weight (g)	*Nitrous*	355	3312	537	0.18 (-122, 22)
	Nitrous-Neuraxial	414	3362	475	
Cervical Dilation at Nitrous Start (cm)	*Nitrous*	354	7.48	2.03	0.000* (2.29, 2.83)
	Nitrous-Neuraxial	414	4.92	1.75	

Table 1. Unpaired t-test results for various factors analyzed as possible predictors of conversion from nitrous oxide to neuraxial analgesia for women who delivered vaginally, where "Nitrous" includes women who delivered with nitrous oxide only, and "Nitrous-Neuraxial" includes women who converted from nitrous oxide to neuraxial. Patients with missing data were excluded from analysis. *Denotes a statistically significant result.

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 06

Mission Possible: Case Series of Successful Neuraxial Procedures for Parturients with Chronic Cerebrospinal Fluid Leaks

Presenting Author: Youri Tan, MD

Presenting Author's Institution: SUNY Upstate Medical University - Syarcuse, New York

Co-Authors: Michael J. Furdyna, MD - Brigham and Women's Hospital
Ricardo Kleinlein, PhD - Brigham and Women's Hospital, Harvard Medical School
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Neel Madan, MD - Brigham and Women's Hospital

Abstract :

Introduction: Spontaneous CSF leaks cause intracranial hypotension and are a rare but increasingly seen cause of chronic headaches. The etiology remains unclear; some cases may be precipitated by sudden mechanical triggers[1, 2]. While symptoms are usually self-limited, some patients require interventions such as an epidural blood patch or surgery. Literature is limited on the risks and considerations of neuraxial anesthesia or analgesia in this patient population.

Methods: All patients who had pregnancies beyond 20 gestational weeks and gave birth from 1994 to 2024 in our hospital system were included. IRB approval was obtained with a waiver of patient consent. We obtained all free-text clinical notes and searched using regular expressions (regex) for the following combinations of terms: “spontaneous spinal cerebrospinal fluid leak,” “idiopathic intracranial hypotension,” and “spontaneous dural tear.” Subsequently, all matches were validated, and all relevant data were extracted using manual chart review.

Results: We identified fourteen deliveries by nine women with a history of chronic CSF leaks (Table 1). Eight patients received neuraxial anesthesia or analgesia, while one patient opted to deliver without analgesia. Two patients with active symptoms at the time of delivery received non-dural puncture epidural analgesia and had a vaginal childbirth. One of the two patients (#1) experienced acute exacerbation of headaches after her first delivery and ultimately received epidural blood patches. One patient without preexisting symptoms (#6) developed post-dural puncture headache after receiving spinal anesthesia for cesarean delivery. Of note, in two epidural placements (#1 and #9), the anesthesiologists specifically documented their intention to avoid dural puncture technique given the history of chronic CSF leaks. One patient (#4) who received labor epidural analgesia had high neuraxial blockade from the standard setting of programmed intermittent bolus epidural pump.

Discussion: While a chronic CSF leak is not an absolute contraindication for any form of neuraxial anesthesia, it presents unique challenges to anesthesiologists. First, due to the potential for persistent communication between epidural and intrathecal spaces, the efficacy of epidurally-administered medications may be unpredictable. Second, a preexisting CSF collection in the epidural space complicates the assessment of CSF return during spinal placement or unintentional dural puncture during epidural placement. Third, while pushing during a vaginal delivery itself can worsen CSF leaks, additional dural puncture, regardless of

intent, can potentially exacerbate preexisting symptoms. Detailed counseling on these risks and careful titration of medication are the keys to successful management of patients with CSF leaks receiving neuraxial anesthesia or analgesia.

References:

1. Schievink. Cephalalgia 2008 Dec;28(12):1345-56.
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CSF leak case series SOAP Abstract TABLE.pdf

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 07

Patient Preferences and Satisfaction with Neuraxial Labor Analgesia for Vaginal Deliveries: A Cross-Sectional Survey in a Diverse Urban Population

Presenting Author: Salwa Najmi, BA

Presenting Author's Institution: Icahn School of Medicine at Mount Sinai - New York, New York

Co-Authors: Yaakov Beilin, MD - Icahn School of Medicine at Mount Sinai
Diana M. Ruiz, n/a - Icahn School of Medicine
Johari Summerville, BS - Icahn School of Medicine at Mount Sinai
Amanda R. Tomlinson, MD - The Mount Sinai Hospital

Abstract :

As health care transitions toward patient-centered models, measuring satisfaction with neuraxial labor analgesia (NLA) in vaginal deliveries (VD) is essential. Prior studies have enrolled relatively homogenous populations, leaving gaps in our knowledge of NLA in diverse populations [1]. To address these gaps, we conducted a cross-sectional survey at a large urban hospital in New York City to capture a broad range of patient perspectives on NLA outcomes and overall satisfaction. The aim of this study was to identify what factors drive maternal satisfaction in VD.

Following IRB approval, patients were surveyed on postpartum day 1. We based our questionnaire on Carvalho et al.'s 2005 methodology [2]—retaining their ranking and relative value format while adding new outcomes and demographic items and expanding the survey to include all delivery modes. The final survey was offered in verbal and written formats in Spanish and English. Participants ranked 10 NLA-related outcomes (e.g., pain during labor, itching, leg weakness, pain after delivery, shivering, anxiety, sleepiness, nausea, vomiting, excess pain medication) by importance (1 = most important to avoid; 10 = least) and allocated $100 among them to indicate relative value. Demographic and clinical data were also collected, and statistical analyses were conducted using SPSS.

A total of 101 participants completed the survey (mean age 32.7; mean parity 2.2; mean BMI 31.3). 45.5% of participants self-identified as non-Hispanic White, 29.7% reported an annual income below $52,000, and 43.6% did not have a college degree. Overall NLA satisfaction was 92.8% (SD 9.6%). The most frequently reported outcome was itching (62.4%). Pain during labor was ranked as the most important to avoid (average rank = 2.14/10) and received the highest monetary allocation ($39.81), whereas sleepiness was deemed least concerning (ranked 7.21/10) and received $4.83. Parity was positively correlated with overall satisfaction, whereas longer labor duration was negatively correlated (both $p < 0.05$). Race, income, education level, and induction were not significantly correlated with satisfaction.

Our findings demonstrate that, in a diverse urban population, overall satisfaction with NLA remains high despite commonly reported side effects. Pain relief emerged as the top priority for participants, underscoring the critical role of effective analgesia in a positive birth experience. Parity and labor duration were the only variables significantly associated with satisfaction, suggesting that clinical factors—rather than demographic characteristics—may exert greater influence on patients' NLA perceptions. A key limitation of this study is its single-site design. Future investigations should include larger samples across multiple centers and

geographic regions to confirm these findings and explore additional factors that may further optimize NLA satisfaction.

References:

1. Harding A, et al. Cureus 2022

2. Carvalho V et al. Anesthesia Analgesia 2005

Figure 1. Ranking and Relative Value of Potential Neuraxial Labor Analgesia Outcomes in Vaginal Delivery

Outcomes Ranked	Ranking	Relative Value (Dollar Amount)
Pain during labor	2.14 ± 2.08	39.8 ± 25.9
Vomiting	4 ± 1.94	8.73 ± 7.36
Nausea	4.6 ± 2.01	7.52 ± 6.51
Pain after delivery	4.71 ± 2.91	10.0 ± 9.50
Itching	5.95 ± 2.54	6.5 ± 8.31
Nervousness and anxiety	6.11 ± 2.61	5.85 ± 6.04
Shivering	6.57 ± 2.51	5.26 ± 5.08
Leg weakness	6.58 ± 2.45	5.5 ± 5.31
Excess pain medication	7.06 ± 2.82	5.99 ± 8.25
Sleepiness	7.21 ± 2.39	4.83 ± 6.11

Data is written as Mean ± SD

Ranking = 1 to 10 from the most important to avoid (1) to the least important (10) outcome, relative value = dollar amount patients would pay to avoid an outcome; e.g., they would pay $39.8 of their $100 to avoid pain during labor.

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 08

Beyond Pain Relief: The Impact of Adverse Events on Satisfaction with Anesthesia in Cesarean Births

Presenting Author: Johari Summerville, BS

Presenting Author's Institution: Icahn School of Medicine at Mount Sinai - NEW YORK, New York

Co-Authors: Yaakov Beilin, MD - Icahn School of Medicine at Mount Sinai
Salwa Najmi, BA - Icahn School of Medicine at Mount Sinai
Diana M. Ruiz, n/a - Icahn School of Medicine
Amanda R. Tomlinson, MD - The Mount Sinai Hospital

Abstract :
Approximately 32.1% of all births in the United States are via Cesarean Delivery (CD) [1]. It is, therefore, imperative to understand what aspects of care are associated with patient satisfaction. Factors associated with patient satisfaction are complex, and other studies have shown that analgesia is not the only goal when undergoing CD [2-4]. This study's main aim was to assess which factors impact satisfaction with obstetric anesthesia care for CS in a diverse patient population.

This study was a cross-sectional single site survey. We surveyed 100 patients who underwent a CD who were proficient in either English or Spanish, on postpartum day 1 to capture their immediate experiences with their care. In the survey the following outcomes were assessed: pain during labor, itching, leg weakness, pain after delivery, shivering, anxiety, sleepiness, nausea, vomiting, and excess pain medication). Each factor was ranked on a scale from 1(least important) -10 (most important) and allotted a weighted monetary value (totaling $100). To contextualize these findings, self-reported demographic data and clinical data were also collected. Data analysis was conducted with SPSS.

100 patients who underwent a CD at MSH (53 planned and 47 unplanned) participated in this study. The average age and parity of our patients was 33.9 years old (range 18-48) and 1.63 (range 1-4), respectively. Overall satisfaction was 89.9% (38%-100%). Patients who had an unplanned CD were less satisfied than those that had a planned CD (85.9% and 93.4%; $p< 0.001$). Among the 10 outcomes surveyed, pain during surgery was ranked as most important and patients used most of their budget on this outcome (average score=2.19/10, average dollar amount=$31.31/$100). Sleepiness during surgery was the lowest priority (average score=7.71/10, average dollar amount $4.76/$100).

In our analysis, the only demographic variable that was significantly associated with satisfaction rates was whether the CD was planned. Avoidance of pain was consistently ranked as a top priority of patients, even in those who did not experience pain during their CD. In the future we aim to see if the clinical data and self-reported demographics would be significantly associated with satisfaction rates.

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1. CDC. (4.9.24). FastStats - Births - method of delivery.

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3. Anim-Somuah M et al. Epidural versus non-epidural or no analgesia for pain management in labour. Cochrane Database Syst Rev. 2018
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SOAP Abstract_Figure1.pdf

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 09

The informational needs of postpartum Spanish-speaking parturients undergoing obstetric anesthesia.

Presenting Author: Mariana Restrepo, BA

Presenting Author's Institution: Icahn School of Medicine at Mount Sinai - New York, New York

Co-Authors: Sananda Pai, Talia Scott, MD, Garrett A. Burnett, MD

Abstract:

Introduction:

Spanish-speaking Hispanic parturients face various racial and ethnic disparities in maternal care, particularly obstetric (OB) anesthesia.[1,2] Research suggests inadequate language-specific patient education may perpetuate these disparities, and by extension inequities in pain management and care outcomes.[3] This study aims to explore the educational sources parturients rely on for information, their satisfaction with the information provided, and the importance of receiving health information in Spanish.

Methods:

30 in-person patient interviews were conducted on the postpartum recovery unit at a high-volume urban hospital with a diverse patient population. Descriptive statistics were analyzed from a 5-minute questionnaire that surveyed native Spanish-speakers on demographic data and on their information needs regarding OB anesthesia. This includes details on the anticipation of OB anesthesia, primary informational sources, first informational resources, satisfaction with OB anesthesia knowledge, and general comments on OB anesthesia.

Results:

30 native Spanish-speaking patients participated in this study. On average, they were 29.5 (24.3-37) years old and completed 11.5 (6-13.5) years of education. 83.3% of patients received epidural anesthesia and 63.3% had a vaginal delivery. Half were undecided about their desired OB anesthesia care prior to admission (Table 1). Satisfaction with the information received was high and 73.3% emphasized the importance of Spanish-written resources. The primary sources of information were healthcare professionals, though 16.7% relied on the internet or social media. 27% percent of patients would have liked to know more about side effects, timing, and logistics related to OB anesthesia care.

Conclusion:

This study suggests that Spanish-speaking parturients predominantly rely on their healthcare providers for OB anesthesia education, with the minority of patients referring to the internet, social media, or informational articles. Although satisfaction with health information on OB anesthesia was high, it is important for this patient population to have access to Spanish-written resources and there is room for improvement in the information that they receive.

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Additional File

SOAP Informational Needs Abstract Figure 1.pdf

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 10

Making Labor Epidural Analgesia Better: A Quality Improvement Project

Presenting Author: Soobin Song, n/a

Presenting Author's Institution: Boston University Chobanian & Avedisian School of Medicine - Boston, Massachusetts

Co-Authors: Rachel A. Achu-Lopes, MD - Boston Medical Center
Mark Norris, MD - Boston Medical Center

Abstract :

Background: PIEB is an effective method for labor analgesia.[1] Systematic evaluations suggest an optimal PIEB regimen of 10 mL every 40 min.[2-4] Other sources suggest increased bulk flow rate improves the distribution of local anesthetic and provides more effective pain relief.[5-7] This ongoing QI project sequentially adjusted PIEB bolus volume and infusion rate to determine if they reduced the need for provider interventions.

Methods: This QI project took place at an urban safety net hospital. Upon patient request, epidural, DPE, or CSE analgesia was induced per anesthesiologist preference with varying doses of intrathecal or epidural bupivacaine, fentanyl, and lidocaine. CADD infusion pumps delivered 0.0625% bupivacaine with 2 mcg/mL fentanyl at various settings. In June 2023 (Group A), PIEB used 8 mL boluses q 30 min, optional 8 mL self-boluses q 15 min, with a 32 mL/h limit and a 40 mL/h infusion rate. In September 2023 (Group B), settings were: bolus 10 mL q 40 min, optional 10 mL self-boluses q 20 min, a 30 mL/hour limit, and a 40 mL/h infusion rate. We continued to use these settings in April 2024 (Group C). In July 2024 (Group D), infusion rate was increased from 40 mL/h to 250 mL/h with unchanged settings.

We extracted data from each patient's electronic medical record. The primary outcome was time to first provider intervention or vaginal delivery. Secondary outcomes included number of rescue boluses, infusion adjustments, and catheter replacement. Competing risk survival analysis was conducted using the Fine-Gray sub-distribution hazards model to account for the presence of competing events, which included vaginal delivery and c-section.

Results: 528 patients were included in this analysis. 39.0% required a rescue bolus, 13.1% underwent c-section, and 47.9% gave birth without additional provider intervention. There was a 53% decrease in the odds of needing a rescue bolus after the increase in infusion rate from 40mL/h to 250mL/h (OR = 0.47, 95% CI (0.28, 0.79)).

At hour 8 post epidural placement, cumulative incidence of rescue bolus administration was 31% (95% CI: [23%, 40%]), 37% (95% CI: [32%, 43%]), and 20% (95% CI: [14%, 27%]) for Group A, Groups B+C, and Group D, respectively. Neither treatment nor other covariates were statistically or clinically significant predictors of the risk of receiving a rescue bolus.

Conclusion: At our institution, increasing the bolus infusion rate from 40 mL/h to 250 mL/h decreased the need for provider intervention and may improve the quality of analgesia, as measured by the decreased number of provider-administered rescue boluses.

References:

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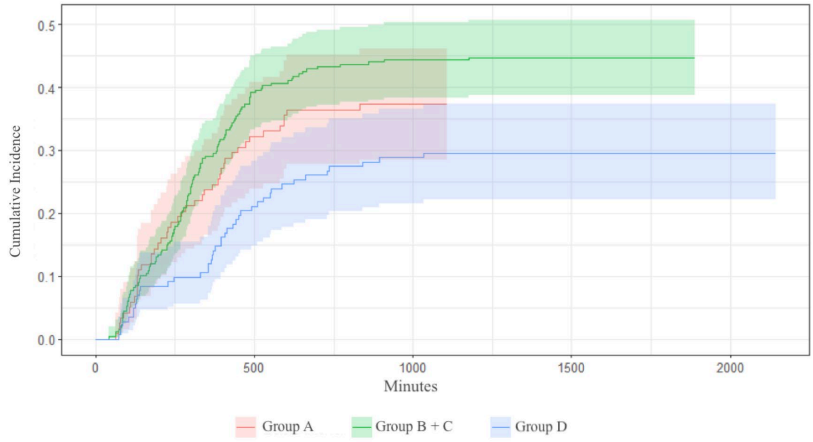

Figure: Cumulative Incidence of Rescue Bolus for Each Treatment Group with 95% Confidence Bands

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 11

Developing Interdisciplinary Medical Education for L&D Nurses on Labor Epidurals: A Quality Improvement Initiative

Presenting Author: Brittany Duck, n/a

Presenting Author's Institution: UAB Heersink School of Medicine - Auburn, Alabama

Co-Authors: Andrew Hackney, MD - UAB Heersink School of Medicine
Kim Langer, MSN, RN, RNC - UAB Center for Nursing Excellence
Blake Wiggins, MD - UAB Department of Anesthesiology

Abstract :

Background: The labor and delivery unit is a dynamic, interdisciplinary environment requiring effective communication and collaboration. A key challenge in our institute had been addressing patient expectations about labor epidurals as well management of breakthrough pain and hypotension after epidural placements. A survey of 35 L&D nurses revealed that 58.33% saw a need for additional education about labor Epidurals. A similar survey was conducted among anesthesia residents to identify communication barriers with L&D nurses during labor epidural management. As interdisciplinary healthcare education has been long-established as an effective means for improving patient outcomes [1], the need for an intervention of this approach was recognized.

Methods: A labor epidural case review was conducted with L&D senior nurses via Zoom. The case review was created based on input from anesthesia residents. Among 30 nurses who completed the post-intervention survey, the activity received an average rating of 4.8/5, reflecting strong agreement that it would enhance their job performance. To sustain this effort, quarterly in-person education sessions are held for new nursing hires, incorporating continuous feedback from the team. Additionally, quarterly interdisciplinary CQI meetings via Zoom facilitate knowledge sharing on topics like magnesium infusion and postpartum hemorrhage among OB, L&D nurses, and anesthesia teams.

Discussion: Barriers to developing interdisciplinary education included fostering a culture of mutual respect and openness amongst teams, as well as aligning educational leaders from both teams with the purpose and objectives of the project. An additional factor was interdisciplinary learning about the ritualized communication styles inherent to different disciplines. The anesthesia education module and multidisciplinary CQI presentations are reviewed by educators from all teams to ensure the use of terminology that is clear and understandable across all specialties.

Conclusion: Interdisciplinary education can contribute towards improvement in patient care by development of a common knowledge pool amongst various disciplines.

References: [1]Allen DD, Penn MA, Nora LM. Interdisciplinary healthcare education: fact or fiction?. *Am J Pharm Educ*. 2006;70(2):39. doi:10.5688/aj700239

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 12

Which is Less Painful? Intradermal vs. Subcutaneous Lidocaine Injections for Tuohy Needle Insertion: A Pilot Double-Blind Randomized Trial

Presenting Author: Lukas Croner

Presenting Author's Institution: The Ohio State University College of Medicine - Columbus, Ohio

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Plato Lysandrou, MD - Department of Anesthesiology The Ohio State University Wexner Medical Center
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Abstract :

Introduction

The use of local lidocaine skin infiltration before Tuohy needle insertion for epidural placement is a critical component of analgesic care. Lidocaine can be administered either intradermally or subcutaneously; however, it is unclear which technique causes less pain in laboring patients [1]. Pain is most commonly assessed using patient-reported numeric rating scale (NRS) scores [2]. The Critical-Care Pain Observation Tool (CPOT), includes four components (facial expression, body movement, muscle tension, and vocalization), with each component scored from 0-2, and a total score range of 0-8. Among these, body movement and vocalizations may have a greater physical and psychological impact on provider performance.

Methods

This double-blind randomized clinical trial evaluated whether subcutaneous (90-degree angle to the skin, S Group) or intradermal (60-degree angle, I Group) administration of 3 mL 1% lidocaine using a 25G needle reduced pain during epidural procedures in laboring patients. The null hypothesis stated no difference in pain levels between the two techniques. The primary outcome was pain during lidocaine injection, assessed using CPOT and NRS scores. Kruskal–Wallis tests were used to test the difference between two techniques. Secondary outcomes included the analgesic effect of Tuohy needle insertions, hemodynamic stability, and overall patient satisfaction. Proper statistical methods were used to analyze the secondary outcomes based on the data types and distributions. Statistical significance was defined as a P-value ≤ 0.05.

Results

Fifty-one patients were randomized into the S Group (n = 26) and I Group (n = 25). CPOT total scores and NRS scores didn’t show clinically significant differences between the two techniques for lidocaine injection but a statistically significant difference for muscle tension scores of CPOT (p = 0.018) (Table 1). Secondary outcomes, including analgesia effect for Tuohy needle insertions and patient satisfaction, were similar between the groups. Although mean hemodynamic data were lower in S Group, the difference was not statistically significant. The Pearson correlation coefficient showed a weak correlation between CPOT and NRS scores during lidocaine injection (Correlation = 0.2805, p = 0.046).

Conclusion

This pilot study did not find conclusive differences in pain levels between subcutaneous and intradermal lidocaine administration before Tuohy needle placement, likely due to the limited sample size and pilot design. However, subcutaneous lidocaine injections demonstrated comparable CPOT and NRS scores to the more commonly used intradermal injections. Further research with a larger and more diverse population is warranted to validate these findings.

References:

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2. Hjermstad, MJ, et al.. Journal of pain and symptom management, 2011.

Which is Less Painful? Intradermal vs. Subcutaneous Lidocaine Injections for Tuohy Needle Insertion- A Pilot Double-Blind Randomized Trial- Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 13

Success in Predicting Neuraxial Analgesia Failure: A Retrospective Model Development Study

Presenting Author: Daniel F. Berenson, MD, PhD

Presenting Author's Institution: Brigham and Women's Hospital - Brookline, Massachusetts

Co-Authors: Braden W. Eberhard, BS - Harvard Medical School
Ricardo Kleinlein, PhD - Brigham and Women's Hospital, Harvard Medical School
Nolan K. Wheeler, BS - Brigham and Women's Hospital

Abstract :
Background: Neuraxial catheters for labor analgesia have a failure rate of 5-15%, leading to decreased maternal satisfaction and increased risks. Several patient, procedural, and post-placement risk factors for catheter failure have been previously identified, such as older age, higher body mass index (BMI), nulliparity, and catheter dwell time (Berger et al., 2022). However, prior studies have been limited by relatively small, single-institution data sets, and by information on a limited set of risk factors. We hypothesized we could leverage a large data set to predict catheter failure.

Methods: We conducted a retrospective cohort study of parturients who had labor neuraxial catheters performed within our multi-hospital health system between 2015 and 2024. Data from the electronic health records were ingested and transformed (Cohen & Kovacheva, 2023). We evaluated demographic data, comorbidities, clinical flowsheet data, and information from anesthesia procedure notes. We defined neuraxial catheter failure as a subsequent neuraxial catheter, spinal, or airway within the same encounter, and performed uni- and multi-variate logistic regression to predict catheter failure. To prevent data leakage, we restricted our analysis to information known at the time of catheter placement.

Results: There were 106,750 labor neuraxial catheters from 8 hospitals (*N* = 81,338 patients). The overall neuraxial catheter failure rate was 5.4%. Of the 59 potential risk factors in the univariate analysis, 35 were significant at a Bonferroni-corrected *alpha* = 0.0008. After collinearity reduction, odds ratios for 25 potential risk factors were calculated by multivariate logistic analysis (Figure 1). Our data confirm known important risk factors, including higher BMI and lower parity. Unexpectedly, we found that catheter placement or supervision by a highly experienced anesthesia attending was a risk factor, while delivery at our obstetric teaching hospital was protective. Multivariate logistic regression achieved an area under the receiver operating characteristic curve of 0.66.

Conclusions: Our model for predicting the risk of neuraxial failure during labor at the time of placement achieved moderate discrimination. Further research is needed to explore nonlinear relationships among risk factors and the effects of attending- or hospital-specific practice. It is likely that post-placement data, such as need for clinician top-ups, will improve predictive power. Our model may help clinicians identify and intervene on catheters at high risk for failure on the labor floor in a timely manner and thus improve patient outcomes.

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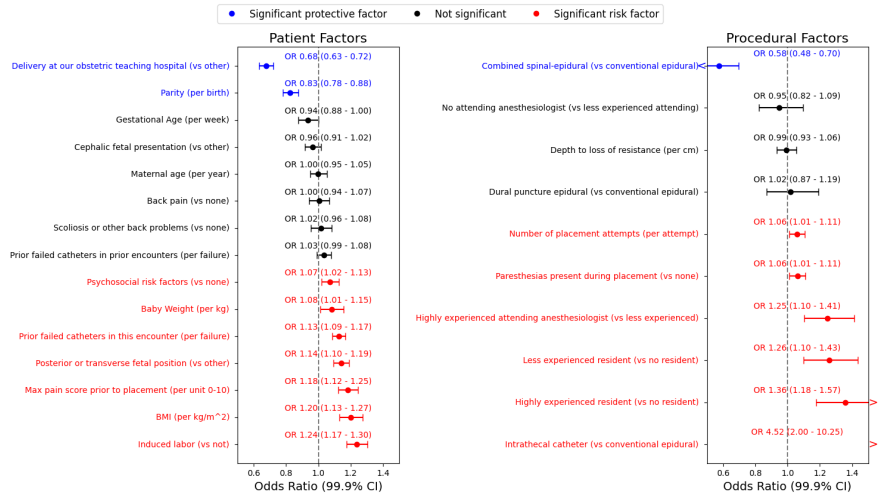

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 14

A survey of patients regarding factors impacting their decision to choose labor epidural analgesia

Presenting Author: Jessica Stockinger, MD

Presenting Author's Institution: Duke University Medical Center - Durham, North Carolina

Co-Authors: Sara Feldman, MD - Duke University Medical Center
Hannah L. Ford, n/a - Duke University School of Medicine
Meg Hardesty, n/a - Duke University
Jong ok La, n/a - Duke Molecular Physiology Institute, Duke University School of Medicine

Abstract :

Introduction

Untreated pain during labor can lead to lasting effects such as birth-related trauma and postpartum depression (1-3). A patient’s decision to receive labor epidural analgesia may be influenced by several factors, including input from providers or nursing staff. We conducted an IRB approved survey-based study of postpartum patients at our tertiary care delivery center to attempt to better understand patients’ perspectives on the factors that influence their choices regarding labor epidural analgesia at our birthing center. We hypothesized that there will be significant differences between patients who desire an epidural versus those who do not in their concerns regarding their perceived risks of labor epidural analgesia.

Methods

After IRB approval, a Likert scale-based survey was used to evaluate factors that influenced a patient's desire to receive labor epidural analgesia. Patients recruited for the study included all postpartum patients in the specified study period who delivered vaginally, as well as those who planned for vaginal delivery but required an intrapartum cesarean delivery.

Our primary outcome was differences in factors that influence a patient's desire to obtain an epidural between those who desired epidural labor analgesia upon arrival compared to those who did not initially desire a labor epidural upon arrival. Responses to level of agreement questions were assigned numeric values and compared using Wilcoxon rank-sum tests. Chi-squared tests or Fisher exact tests were performed for categorical variables.

Results

We enrolled 201 patients in our study (initially desired epidural n=150, did not initially desire epidural n=50, withdrawal prior to completion n=1). There were statistically significant differences in survey responses between the groups regarding concerns with epidural placement related to risk to self, risk to baby, pain from the needle/procedure, risk of prolonging labor and increasing the risk of cesarean delivery. There was also a significant difference in the desire upon arrival for natural childbirth between the two groups. The influence of family, nursing staff, OB team, and anesthesia team were not significantly different between the two groups.

Discussion

Our study demonstrates that there are several concerns and factors that are significantly different in patients who initially desired an epidural versus those who initially desired no epidural for childbirth. These included the perceived risk of increasing cesarean delivery rates or prolonging labor. This study can help better understand patients' perspectives and improve the counseling patients receive regarding labor epidurals by both anesthesia providers and nursing staff. These findings can also possibly guide development of new avenues for patient education.

References:

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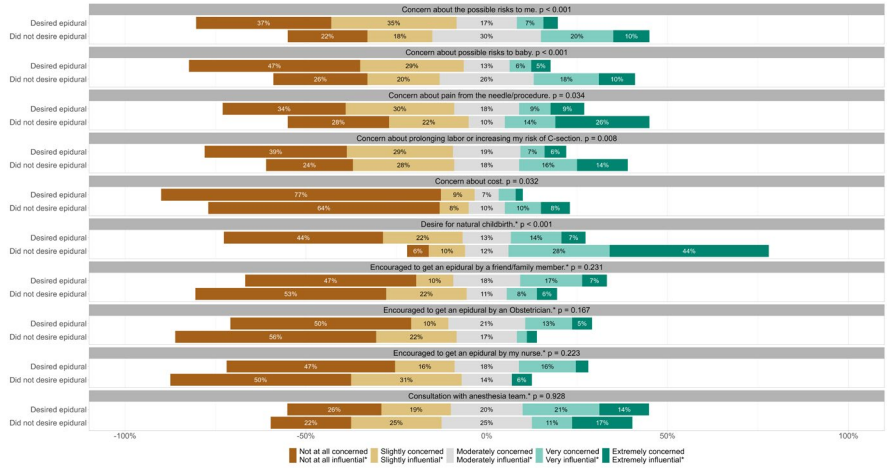

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 15

A survey of provider factors that may affect receipt of labor epidural analgesia at a large, tertiary-care center

Presenting Author: Jessica Stockinger, MD

Presenting Author's Institution: Duke University Medical Center - Durham, North Carolina

Co-Authors: Sara Feldman, MD - Duke University Medical Center
Hannah L. Ford, n/a - Duke University School of Medicine
Meg Hardesty, n/a - Duke University
Jong ok La, n/a - Duke Molecular Physiology Institute, Duke University School of Medicine

Abstract :

Introduction

Though epidural analgesia is considered the gold standard for labor analgesia, a patient's desire to obtain one and its timing may be influenced by several factors such as provider advocacy. A previous study found similar knowledge and attitudes amongst nurses, anesthesiologists, and obstetricians towards epidural labor analgesia but demonstrated significant differences between the groups regarding a variety of patient conditions and clinical factors that influence the timing of epidural analgesia (1). We conducted this survey of labor and delivery nurses and anesthesia providers at our center to evaluate these factors. We hypothesized that there would be differences between anesthesia providers and nurses with regards to the factors that would drive them to advocate for labor epidural analgesia for their patients.

Methods

After IRB approval, Likert scale-based surveys were distributed to labor and delivery nurses and anesthesia providers (CRNAs and residents) who staff our unit.

Our primary outcome was the level of agreement between anesthesia providers and nurses with regards to advocating for labor epidural analgesia in specific clinical scenarios. Secondary outcomes included differences between the beliefs of anesthesia providers and nurses regarding IV analgesia. Results were descriptively summarized by provider and nursing category. Responses for level of agreement questions were assigned a numerical value and compared using Wilcoxon rank-sum tests. Chi-squared tests or Fisher exact tests were performed for categorical variables.

Results

We enrolled 100 providers (58 nurses, 19 CRNAs, 21 anesthesiology residents, and 2 unspecified providers). There was a significant difference in the level of agreement for epidural advocacy with anesthesia providers more strongly agreeing to advocate for an epidural in most scenarios. Clinical scenarios with significant differences were as follows: patient uncomfortable with < 2cm cervical dilatation, patient who is at 10 cm cervical dilatation, grand multiparous patient in spontaneous labor, morbidly obese patient (BMI >40 kg/m2), patient with previous vaginal delivery without an epidural, patient attempting TOLAC, and a patient

with a history of shoulder dystocia. We found no difference in advocacy for patients with non-reassuring fetal status or with a plan to artificially rupture membranes. (Figure 1).

Discussion

Our study found differences in the attitudes of anesthesia providers and nurses at a single center in several clinical scenarios, including some when labor epidurals are strongly encouraged by anesthesia providers (e.g. morbid obesity) but not by nurses. Our findings provide insight into opportunities for improved staff education and patient counseling regarding labor epidural analgesia at our delivery center.

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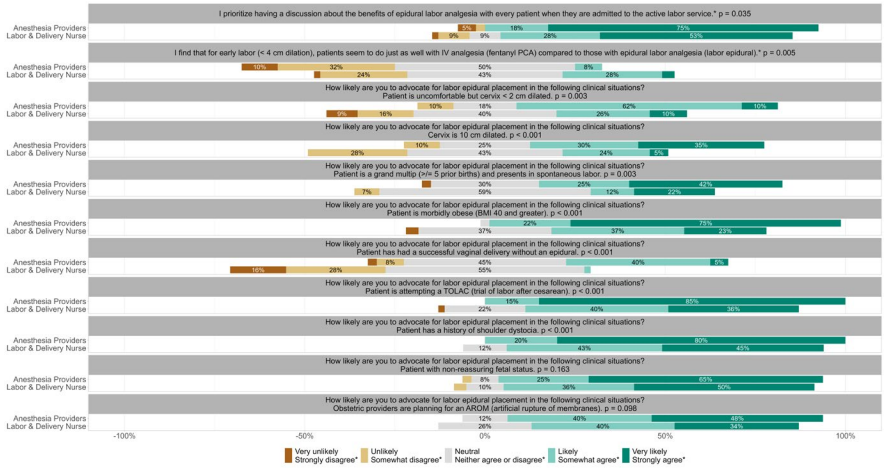

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 16

The Assessment of the Pain with Local Anesthetic Infiltration and Its Predictive Value of Pain During the Labor Course, a Retrospective Analysis

Presenting Author: Payton Marshall

Presenting Author's Institution:

Co-Authors: Andres Maldonado, BA, Natasha D. Harrison, MPH, Dipro Chakraborty, MS, Pervez Sultan, MBChB, Brendan Carvalho, MBBCh, FRCA, Cedar Fowler, MD, PhD, MPH

Abstract:

Introduction:

Prediction models for peripartum pain and adequate epidural analgesia are lacking.[1] Studies demonstrate a correlation between pain with local anesthetic infiltration (LAI) and post-cesarean pain.[2,3] We sought to determine if pain with LAI predicts adequate labor analgesia.

Methods:

Following IRB approval, we conducted a four-year (2020-2023) retrospective observational analysis. Inclusion criteria were parturients receiving labor epidural analgesia and undergoing successful vaginal delivery at our institution. We excluded intrapartum cesarean deliveries and cases where no LAI pain score was documented during epidural placement. LAI pain was charted using a 0-10 Numerical Rating Score (NRS). Patient demographics, medical history, anesthesia, and obstetric variables were extracted from the medical record. Our primary outcome was a correlation between LAI pain and average pain during labor with an epidural. Secondary outcomes were a correlation between LAI pain and patient demographics, labor characteristics, and epidural success (failed epidural, number of clinician-administered boluses). We performed a Spearman correlation analysis between LAI pain scores and average labor pain scores until delivery.

Results:

5,221 patients who underwent vaginal deliveries were included in the analysis. They were categorized into three cohorts based on reported LAI pain scores: 0-3 (n=2868), 4-7 (n=1919), and >7 (n=434).

The primary outcome of pain during labor epidural analgesia was not associated with LAI pain (Spearman correlation coefficient: 0.02, p=0.136). Average pain scores before epidural placement, during LAI, and after epidural placement are shown in Figure 1.

Pain with LAI did not correlate with epidural top-ups or failed epidural analgesia. Patients in the LAI pain >7 cohort were more likely to need an interpreter, speak Spanish as their primary language, and self-identify as Hispanic. In contrast, the LAI pain 0-3 and 4-7 cohorts were more likely to identify as White, Non-Hispanic, and speak English as their primary language.

Conclusion:

Pain with LAI prior to neuraxial block placement is not a reliable predictor of labor pain in parturients who undergo vaginal delivery with epidural analgesia. Future studies are needed to identify predictors of labor pain and to understand why severe LAI pain is more common in patients of Hispanic ethnicity and who need an interpreter.

References:
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Marshall_LAI.pdf

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 17

"Ready, Set, Huddle": Implementation of Perioperative Huddles on Labor and Delivery

Presenting Author: Lauren Blake, MD, MHS

Presenting Author's Institution: Stanford University School of Medicine - Palo Alto, California

Co-Authors: Kelly A. Fedoruk, MD, FRCPC - Stanford University
Lynn Squires, MD FRCPC - University of Alberta
James Xie, MD - Stanford University School of Medicine

Abstract :

Background: Multidisciplinary team communication is vital when caring for patients in the constantly evolving environment of Labor and delivery (L&D). Communication failure represents the leading cause of perinatal sentinel events, with cultural barriers such as hierarchy, intimidation, and failure to function as a team as contributing factors.[1-2]

Goals/Objective: The aim of this process improvement project was to use the Define, Measure, Analyze, Design and Verify or DMADV methodology to develop a new, standardized communication tool for the perioperative team on L&D.[3] Our goal was to complete a standardized preoperative huddle checklist in >90% of non-emergent operating room (OR) procedures.

Methods: The **current state** was assessed using process mapping, which identified the absence of a standardized process for the L&D teams' (obstetricians, anesthesiologists, neonatologists, nurses, and operating room technicians) perioperative communication. **Implementation** strategies addressed **key drivers** identified: including all teams, participation of responsible providers from each team, communication occurring immediately before transport to the OR, and checklist use. The **interventions** included educating team members, creating and revising the checklist based on solicited feedback.

Outcomes: After two weeks of education, we tracked huddle implementation and compliance over 21 weeks, spanning seven measurement and analysis cycles (Figure 1: p-chart of huddle adherence rate). These cycles led to four checklist versions and valuable team feedback on successes and barriers. **Cycles 1–2:** Huddles were counted based on checklist completion and return, with all OR cases included in the denominator. **Cycles 3–4:** Huddles were counted if the checklist was returned or if team feedback confirmed a missed but completed huddle. **Cycles 5–7:** Compliance was measured solely by checklist return, without reminders or education. The denominator (cycles 3–7) included all non-emergent/STAT OR cases. Adherence ranged from 33% (week 1) to 95% (weeks 8 & 18) (see P-chart). Now in the verification phase, the checklist is being integrated into the electronic medical record and sustainability measures have been established.

Conclusion: Using a standardized checklist helps ensure critical steps are not missed and that all team members have a shared mental model. The DMADV methodology is a useful tool to guide implementation as it allows for multiple cycles of feedback and re-design within each phase. This has led to the development of a sustainable systematic perioperative huddle and

standardized checklist. Ongoing measurement of clinical outcomes and sentinel event rates will corroborate the benefit of the huddle.

References: 1. PMID: 31145113
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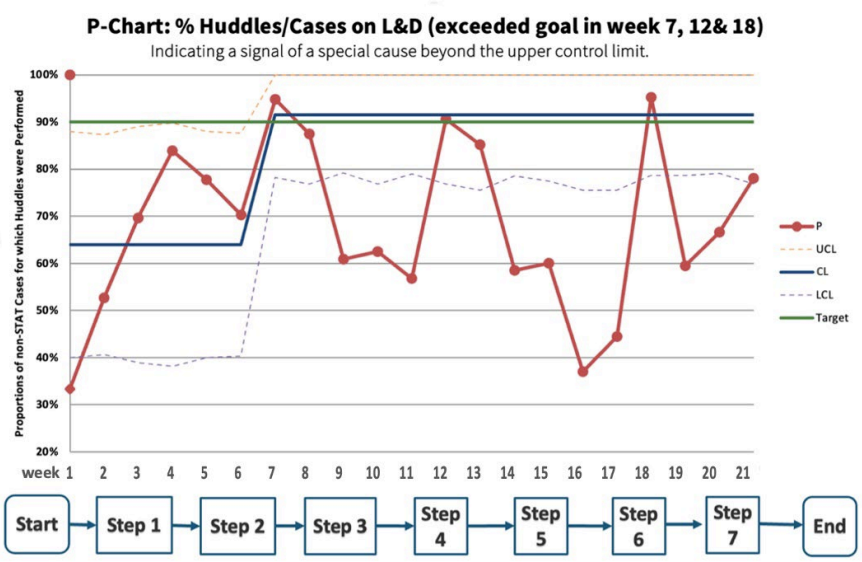
Figure 1: P- chart



Step 1: Introduction of the huddle process, checklist v1
Step 2: Education on the steps to huddle, checklist v2
Step 3: Standardization of the steps to huddle, checklist v2
Step 4 - 6: Focus on Huddle Efficiency, checklist v3
Step 7 – End: Focus on Huddle Sustainability, checklist v4

Abstract #: FRI - RA - BS 2 - BR 2 - Neuraxial Labor Analgesia – 18

The Angle Labor Pain Questionnaire demonstrates good to excellent test-retest reliability and performance for pain measurement during preterm labor

Presenting Author: Pamela Angle, MD FRCPC MSc (oxon)

Presenting Author's Institution: Sunnybrook Health Sciences Centre - Toronto, Ontario

Co-Authors: Dini Hui, MD, FRCSC - Sunnybrook Health Sciences Centre
Alex J. Kiss, Ph.D. - Sunnybrook Research Institute/University of Toronto

Abstract :

Introduction
Women in preterm labor are usually omitted from labor analgesia trials [1]. Research is needed to better understand their pain experiences. These goals are best achieved by using multidimensional pain tools developed and validated for laboring women. This instrument validation study builds on our previous instrument development and validation work for the Angle Labor Pain Questionnaire (A-LPQ) which focused on women with term labor [2-3]. The current study examined the test-retest reliability (primary outcome) and performance of the A-LPQ during preterm labor. Concurrent assessments with the Angle Pictorial Pain Mapping and Ranking Tool (A-PPMRT) provided additional insight into the nature of preterm labor pain and its variability between women.

Methods
The study employed a single group, two-test research design. The multidimensional A-LPQ was administered once during each of two test sessions, held 20-minutes apart, to women in early active preterm labor (≥24< 37 weeks) without pain relief. This was followed by assessment of changes in participants' pain between test sessions on the Patient Global Impression of Change Scale.
Overall pain intensity on the Numeric Rating Scale (NRS) and Verbal Rating Scale (VRS), as well as pain coping on the Pain Mastery Scale (PMS), were concurrently measured, along with NRS scores for common types of labor pain (e.g., uterine contraction pain, back pain) and/or their depictions on the A-PPMRT. Test-retest reliability of the A-LPQ was examined with Intraclass Correlation Coefficients (ICC). Internal consistency, content validity, convergent validity, sensitivity to change and responsiveness were also examined (secondary outcomes).

Results
Sixty participants were analyzed, half of whom were nulliparous. Most women (62%, 37/60) had moderate to late preterm pregnancies (≥32< 37 weeks); remaining participants had extremely to very preterm gestations (≥24< 32 weeks). Moderate pain was reported by half of women; one quarter reported severe or agonizing pain on both tests. A-LPQ scores demonstrated good to excellent test-retest reliability (ICC's 0.82-0.92, $p < .001$) and acceptable to excellent internal consistency (A-LPQ scores $\alpha \geq 0.92$, subscales $\alpha = 0.71$-0.92). Content validity, convergent validity, sensitivity to change, and responsiveness were also supported.

Discussion
Women's experiences preterm of labor pain and labor pain relief remain a "black box" in the literature. Clinical experience suggests that these women may experience delayed access to epidural analgesia and/or precipitous delivery without pain relief. Future research should focus on women's experiences of preterm labor pain, as well as the psychological impact of current pain management strategies. Our study supports use of the A-LPQ for preterm labor pain measurement.

References:

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Table1_Preterm.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 01

High-Risk Obstetric Anesthesiology Consultations: A Retrospective Single-Center Study at a Quaternary Academic Medical Center in the United States

Presenting Author: Laura Nerb, MD

Presenting Author's Institution: University of California, San Francisco - San Francisco, California

Co-Authors: Katherine Perryman, MD - Northwestern University
Yu-chi Tu, MD - Kaohsiung Medical University

Abstract :

Introduction

Anesthesiologists are essential consultants for obstetricians as they work to optimize patients with high-risk pregnancies for delivery, particularly in parturients with multiple complex medical conditions. Antepartum evaluation by an anesthesiologist allows the opportunity to develop personalized, risk-reducing plans that cater to the specific needs and goals of the patient before delivery. At our center, these consultations are typically carried out by an obstetric anesthesiology fellow and staffed by an obstetric anesthesiologist. The aim of this study is to perform a retrospective chart review to determine demographics of and indication for referral of the patients referred for to the high-risk obstetric anesthesiology clinic at our center for evaluation and recommendations.

Methods

This retrospective study evaluated telehealth antepartum consultations with the obstetric anesthesiology team at a single center over the course of just over one year (June 1, 2023 and June 30, 2024). The consultation notes were manually reviewed by 2 team members to collect these data: maternal age, gestational age at the time of consultation, gravida and parity, the planned mode of delivery, primary consultation question, referrals to other specialists, and candidacy for neuraxial analgesia and anesthesia.

Results

During the study period, 206 parturients were seen for consultation. The majority of patients were planning for a vaginal delivery (73%), while 17% had an indication for a cesarean, and the remainder were to be determined at time of consultation. Nulliparous patients represented 63% of the consultations (130/206). Patients were often referred for multiple conditions, with the most common reason being cardiac issues (excluding congenital heart disease; 89/206), followed by hematologic conditions (68/206) and anticoagulation therapy (51/206) (Figure 1). Notably, 44% of the study population had more than one condition or issue that were addressed during the consultation. Only four patients (2%) were deemed to be poor candidates for neuraxial analgesia/anesthesia; reasons for ineligibility included patient refusal and blood dyscrasia-related condition.

Discussion

The majority of patients (98%) were candidates for neuraxial analgesia and anesthesia, though some of these were conditional (e.g. only if there had been enough time since the last dose of anticoagulation). Despite the recommendation for early anesthetic evaluations by various professional organizations, one study found that only 38% of surveyed U.S. academic centers reported operating a high-risk obstetric anesthesiology

clinic.[1] These findings indicate which comorbidities are likely more prevalent among patients with high-risk pregnancies at our center, and they also illustrate some reasons for consultation that may be worth considering at other sites (e.g. history of traumatic delivery or blood product declination).

References:

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Figure 1.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 02

Building Electronic Health Record Infrastructure to Optimize Antenatal Anesthesia Planning Consults Across a Municipal Hospital System: A Quality Improvement Initiative

Presenting Author: Nita Wong, BS

Presenting Author's Institution: Albert Einstein College of Medicine - New Hyde Park, New York

Co-Authors: Anthony Chang, MD - NYC Health + Hospitals/Elmhurst
Kelly Fitzgerald, MSN, CNM - NYC Health + Hospitals
Richard Mercuri, BBA - NYC Health + Hospitals
Ngozi Nwankpa, MD, MHL - NYC Health + Hospitals/King's County
Eli Zarkhin, MD - NYC Health + Hospitals/Elmhurst

Abstract :

Antenatal anesthesia planning consults (AAPCs) present an opportunity for the early initiation of multidisciplinary evaluation and individualized management of patients at high risk for anesthetic complications. While the American Society of Anesthesiologists emphasizes the importance of a formal antenatal anesthesiology consult system, many institutions lack the necessary infrastructure. This limitation is particularly concerning in the United States, where maternal mortality exceeds that of other developed nations, especially among Black, Indigenous, and People of Color (BIPOC). This quality improvement initiative was a response to a historically informal approach to AAPCs that resulted in inconsistent or inappropriate referrals and ineffective interdisciplinary communication at an institution that serves a largely BIPOC population. We aimed to build the electronic health record (EHR) infrastructure necessary to standardize AAPCs across a large municipal hospital system.

Led by a multidisciplinary team that includes anesthesiologists, obstetricians, and certified nurse midwives (CNMs), we completed a literature review and a driver diagram to identify the elements necessary for a standardized, streamlined AAPC workflow:

- **Clinical decision support tool for obstetric clinicians** standardizes identification and referral of patients
- **EHR consult order** allows referring obstetric clinicians to communicate relevant clinical information to anesthesiologists
- **Dedicated EHR work queue** facilitates anesthesiologist access to the record of patients referred for consults
- **EHR anesthesiology note template** standardizes and streamlines documentation
- **EHR flag** alerts future care teams to a patient's management plan
- **EHR quality assurance reports**

We obtained enthusiastic support for our proposal from our institution's anesthesiology and OB/GYN leadership. Changes to the EHR, however, required approval from several system-wide governing bodies including the Obstetric Anesthesiology Subcommittee (OAS). Navigating the bureaucracy of a large municipal healthcare system enabled us to recruit stakeholders from other institutions within our system, leading to system-wide adoption of the initiative. The OAS joined the project team as active leads, and the hospital system assigned a team of EHR analysts to spearhead the build.

The new EHR infrastructure and workflow were piloted at our community hospital from June to October 2024. Several post-pilot implementation PDSA cycles occurred to resolve workflow and EHR defects. To date, all consult orders placed by OB/GYN clinicians have received a corresponding note from an anesthesiologist. The exponential growth of the project since its inception highlights the widespread need for a formal antenatal anesthesiology consult system within our hospital network. We hope that our work will contribute to addressing a broader need by serving as a model for other medical centers across the country seeking to develop similar infrastructure.

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 03

Challenges in the Provision and Use of Labour analgesia in African Countries; A Literature Review

Presenting Author: sakina bhaloo, Anaesthetist

Presenting Author's Institution: Hillingdon Hospital NHS trust - iver, England

Co-Authors: Con Papageorgiou, Anaesthetist - Hillingdon Hospital NHS trust

Abstract :

Introduction: Despite adequate pain relief being a human right, the provision and use of labour analgesia in African countries lags behind the developed world. High costs of narcotics, lack of trained personnel, and limited access to equipment and monitoring have been identified as barriers to providing labour analgesia.[1] Approximately 80% of women globally deliver with the assistance of skilled birth attendants, and evidence suggests that more women in developing countries are accessing maternal services.[2] Understanding the reasons for poor utilisation and provision of labour analgesia can help develop context-specific solutions for improving this service for African women.

Objective: This study aims to collate relevant themes from the literature to highlight the challenges faced by healthcare providers and patients in the provision and use of appropriate labour analgesia in Africa.

Methods: We used Arksey and O'Malley's[3] five-step scoping review framework to establish our research question and narrow the scope of our literature review to relevant studies. We utilised Web of Science, PubMed, CINAHL, and SCOPUS search engines with key search terms such as 'Challenges,' 'Labour analgesia,' and 'Africa' using Boolean operators 'OR' and 'AND.'

Results: We identified 31 relevant papers from 10 African countries: Nigeria (11 studies), Ethiopia (9), Ghana (4), and Lesotho, Uganda, Egypt, South Africa, Cameroon, Kenya, and Tanzania (1 each). Challenges were categorized into patient-related, healthcare professional-related, and health systems-related issues. Infrastructure gaps exist across Africa, from restrictive national policies preventing opioid procurement to insufficient equipment, training, and shortages of trained healthcare providers. Attitudes towards labour pain as a natural phenomenon, cultural and religious beliefs, limited awareness of pain management options, and concerns about side effects further affect both provision and access to labour analgesia.

Conclusion: Efforts toward lifesaving treatment and good antenatal care are priorities for African women. However, the management of labour pain should not be considered a luxury. It is a basic human right and an integral part of providing better-quality maternal care.

References: 1. M. Size, O. A. Soyannwo, and D. M. Justins, "Pain Management in Developing Countries," *Anaesthesia* 62, no. 10 (2007): 999–1003, https://doi.org/10.1111/j.1365-2044.2007.05296.x.

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Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 04

Strategies for disaster preparedness and planning for peripartum healthcare delivery: a scoping review

Presenting Author: Cassandra Poirier, MDCM

Presenting Author's Institution: Department of Anesthesiology, Pharmacology & Therapeutics, University of British Columbia, Vancouver (UBC), Vancouver, British Columbia, Canada - Burnaby, British Columbia

Co-Authors:

Abstract :

Natural disasters severely impact healthcare delivery, particularly disadvantaging pregnant patients, yet emergency perinatal services have been historically neglected. The literature on guidelines for peripartum healthcare delivery, including the role of anesthesiologists, during natural disasters has been lacking. This scoping review examined the existing literature on strategies for disaster preparedness and planning for peripartum healthcare delivery. It was conducted according to the Joanna Briggs Institute methodology and reported using PRISMA-ScR guidelines, with registration on the Open Science Framework. Studies published from 2003 to 2025 involving adults (≥ 18 years) who received perinatal care during and/or in the immediate aftermath of a natural disaster were included. Of the 4010 results retrieved from databases and grey literature, 54 articles met inclusion criteria. Fifteen countries were represented, though representation from low-income countries was limited. There were 3 systematic reviews, 23 narrative reviews, 11 observational studies, 7 retrospective studies, 5 expert opinions and 5 commentaries. The following disaster types were covered: COVID-19 pandemic (35%), general disasters (28%), earthquakes (21%), hurricanes (7%), floodings (4%), influenza pandemics (4%), and less frequently, tsunamis, Zika, Ebola, and manmade disasters (2% each). They addressed the four stages of disaster planning to varying degrees across the continuum of perinatal care, including mitigation (25%), preparedness (34%), response (31%) and recovery (12%). Data from the selected articles underwent thematic and deductive analysis, focusing on the four disaster planning phases and six healthcare delivery domains as defined by the AHRQ (capacity, organizational structure, finances, patients, care processes and infrastructure, culture) to identify common themes and potential areas for further research and intervention. Key strategies identified included perinatal triage and management protocols, formation of obstetrical multidisciplinary teams, use of mobile health units for rapid deployment, equipment checklists, and interdisciplinary training simulations. Challenges relating to resource allocation and disruptions in infrastructure, particularly in low-resource settings, were recurring themes. Ultimately, the findings will fill a critical gap in the literature and inform future policy, multidisciplinary practice guidelines, and educational efforts to improve peripartum care delivery during natural disasters.

References:

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Piña IL et al. A framework for describing health care delivery organizations and systems. Am J Public Health American Public Health Association; 2015; 105: 670–9.

Sendai Framework Terminology on Disaster Risk Reduction: Disaster. United Nations Office for Disaster Risk Reduction.

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 05

Obstetric Anesthesiologist Involvement on State Maternal Mortality Review Committees (MMRC): A Survey of Society for Obstetric Anesthesia and Perinatology State Representatives and MMRC

Presenting Author: Stratton Dangerfield, MD

Presenting Author's Institution: Brigham and Womens Hospital - Boston, Massachusetts

Co-Authors: Samantha Devane, n/a - Brigham and Womens Hospital
Noor A. Raheel, MD, MPH - Brigham and Women's Hospital

Abstract :
Background: At least 84% of maternal deaths in the United States are considered preventable (Trost). State-level efforts may be the most impactful way to identify solutions to prevent deaths. Maternal mortality review committees (MMRCs) are multidisciplinary groups that review all maternal deaths to create state-specific recommendations. MMRC funding by the US Centers for Disease Control recently focused on enhancing the reporting of maternal deaths with a shared maternal mortality review information application (MMRIA). MMRC committee member makeup is not standardized, and anesthesiologists are not uniformly included. In 2023, the Society for Obstetric Anesthesia and Perinatology (SOAP) created a network of OB anesthesiologists at the state level: the SOAP State Representatives Program. Each State Representative was tasked with identifying if their state had an anesthesiologist on its MMRC. We report a survey of SOAP State Representatives on the status of their MMRCs.

Methods: The SOAP State Representatives Directory was accessed to identify State Representatives and MMRC members. Members were emailed a brief survey to verify their role as a SOAP representative, a MMRC member, or both. MMRC members were asked if membership preceded or followed the initiation of the SOAP State Representatives Program. Top 3 reviewed causes of maternal death to date and desired type of additional support from SOAP were also elicited.

Results: A total of 66 individuals were emailed: 53 state representatives, 22 MMRC members, and 9 individuals who were both. We received 44 total responses for a response rate of 66%, with responses from 29 state representatives (54% completion rate), and 19 MMRC members (86% completion rate). 100% response rate is anticipated by May 2025.

Of the 19 responding MMRC members, 13 reported memberships prior to the State Representatives Program (68%), 4 reported joining after (21%), and 2 did not specify. 100% of the responding MMRC members reported using MMRIA and having no barriers to joining the committee.

The most common requested type of support from SOAP included improved networking among OB anesthesiologists (3/41), the need for easily distributable standardized resources (3/41), and the desire for a standardized directory (2/41).

The most common reported causes of maternal death reviewed by MMRC were drug overdose (7/21), respiratory arrest (3/21), cardiac arrest (2/21), cardiomyopathy (2/21), and septic shock (2/21).

Conclusion: We present our first report of the SOAP State Representative Program's effort to identify MMRC involvement of obstetric anesthesiologists at the state level. As experts in crisis management, OB anesthesiologists are critical in recognizing preventable maternal morbidity and mortality, underscoring the importance of their presence on every MMRC. The final results of this survey will define gaps and establish a baseline for our efforts

References:

Trost SL et al. https://www.cdc.gov/maternal-mortality

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 06

Assessment of Knowledge Acquisition during a Novel, Intensive Obstetric Anesthesia Simulation Curriculum: A Pilot Study in Vietnam

Presenting Author: Jordan A. Francke, MD MPH

Presenting Author's Institution: Brigham & Woman's Hospital - Boston, Massachusetts

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Lanh Thi Thu Tran, MD - Huế University of Medicine and Pharmacy
Huan Vu Tran, MD - Huế University of Medicine and Pharmacy

Abstract :

Background

Nearly 95% of all maternal deaths occur in low and lower-middle income countries.[1] According to international surveillance data, Vietnam's maternal mortality ratio (MMR) increased from 109/100,000 live births in 2015 to 124/100,000 live births in 2020.[1] Anesthesiologists can play a key role in improving maternal health outcomes. Funded by the SOAP/Kybele International Outreach Grant, a partnership was formed between two academic medical centers in the US and Vietnam to enhance medical education in lower resource environments through a novel obstetric anesthesiology simulation curriculum.

Methods

After institutional ethics board approval at both sites, an intensive obstetric anesthesiology simulation curriculum was implemented in Vietnam over one week with a total of 24 residents. Participants completed a 30-item pre-test on day one. The exam contained five questions each related to the four simulated scenarios ("simulation" questions, 20 total) and ten interspersed questions related to obstetric anesthesia but unrelated to the simulated topics ("distractor" questions). Groups of four residents completed clinical simulations covering profound fetal bradycardia, failed intubation, postpartum hemorrhage, and amniotic fluid embolism. The simulations occurred daily during a 90-minute protected education block. Residents rotated through each role per simulation scenario: primary anesthesiologist managing the case, anesthesia resident assisting the anesthesiologist, operating room nurse, and surgeon. Each session included the simulation, a facilitated debrief, and a 20-minute lecture on the clinical topic covered. On the final day, participants completed the same 30-item exam as a post-test to assess knowledge acquisition. The primary outcome was score improvement between the pre- and post-tests. Two additional tests will be administered at 2- and 12-week delayed intervals to evaluate knowledge retention.

Results

Overall, the resident score significantly increased from a pre-test median score of 58% [IQR: 52-62] to a post-test median score of 80% [IQR: 75-83], $p < 0.001$. Residents experienced a larger median increase in their scores on simulation questions (30%, IQR 23-38) compared to distractor questions (10%, IQR 0-20), $p < 0.001$)(Figure). There were no differences in baseline knowledge by training year or gender. Similarly, no differences were detected

between pre- and post-test scores based on level of training, gender, or simulation role assignment.

Discussion

This study shows that an intensive obstetric anesthesia simulation curriculum improves resident knowledge of key obstetric anesthesia scenarios implicated in maternal morbidity and mortality. A planned assessment of post-test administration at 2- and 12-week time points will assess longitudinal retention and may inform further applications and intervals of simulation-based education in lower resource training environments.

References:

1. Trends in Maternal Mortality 2000-2020. WHO. 2023.

Francke SOAP_ Kybele PrePostTest Abstract Figure Final 1 29 2025B FINAL.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 07

Automating Anesthesiology Anetnatal Consultation Notes for Postpartum Hemorrhage Risk: A Feasibility Study Using Large Language Models

Presenting Author: Domenic J. Pedulla, MD

Presenting Author's Institution: Brigham and Women's Hospital - Boston, Massachusetts

Co-Authors:

Abstract :

Introduction

Postpartum hemorrhage (PPH) remains a leading cause of morbidity and mortality among parturients in the US (1,2). Optimizing antenatal anesthesiology evaluations for patients at high risk for PPH may improve care coordination and outcomes. Standardized templates for common scenarios like elevated PPH risk may assist in identifying risk factors and decreasing workload for providers in a busy obstetric anesthesia service. Recently, large language models (LLMs) have proven useful in automation of such clinical workflows as generating notes and summarizing large clinical datasets (3). A recent study demonstrated that an LLM generated superior handoff notes compared to physician written summaries based on automated evaluation methods (4). This feasibility study sought to evaluate the quality and accuracy of LLM-generated standardized antenatal anesthesia consultation notes for mock patients at high risk for PPH .

Methods

Experienced physicians generated mock patient scenarios simulating patients at elevated risk of PPH (non-human research IRB determination). For each scenario, a mock obstetric (OB) note was written by physicians, and a mock antenatal anesthesiology consult between two physicians, one acting as a patient and the other as an anesthesiologist, was recorded and transcribed using Whisper large-v3 1550M. GPT4 (OpenAI) was used to generate an antenatal anesthesia consultation note. The model was prompted via a chain-of-thought technique and provided with an example script; for each scenario, it was then provided with an OB note and transcript and instructed to generate an anesthesia consult note. Each LLM-generated note was evaluated using a qualitative evaluation framework using Likert scale of 1 to 5 (5). Descriptive statistics were used for analysis.

Results

We generated 10 mock patient scenarios. Based on review by an experienced physician, the LLM-generated notes had a mean (SD) quality score of 5 (4-5 25-75%IQR) out of 5. Eight of the ten notes had a correctness score of 5 out of 5. A majority of the notes (N=6) were considered of sufficient quality and accuracy to be included directly in the medical record. Only 1 note demonstrated inadequate quality due to inaccurate OB history and incomplete plan, suggesting potential patient risk if not corrected.

Conclusions

In this feasibility study, the LLM-generated anesthesia consultation notes demonstrate high quality scores, indicating an overall high level of accuracy. These findings suggest that LLM-based tools may improve the standardization and quality of clinical documentation for high-risk OB patients. We will continue to utilize our LLM tool to generate more notes from mock patient scenarios, with further studies using this LLM tool for real world clinical scenarios.

References:

1- Uwubamwen, Verma. Anaest Intens Care M. 2019.
2- Corbetta-Rastelli et al. Obstet Gynecol. 2023.
3- Williams et al. MedRXIV. 2024.
4- Hartman et al. JAMA Netw Open. 2024.

LLM Table I.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 08

Development of a Novel Obstetric Anesthesia Simulation Curriculum in Vietnam: A Model for Improving Maternal Care in Low- and Middle-income Countries

Presenting Author: Jordan A. Francke, MD MPH

Presenting Author's Institution: Brigham & Woman's Hospital - Boston, Massachusetts

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Thịnh Xuân Trần, MD, PhD - Huế University of Medicine and Pharmacy

Abstract :

Background

A lower middle-income country, Vietnam has made significant strides in maternal mortality reduction over the past few decades. However, rates of morbidity and mortality have recently increased, especially in rural regions.[1] Anesthesiologists can play a critical role in improving maternal outcomes in such settings. Funded by the SOAP/Kybele International Outreach Grant, a partnership was established between two academic medical centers (AMC) in the United States and Vietnam to bolster training in low resourced environments via a novel obstetric anesthesiology simulation curriculum. The Vietnam AMC serves as a critical pipeline for medical education to more rural areas of the country. In this context, simulations can foster a safe opportunity to practice clinical, communication and teamwork skills for rare and high acuity events.[2] Simulation may also reveal weaknesses in institutional structures and processes during crisis events and help identify areas for improvement.

Methods

After institutional ethics board approval at both sites, a 2-week visit to Vietnam was conducted with aims to:(1) establish a physical space; (2) train faculty on simulation design and execution; (3) implement the simulations; and (4) solicit participant feedback. During the first week, a dedicated space was created, and 8 Vietnamese faculty anesthesiologists were trained on 4 obstetric anesthesia simulations: profound fetal bradycardia, failed endotracheal intubation, postpartum hemorrhage, and amniotic fluid embolism. An intensive 4-day course followed for 2nd- and 3rd-year anesthesia trainees. Groups of 4 residents participated in each session, comprising a simulated scenario, facilitated debrief, and 20-minute lecture on the simulation topic.

Results

All eligible residents enrolled in the study–fourteen 3rd-year (58%) and ten 2nd-year residents (42%). Fourteen residents (58%) identified as female. The median rating of the experience was 9 out of 10 (SD 0.7). Simulation feedback was assessed on a 5-point Likert scale: ~80% strongly agreed/agreed that the experience was educational, would change future clinical practice, and desired more simulation in training; 20% agreed that language was a barrier to

learning. Using a Wilcoxin Rank-Sum analysis, no differences in the simulation experience were found across gender or training levels (p >0.05).

Discussion

Simulation was well-received in this population, with high rates of participation and engagement. Key factors for successful development and implementation of a simulation curriculum include: institutional leadership support, faculty engagement, cultural readiness, and trainee participation. Simulation in obstetric anesthesiology can be an integral and effective educational tool with the potential to improve maternal health outcomes, especially in lower resource settings where rates of severe morbidity and mortality remain high.

References:

1. Trends in Maternal Mortality. WHO. 2023

2. Volk. Otolaryngol Clin North Am. 2017

Simulation Feedback Survey Figure 012925_FINAL.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 09

Obstetric Anesthesia for Parturients with Acquired or Congenital Heart Disease: A Comparison of Management and Outcomes between Thailand and United States Tertiary Hospitals

Presenting Author: Saranya Lertkovit, MD

Presenting Author's Institution: Brigham and Women's Hospital - Brookline, Massachusetts

Co-Authors: Jean M. Carabuena, MD - Brigham and Women's Hospital
Noor A. Raheel, MD, MPH - Brigham and Women's Hospital
Namtip Triyasunant, MD - Siriraj Hospital, Mahidol University, Bangkok. Thailand

Abstract :

Background: Cardiovascular disease is a leading cause of global maternal morbidity and mortality. International collaboration may help tailor practices for improved outcomes.[1, 2] Here we compare maternal cardiac complications and anesthetic management in parturients with cardiovascular disease at Siriraj Hospital (SIR), Thailand, and Brigham and Women's Hospital (BWH), United States.

Method and methodology: Patients with acquired or congenital heart disease delivering at BWH or SIR between 2015 and 2023 were analyzed using a retrospective observational cohort study design. Disease phenotype and severity, mode of delivery, mode of anesthesia, interventions, morbidity outcomes, and complications were compared.

Result: A total of 489 BWH and 483 SIR cardiac pregnancies were identified for analysis. SIR had a lower incidence of congenital heart disease (18.2 vs 26.8%) and higher incidence of acquired heart disease (64.8 vs. 40.1%). A BMI >30 kg/m^2 was more common at BWH (48.5 vs. 26.6%). SIR had significantly more ASA classification II patients (60 vs 32.1%) and fewer class III (36.9 vs. 66.7%). Applying mWHO risk stratification, 36.6% of BWH patients were class II-III, while 35.4% of SIR patients were class I. SIR had a higher rate of preterm delivery (21.3 vs. 12.7%) and cesarean delivery (CD; 55.9 vs. 34.8%; $p < 0.001$). BWH patients received neuraxial labor analgesia for 94.4% of vaginal deliveries, while the majority (89.2%) at SIR received opioid or nitrous oxide (44.2%) or natural childbirth (55.8%) instead (Table). For scheduled and unscheduled CD, general anesthesia was administered for 14.1 and 27% of SIR patients compared to and 0 and 5.1% at BWH, respectively. In situ epidurals were activated at BWH (70.7%) for unscheduled CD, while most of the equivalent SIR patients received a single-shot spinal (64.3%). Maternal cardiac complications were more common at SIR (13 vs. 9%, $P = 0.044$). Primary cardiac events (pulmonary edema, symptomatic arrhythmia, stroke, cardiac arrest, death) were more frequent at SIR ($p = 0.035$), while secondary cardiac event rates were similar ($p = 0.588$). Telemetry monitoring was more frequent at BWH (16.2% vs. 5.2%; $p < 0.001$). Arterial line use was similar overall but higher among women with cardiac events at SIR (34.9 vs. 6.8%; $p= 0.001$). SIR had more neonatal events, longer hospital stays, and more postpartum ICU admissions.

Conclusion: Maternal cardiac events were more frequent at SIR compared to BWH, and obstetric and anesthesia management was disparate. Modification of obstetric and anesthesia practices at SIR (increasing vaginal delivery rate and epidural analgesia/anesthesia; avoidance of general anesthesia) may elucidate whether maternal cardiac morbidity is driven by lower resource availability or by differential delivery and anesthesia management.

References:

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2. Meng ML et al. Anesthesiology. 2021; 135(1):164-83.

Anesthesia management	BWH deliveries	SIR deliveries	p-value	BWH deliveries with Cardiac Events	SIR deliveries with Cardiac Events	p-value
Overall	**(n = 489)**	**(n = 483)**		**(n = 44)**	**(n = 63)**	
Arterial line placement	8 (1.6)	55 (11.4)	0.659	3 (6.8)	22 (34.9)	0.001
Telemetry	79 (16.2)	25 (5.2)	<0.001	21 (47.7)	10 (15.9)	<0.001
Vaginal Delivery	**(n = 319)**	**(n = 213)**		**(n = 25)**	**(n = 19)**	
Neuraxial labor analgesia	301 (94.4)	23 (10.8)	<0.001	24 (96)	4 (21.1)	<0.001
Scheduled CD	**(n = 71)**	**(n = 85)**		**(n = 9)**	**(n = 9)**	
General Anesthesia	0	12 (14.1)	0.001	0	1 (11.1)	1.000
Unscheduled CD	**(n = 99)**	**(n = 185)**		**(n = 10)**	**(n = 35)**	
Epidural (in situ or new)	70 (70.7)	14 (7.6)	<0.001	6 (60.0)	2 (5.7)	<0.001
Single shot spinal	16 (16.2)	119 (64.3)	<0.001	0	14 (40.0)	0.016
General Anesthesia	5 (5.1)	50 (27)	<0.001	2 (20)	19 (54)	0.055
Outcomes	**(n = 489)**	**(n = 483)**	**p-value**	**(n = 44)**	**(n = 63)**	**p-value**
LOS	3 ±1	5 ±2	<0.001	4 ±2	7 ±5	<0.001
Postpartum ICU	1 (0.2)	53 (11)	<0.001	1 (0.2)	29 (46.0)	<0.001

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 10

Defining a Critical Care Obstetrics (CCOB) Population: From Risk Stratification to Patient Outcomes

Presenting Author: James Conwell, DO

Presenting Author's Institution: Columbia University Medical Center - New York, New York

Co-Authors: RUTH LANDAU, MD - Columbia University
Jessica Morgan, MD - Columbia University
Jean-Ju Sheen, MD - Columbia University

Abstract :

Background

Critical care admissions in pregnant and postpartum women have increased over time, with pooled intensive care unit (ICU) admission rate of 1.6% worldwide.[1] Though scoring systems, such as the Maternal Comorbidity Index, predict severe maternal morbidity,[2] there are no established care guidelines for the escalation of care without ICU admission. Very few centers in the US have a dedicated obstetric-ICU to provide tailored and specific care to the sickest pregnant and peripartum patients. We created a designation entitled Critical Care Obstetrics (CCOB) in the electronic medical record (EMR) for the most medically complex obstetric patients. This designation prompts enhanced multidisciplinary care in our labor and delivery (L&D) high-risk unit.

Methods

In 2023, a working group of obstetricians, nurses, and anesthesiologists defined criteria for CCOB designation at our institution, including both chronic comorbidities (planned CCOB), and acute diagnoses (unplanned CCOB). In May 2024, patients meeting the criteria had “CCOB” added to their EMR problem list (EPIC). A chart review for all CCOB cases between May and December 2024 was completed; characteristics and outcomes between the planned CCOB and unplanned CCOB patients were compared.

Results

A total of 80 CCOB patients were identified; 50 (62.5%) planned (48 delivered) and 30 (37.5%) unplanned (28 delivered) (Table 1). Planned cases were more likely to have a cardiac CCOB indication. Compared with planned CCOB patients, unplanned CCOB patients were more likely to be Hispanic, present and deliver at an earlier gestational age, be diagnosed with preeclampsia, bleeding, or sepsis, receive a general anesthetic at or after delivery, experience a postpartum hemorrhage (PPH), receive a blood product transfusion, have an ICU admission or a longer stay in the high-risk unit, and have their baby admitted to the neonatal ICU (NICU). These results are statically significant ($p< 0.05$).

Discussion

The dedication of critical care resources is needed to manage the unique complications that occur in obstetric patients, often without warning. The CCOB designation was implemented to standardize our approach to managing medically complex obstetric patients throughout

pregnancy and the immediate postpartum period, with the goal to provide enhanced care in our high-risk unit. This preliminary analysis demonstrates that unplanned CCOB cases are more critically ill and require higher resource utilization. Future work will include standardization of care expectations for the CCOB patient population. This novel approach to high-risk obstetric patient identification might serve as a model for other institutions.

References:

1. Critical care admissions and outcomes in pregnant and postpartum women: a systematic review. *Intensive Care Med*. Dec 2024;50:1983-993.

2. Bateman BT, Mhyre JM, Hernandez-Diaz S, et al. Development of a comorbidity index for use in obstetric patients. *Obstet Gynecol*. Nov 2013;122(5):957-965.

CCOB Data Table PDF.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 11

Comparison of Apgar score, skin-to-skin initiation time and resuscitative interventions between Black and non-Black neonates

Presenting Author: Sandy Kim, MD

Presenting Author's Institution: Columbia NY Presbyterian - New York, New York

Co-Authors: James Conwell, DO - Columbia University Medical Center
JEAN R. GUGLIELMINOTTI, MD, PhD - COLUMBIA UNIVERSITY IRVING MEDICAL CENTER

Abstract :

Background

Research shows that Black neonates have lower Apgar scores and higher NICU admission rates.[1] This has been suggested as discriminating against neonates with darker pigmented skin, thus leading to “false” low Apgar score and unnecessary interventions.[2,3] We hypothesized that Black neonates have lower Appearance (color) Apgar score leading to more resuscitative interventions than non-Black neonates and delayed skin-to-skin initiation-important for maternal-infant bonding and breastfeeding initiation.

Methods

Observational cross-sectional study among neonates born via cesarean delivery (CD) between Nov 2023 and Feb 2024 in an academic center. The exposure was neonate race (Black vs non-Black), recorded from neonatal EMR. The primary outcome was Apgar score at 1 min, and secondary outcomes Apgar score at 5 min, resuscitative interventions, and skin-to-skin initiation time. Resuscitative interventions were the composite of O_2 blowby, positive pressure ventilation (PPV), intubation, and NICU admission. Statistical comparisons used ANOVA and Chi-square tests.

Results

Among the 204 neonates included, 25 were Black and 179 non-Black. No difference in the Apgar score at 1 and 5 min was observed between Black and non-Black neonates (Table 1). Black neonates had significantly longer mean skin to skin initiation time compared with non-black neonates (94.9 versus 74.8 min; P=0.02) but no higher utilization of resuscitative interventions (28.0% versus 30.2%; P >0.99). Lower Apgar score was associated with longer skin-to-skin-time and higher use of interventions, both for Black and non-Black neonates. Neonate characteristics were compared between those who received interventions (n=61) and those who did not (n=143); the only significant difference was in gestational age (37.5 vs 38.5 weeks, respectively).

Conclusions

Our analysis confirms that lower Apgar scores are associated with higher interventions. Despite not finding differences in Apgar scores and interventions performed for black neonates, which may be related to our low small study sample, skin-to-skin initiation times for black neonates occurred significantly later. It is possible that another form of implicit bias we were unable to capture is occurring. The interaction between Apgar score, skin to skin initiation and resuscitative interventions needs further evaluation. Future analyses assessing the Apgar score without the appearance component (total score of 8) in larger cohorts to reduce unnecessary interventions is warranted.

References:

1. Am J Obstet Gynecol, 2023. 228:229 e1-229 e9.

2. Population Research and Policy Review, 2003:41-64.

3. J Perinat Med, 2023. 51: 628-33

RL SK Apgar race Table 1 v2-JG.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 12

Personalized AI-Powered Precision Medical Education App

Presenting Author: Patrick Pham, BS

Presenting Author's Institution: Oregon Health & Science University - Fairview, Oregon

Co-Authors: Glenn Woodworth, MD - Oregon Health & Science University

Abstract :

Introduction

Competency based medical education (CBME) is an educational framework becoming more widespread across many academic medical institutions.[1,2] Precision medical education (PME) aims to address a core tenet of CBME by personalizing delivery of educational content and experiences based on data driven analytics.[3] Our multi-institutional initiative is developing a novel AI-powered PME app to individualize the learning experience of anesthesia residents by dynamically sending personalized content recommendations. Drawing from the principles of PME, we hypothesized that implementation of this novel app may facilitate effective content recommendations that are pertinent to learners' educational needs. Within the PME app, curated content is recommended to learner's specific areas of growth to facilitate competency attainment. We hypothesize the development of a PME recommender system is feasible and will be useful to residents.

Methods

Iterative focus groups were conducted with residents and faculty to create a design specification for app functionality and the user experience of the PME app. Subspecialty society and education experts were asked to identify high quality content to include in a curated content database. Extract transform load process were developed to extract daily surgical case and monthly experience data from the electronic health record (EHR) and load into an education data warehouse. Large Language Model (LLM) trained to map user queries and surgical case to content database.

Results

3,207 content items included in content database. PME App 1.0 includes a "light" version that does not require data from the EHR and a "heavy" version that utilizes EHR data to recommend and prioritize content. LLM able to recommend items from the content database to learners.

Discussion

Release of version 1.0 of the App light to all accredited US anesthesiology training programs planned for April 1, 2025. Data from version 1.0 will be used to fine tune the LLM. Version 2.0

release planned for Q3 2025. Version 2.0 will include a heavy version of the App and will employ user experience with surgical cases and medical conditions to prioritize the list of recommended content to learners. (Figure 1) Future research will be needed to investigate the impact of the PME system on learning outcomes.

References:

Van Melle, E., et al., A core components framework for evaluating implementation of competency-based medical education programs. 2019. 94(7): p. 1002-1009

Desai SV, et al. Precision Education: the future of lifelong learning in medicine. Acad Med. 2024; 99(4S Suppl 1):s14-s20. Triola M, Burk-Rafael J. Precision Medical Education. Acad Med. 2023;98(7):775-781.

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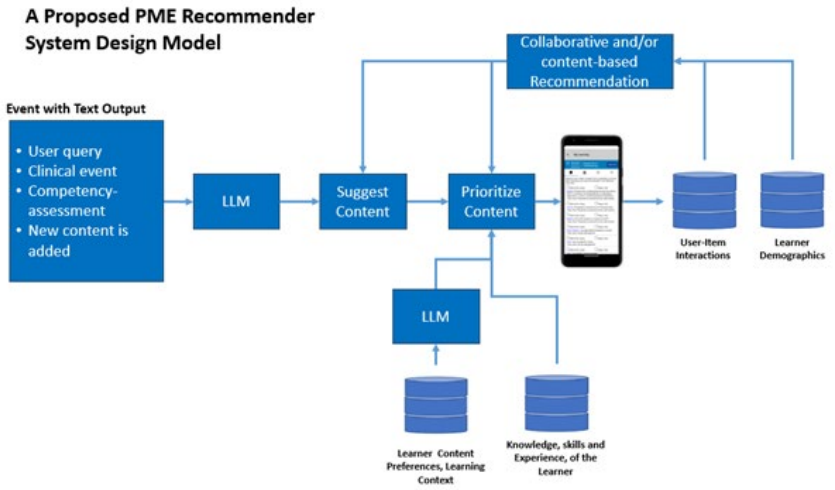

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 13

Spanish-language patient education materials for obstetric anesthesia: a comparison of readability and quality of online Spanish-language resources

Presenting Author: Mariana Restrepo, BA

Presenting Author's Institution: Icahn School of Medicine at Mount Sinai - New York, New York

Co-Authors: Sananda Pai, n/a - Icahn School of Medicine
Talia Scott, MD - Icahn School of Medicine at Mount Sinai

Abstract :

Introduction

Hundreds of thousands of Hispanic parturients give birth in the U.S. each year, highlighting the importance of accessible health education resources for patients whose primary language is not English. Patient education materials (PEMs) for obstetric (OB) anesthesia that are readily accessible online should therefore be readable and of high quality across all languages. Given the maternal care disparities Hispanic patients face and the known high reading levels of many Spanish-written PEMs, it is critical to identify gaps in resources to ensure equitable access to vital health information.[1,2] This study aims to assess the readability and quality of online Spanish-language PEMs on OB anesthesia from both a general internet search and academic leaders in OB anesthesia.

Methods

To identify Spanish-written PEMs on OB anesthesia, the authors screened the webpages of 62 academic medical centers (AMCs) recognized as leaders in OB anesthesia. A general internet search using the term "anestesia y alivio del dolor durante el parto" (“anesthesia and pain relief during labor and delivery”) to find an equal number of additional resources was conducted to evaluate a patient’s potential online search. The readability of PEMs was assessed using the Fernandez-Huerta Reading Ease (FHRE) and INFLESZ analyses, while quality was evaluated using the DISCERN instrument and the Health Education Materials Assessment Tool (HEMAT).

Results

28 Spanish-language PEMs for OB anesthesia from AMCs and 28 from a general internet search were identified. The FHRE and INFLESZ readability analyses revealed that PEMs from both cohorts are not significantly different from one another and primarily aligned with a 9^{th}-10^{th} grade reading level (Table 1). These reading levels significantly exceeded the recommended 4^{th}-6^{th} grade level ($p< 0.001$). DISCERN scores indicated no overall quality difference between PEMs from AMCs and a general internal search as they both partially completed criteria. Both groups achieved high HEMAT scores for understandability.

Conclusion

The readability of Spanish-written online PEMs on OB anesthesia from AMCs and a general internet search was found to be similar and of a higher level than what is nationally recommended. No difference in quality was found between AMCs and a general internet search. Improvements in readability and quality are needed to allow for better patient-centered care and to emphasize the importance of shared-decision making.

References:

1. Aponte J, Tejada K, Figueroa K. Readability Level of Spanish Language Online Health Information: A Systematic Review. *Hisp Health Care Int Off J Natl Assoc Hisp Nurses*. Published online October 3, 2024:15404153241286720. doi:10.1177/15404153241286720
2. Patel SK, Gordon EJ, Wong CA, Grobman WA, Goucher H, Toledo P. Readability, Content, and Quality Assessment of Web-Based Patient Education Materials Addressing Neuraxial Labor Analgesia. *Anesth Analg*. 2015;121(5):1295-1300. doi:10.1213/ANE.0000000000000888

SOAP Readability Abstract.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 14

Accuracy and readability of ChatGPT and Gemini responses to obstetric anesthesia questions: effect of time, query level, and hallucinations

Presenting Author: Christine Chen, MD

Presenting Author's Institution: Cedars-Sinai Medical Center - Los Angeles, California

Co-Authors: Donald Lee, MD - Cedars-Sinai Medical Center
Ario Ramezani, DO, MS - Cedars-Sinai Medical Center

Abstract :

Introduction
The popularity of large language models (LLM) propelled answer engines such as ChatGPT to become one the fastest growing applications in history, with 3.6 billion visits per month.[1] Over 90% of parturients have searched the internet for health information.[2] We measured the change over time in readability, accuracy, and quality of answers to common obstetric anesthesia questions using LLMs, as well as with query modifications.

Methods
This study is IRB exempt. 20 FAQs about obstetric anesthesia[2] were used to query the LLMs ChatGPT 4o mini and Google Gemini (formerly Bard) in November 2024. Answers were graded for accuracy and quality (understandability and actionability) using the Agency for Healthcare Research and Quality (AHRQ)'s Patient Education Materials Assessment Tool for Print (PEMAT).[2,3] Readability was measured using validated indices.[2] Accuracy, quality, and readability were compared using independent t-test ($p < .05$ significance level). Using our data from November 2023, we compared the effect of one year's time on answers to the same questions using dependent t-test.[2] We examined the effect of query modifiers "can you make it simpler" and "tell me more" compared to the first answers, using repeated measures ANOVA. Finally, the LLMs were queried with "Can you give me scientific references?" and sources were checked for validity.

Results
The accuracy of Gemini (96.3%±5.8) was statistically significantly improved from 1 year prior ($p < .001$), but accuracy of ChatGPT (92.3%±8.5) was not significantly improved ($p = 0.14$). Both LLMs significantly improved in understandability and actionability by PEMAT over time ($p < .0001$). ChatGPT significantly improved in readability by all scoring metrics over time ($p < .001$), while Gemini significantly decreased in readability in 4 of 6 scoring metrics. In 2024, query modification "can you make it simpler" made answers easier to read, followed by some increase of reading level with "tell me more." Both LLMs were highly accurate at all query modification levels, but ChatGPT had a significantly lower grade level readability at the "tell me more" level answers than Gemini. ChatGPT provided 15.2% accurate references (high degree of hallucinations) versus Gemini at 98.75% ($p < .00001$).

Discussion
LLM capabilities are rapidly evolving and becoming an integral part of society. People using LLMs for medical information require the accuracy, quality, and readability to meet standards set by AHRQ. The query modification "can you make it simpler" on both LLMs maintained the accuracy of the response while significantly improving readability, a more practical option for

users. Lastly, ChatGPT hallucinated when asked for references. As LLMs continue to advance, they should address readability and therefore access issues.

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2. Lee D. IJOA 2024.PMID: 39754839.
3. Shoemaker SJ. 2014. PMID: 24973195.

Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 15

Standardizing Patient Handoffs between Anesthesia Trainees on Labor & Delivery

Presenting Author: Christine Chen, MD
Presenting Author's Institution: Cedars-Sinai Medical Center - Los Angeles, California
Co-Authors:

Abstract :

Introduction

Nearly 7000 deliveries occur annually at our tertiary care hospital, which serves as the obstetric anesthesiology site for two anesthesia residencies and one nurse anesthetist program. This volume can be difficult for trainees to manage. While other consult services use annotated lists to organize patient information, anesthesia trainees are not in the habit of maintaining lists. Additionally, there is a lack of standardized sign out across obstetric anesthesiology. Surveys have shown that structured handoff tools increase the rate of handing over sick patients by nearly threefold.[1] Currently, a major lapse in the care of obstetric patients is the inconsistency of handovers between trainees.

Methods

Using a literature search and clinical survey of obstetric anesthesiologists, a list of pertinent positives was created and integrated into the electronic medical record (EMR) with a charting shortcut (in Epic, “SmartPhrase”). Next, access to a shared patient list which auto-updated the current census was granted to rotators. A pre-test survey[2] was distributed to anesthesia trainees who had completed at least one obstetric anesthesia rotation. At the start of the rotation, all trainees were instructed on how to use the tool, which consisted of the patient list and SmartPhrase feature. At the end of the month, a post-test was administered. These surveys assessed the trainee’s comfort level and satisfaction with the handoffs before and after integration of the new tool.

Results

The frequency of using standardized handoffs between trainees increased from 31 to 79 percent. All survey respondents agreed that the tool was an effective way to relay information. 83 percent agreed that the new tool did not lend itself to mistakes, and there was a twofold increase in ability to identify and remember at-risk patients (Figure 1). On the post-test, one user commented “it is succinct and able to convey the highest yield information that you would want to know quickly in an emergency.” Post-test data also included suggestions for further data automation in the EMR such as color coding to indicate delivery status. Lastly, 100 percent of survey respondents indicated that they would continue to use the tool.

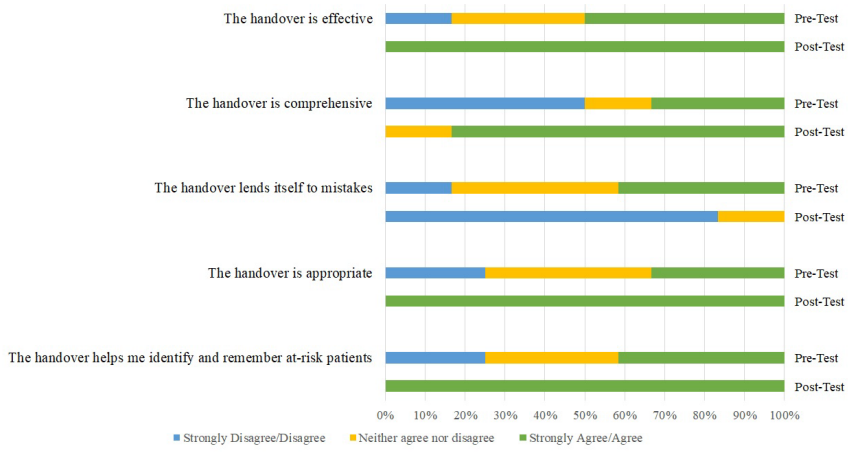
Discussion

The intervention assists trainees of various experience levels with triaging several simultaneous patients. On a high-volume and acuity labor and delivery unit, emergencies require an efficient way to convey crucial patient information between anesthesia team members. Incorporating this tool into anesthesia residencies and nurse anesthetist programs

has the potential to reduce critical errors caused by information gaps during the transfer of care. Future feedback will guide improvements of EMR features and further streamline the handover process.

References: 1. Dharmadasa A. Int J Obstet Anesth 2014. PMID: 24656527.
2. Gabot M. AANA J 2022. PMID: 35076379.

Figure 1. Pretest and Posttest Survey of Handoff Tool



Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 16

Can Large Language Model tools provide useful information for learners?

Presenting Author: Maria D. Patrocinio, MD

Presenting Author's Institution: Beth Israel Deaconess Medical Center - Boston, Massachusetts

Co-Authors: Samantha L. Armstrong, BS - Beth Israel Deaconess Medical Center
Yunping Li, MD - Beth Israel Deaconess Medical Center

Abstract :
Background: Resident trainees use several tools to gain vital knowledge. Newer modalities of education include active learning techniques (simulation, problem-based learning, resident as educator). Learners are shifting from textbooks to internet-based resources, such as using large language models (LLM) in their education. The use of LLM carries a risk as information may not carry a similar value to an expert. Within the Anesthesia field, LLM have reduced accuracy, scoring 45-69% on standardized tests. At the present time, the validity of human evaluation of LLM performance in medical question answering remains poorly described, thus the impact of this evolution must be studied. We propose to evaluate whether LLM-generated learning summaries validly provide a novice resident with knowledge that will aid their ability to learn accurate information.

Methods: Twenty-two second-year residents (CA-1) were approached for inclusion during their first week in obstetric anesthesia training. Exclusion criteria were refusal to participate. A list of 17 summary statement on five educational topics (Local anesthetics, Adjuvants, Complication, Modes of Anesthesia, and Hypertensive disorders) was created from both human-experts and a LLM (ChatGPT-4). A random survey with 20 of these statements was given to each subject. Who rated the topics based on a five-point Likert scale for specificity, thoroughness, precision, and helpfulness for recalling. Results were compared using t-test; significance at the $P \leq 0.05$ level.

Results: Variations among residents showed significant grading differences in scoring ($P < 0.01$), with some ranking their list very favorably, while a few scored their list close to neutral. Despite this, the grading of the statements showed significant high reliability for the expert (Cronback's alpha 0.92) and good reliability for the LLM (Cronback's alpha 0.84). When presented in a survey format, residents were unable to distinguish whether the statements were written by an expert or a LLM, with 43% of expert and 46% of LLM statements being attributed to a human writer. The ratings for all 4 dimensions of assessment favored the LLM statements for anesthetic complications and favored the expert statements for hypertensive disorders. Examples of the statements from both sources are shown in the Figure.

Conclusion: From the statements provided, residents found expert statements highly reliable, but compared to LLM there seemed to be a similar quality. The LLM was less favored for a complex topic (hypertensive disorders) due to lack of specificity, but performed well with a less complex topic (complications), where, perhaps, details are less helpful. Further, residents were not able to differentiate if a LLM or expert had written the provided statements. At this time, LLM can be used to gather quick knowledge, but should be used carefully for detailed information.

References: 1.PMID: 38365551
2.PMID: 37502981
3.PMID: 39779926
4.PMID: 38423884

LLM vs Expert Image.pdf

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 17

3D printing, A Novel Approach to Clinical Teaching in Pursuit to Enhance Patient Safety

Presenting Author: Bhavani Shankar Kodali, MBBS, MD, FASA

Presenting Author's Institution: University of Maryland School of Medicine - Baltimore, Maryland

Co-Authors: Shobhana Bharadwaj, MD - University of Maryland Schoo of Medicine
Jessica Galey, MD - University of Maryland School of Medicine

Abstract :

There is a continuous, unabated enthusiasm for using new technologies, such as ultrasound, in clinical teaching and enhancing patient safety. In the past, 3D visual YouTube videos were created to explain the approach of epidural placements in patients with scoliosis and those requiring a paravertebral thoracic epidural approach. This technology needed anaglyph or polarized eyeglasses to visualize the concept. Difficult epidural placement or failed epidural placement can occur if the concept of alignment of the epidural needle is not appreciated in patients with a scoliotic spine or a spine with a rotational component. 3D printing models may help clinical trainees understand and visualize the concept.

Methods:

Our 3D construction process of the scoliosis spine used a human lumbar vertebra, a 3D version file (.stl). Chitubox, a 3D software, was used to create a scoliotic spine. Each of the lumbar vertebrae was stalked one upon the other, and the direction and placement of each vertebra were aligned to form a scoliotic spine. Once the scoliotic format was achieved, the software was used to add the vertebral body rotational component (1A). After satisfactory alignment of vertebrae, a software-assisted support system was used to strengthen the model while printing. The project was saved in a printable format that can be read by 3D printers and printed using a 3D Eagloo Saturn 3 printer. The printing process was time-consuming and lasted about 6 hours (1B). The final product is cured by ultraviolet rays and ready for teaching and training. The trainees were shown how the direction of the needle could influence the final approach and success of finding epidural space in the scoliosis spine.

Conclusion:

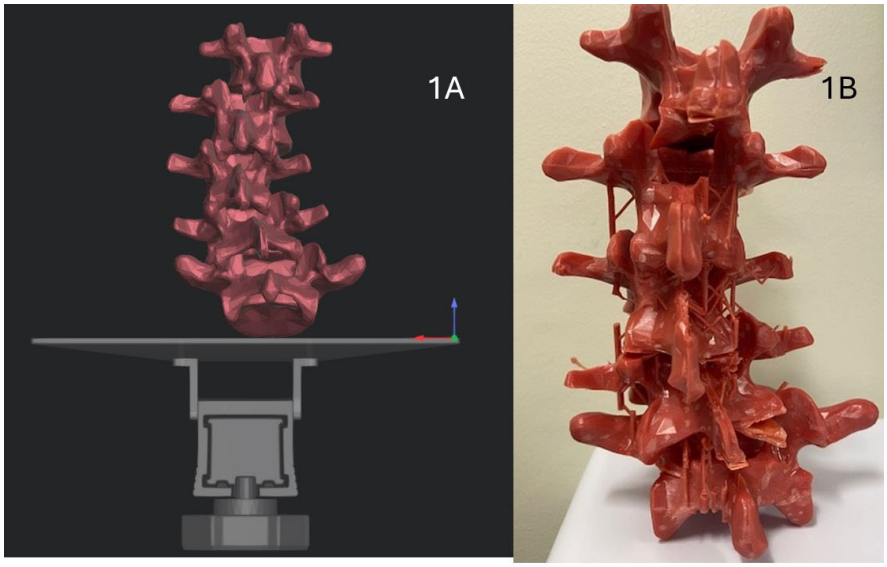
Clinicians know the concept. If clinicians also learn and understand the functionality of 3D software and printing, the academicians and clinicians will have a distinct advantage in converting clinical concepts into actual models for teaching. The future of 3D printing will allow the printing of the actual spine of a scoliotic patient from a CT scan or MRI. High-resolution CT images can be converted into layered 3D images. 3D images facilitate the delineation of the direction of the epidural needle while placing epidurals in a scoliotic patient. Models of the lordotic spine common in pregnancy can be printed to teach why finding a way into the epidural space poses difficulty due to a lack of adequate lumbar spine flexion. Furthermore, 3D model mastery and printing will significantly change the future teaching of difficult airway intubation and cricothyrotomy.

Figure 1A: Scoliotic spine image generated in the software. 1B: Printed 3D image of the scoliotic spine.

References:

1.3-D Understanding of thoracic epidural placement, American Society of Anesthesiology (ASA) Scientific Exhibit, 2009

2.3-D – A novel, simple video model for YouTube, American Society of Anesthesiology (ASA) Scientific Exhibit, 2011



1A: Scoliotic spine image generated in the software.
1B: Printed 3D image of the scoliotic spine.

Abstract #: FRI - RA - BS 2 - BR 3 - Teams & Tech – 18

Quality Assessment: A Novel Interdisciplinary Patient Safety and Quality Care Simulation Program in Labor and Delivery

Presenting Author: Dillon Froass

Presenting Author's Institution:

Co-Authors: Yuyan Liu, MD, Yiying Wu, MD, MPH, Qi Rong, MD,Yue Yu, MAS, Bryan Mahoney,

Abstract:

Introduction

Maternal and neonatal health outcomes are critical metrics for healthcare quality. Team-based approaches in labor and delivery (L&D) have significantly reduced maternal morbidity and mortality. Interdisciplinary team-based training programs are recognized as essential strategies to reduce preventable adverse outcomes.

The “No Pain Labor & Delivery-Global Health Initiative” (NPLD-GHI) has emphasized team-based practices, incorporating low-fidelity simulation training internationally in the past [1]. However, challenges remain, such as limited anesthesiologist coverage, insufficient simulation programs, and unstructured residency curricula.

In response, NPLD-GHI developed TeaM-L&DSim (Interdisciplinary **T**raining for Pati**e**nt Saf**e**ty and Qu**a**lity C**a**re in **M**odern **L**abor **& D**elivery **Sim**ulation), a high-fidelity program. This study evaluates team simulation performance and reliability of new assessment tools, based on results from the program's first-year contest.

Methods

We created 27 L&D scenarios linked to chapters from *Interdisciplinary Clinical Handbook of the Modern Delivery Rooms (2023)*, structured around “Proactive-Prophylactic-Prepared-Rapid Responses” framework. Scenarios targeted communication, teamwork, decision-making, and technical skills to address complex and emergent L&D challenges.

TeaM-L&DSim program included monthly simulations (Mar–Sep 2024) and culminated in a contest in Oct. 9 teams from 10 hospitals participated, each comprising an obstetrician, anesthesiologist, neonatologist, nurse or midwife, and administrator. Evaluations included multidisciplinary judge assessments (70%) and audience evaluations (30%). Final scores were adjusted by difficulty coefficients to ensure fair comparisons.

Results

The 9 contest scenarios revealed disparities in TeamSTEPPS, decision-making, and technical skills among hospitals with varying resource levels. While sample size was limited, Pearson correlation coefficient of 0.8682 ($p=0.01$) indicated strong positive correlation between judge and audience scores. Due to limited sample size and overfitting issues, multiple regression models for the final scores were not performed.

Notably, the Zhangjiakou team, which relied on low-fidelity, monthly simulations following NPLD-GHI training in 2019, achieved unexpectedly high scores.

Conclusion

TeaM-L&DSim program and its innovative evaluation system highlight the transformative impact of team-based simulation training. Its dual focus on low- and high-fidelity training offers a scalable model to address L&D challenges in resource-limited settings.

By fostering interdisciplinary collaboration, enhancing decision-making, and improving technical skills, TeaM-L&DSim represents a critical advancement in global efforts to improve maternal outcomes. This program underscores the importance of teamwork, communication, and adaptability in advancing patient safety and quality care [2].

References

1. Hu LQ et al. A&A. 2016
2. Abrams J et al. Current Opinion in Anesthesiology. 2024

Additional File

Table 1 - Performance and Assessments.pdf

M.D., Ling-Qun Hu, MD

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 01

Prevalence of Inpatient Postpartum Anxiety and Post-Traumatic Stress Symptoms: A Quality Improvement Initiative

Presenting Author: Claudia L. Sotillo, MD

Presenting Author's Institution: Stanford Medicine Division of Obstetric Anesthesiology - Palo Alto, California

Co-Authors: Z J. Bekemeyer, BA - Stanford Medicine Division of Obstetric Anesthesiology
Guillermina Michel, BS - Stanford University School of Medicine
Danielle M. Panelli, MD, MS - Stanford Medicine Division of Maternal-Fetal Medicine and Obstetrics
Sana S. Shah, BS - UCI School of Medicine
Margaret E. Smith, MD - Stanford Medicine Division of Obstetric Anesthesiology

Abstract :

Background: Mental health conditions, including postpartum depression, anxiety, and post-traumatic stress disorder (PTSD), are now the leading cause of maternal mortality in the US, accounting for 23% of deaths within one year postpartum.[1,2] Despite US Preventative Services Task Force (USPSTF) recommendations for universal screening, implementation guidelines and optimal timing of screening remain unclear.[3,4] We aimed to determine the prevalence of inpatient postpartum anxiety and PTSD, and identify associated risk factors.

Methods: This quality improvement (QI) initiative was evaluated as IRB exempt. Over a three-week period, we prospectively assessed all adult, ≥ 23 weeks gestational age patients that delivered by any modes at our institution. Screening was performed within 36 hours of delivery using State-Trait Anxiety Inventory (STAI; cut off ≥80) and PTSD Checklist for DSM-5 (PCL-5; cut off ≥31) questionnaires.[5,6] We collected demographic, obstetric, medical, and neonatal variables through in-person, telephone, or email follow-up, regardless of primary language.

Results: Of 275 eligible patients, 263 (95.6%) completed screening measures. The prevalence of postpartum patients screening positive for anxiety and PTSD was 12.5% and 3.0% respectively, with 2.3% of patients screening positive for both conditions. Prior psychiatric diagnosis/medication use emerged as an independent risk factor for positive anxiety screening (Table 1). Worse anxiety screening scores were associated with demographic factors linked to better healthcare access: older age, higher education, English-speaking status, non-Hispanic ethnicity, and higher income. Worse scores for both anxiety and PTSD were demonstrated in ASA 3 vs 2, Apgar < 7 vs ≥7 and pre-term birth vs term birth.

Conclusions: Our findings support universal inpatient anxiety screening while suggesting more targeted screening for PTSD, particularly among patients with pre-existing psychiatric conditions or complicated pregnancies may be preferable. Future research should focus on determining optimal screening and referral guidelines and developing early targeted interventions for this vulnerable population.

References:

References:

1. Psychiatry News 2024; 59(4): 5, 34
2. JAMA 2023; 329:2163–70
3. Am J Obstet Gynecol MFM 2023; 5:101076
4. Am J Obstet Gynecol 2024; 231:134.e1-134.e13

Sotillo Anxiety PTSD SOAP Table.pdf

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 02

Prevalence and risk factors for postpartum anxiety among insured patients in the United States

Presenting Author: Phillip Callihan, MD PhD

Presenting Author's Institution: Stanford University - Menlo Park, California

Co-Authors: Lauren Blake, MD - Stanford University
Nan Guo, Ph.D. - Stanford University
Natalie Koons, DO - Stanford University
Danielle M. Panelli, MD, MS - Stanford Medicine Division of Maternal-Fetal Medicine and Obstetrics
Margaret E. Smith, MD - Stanford Medicine Division of Obstetric Anesthesiology

Abstract :
Background: Postpartum anxiety disorders are associated with significant maternal morbidity, however the prevalence and risk factors are under explored with current focus on postpartum depression.[1,2] The primary outcome of this study was to estimate the prevalence of new diagnoses of postpartum anxiety in the US. Secondary outcomes were to determine the prevalence of co-morbid anxiety with depression and PTSD, describe temporal changes in prevalence of these diagnoses, and identify risk factors for postpartum anxiety.

Methods: This IRB approved retrospective cohort study used ICD-9 & 10 codes of US-insured patients identified from the Merative ™ Marketscan® Database. Adult women who experienced childbirth between 2007 and 2021 were included if enrolled from 90 days prior to their last menstrual period to 1 year postpartum. Patients with anxiety or depression prior to pregnancy or antenatally were excluded. Univariate and multivariate regression models were constructed to identify demographic, obstetric / medical (including severe maternal morbidity (SMM)[3] and neglected medical conditions (NMC)),[4] and neonatal risk factors for the development of postpartum anxiety.

Results: From 1,469,121 women without prenatal mental health disorders, 84,984 (5.8%) of postpartum patients had a new anxiety diagnosis within 1 year of delivery and 75,494 (5.1%) of these new diagnoses occurred between 1 month and 1 year postpartum. Co-morbid anxiety and depression and anxiety and PTSD occurred in 1.8% and 0.1% of the study cohort, respectively. Prevalence of postpartum anxiety quadrupled between 2008 to 2021 (3.1% to 12.3%). Univariate and multivariate models for the outcome of new postpartum anxiety diagnosis between 1 month to 1 year postpartum are provided in Table 1. Independent risk factors for postpartum anxiety included: demographic (younger age, north central US), obstetric / medical (lower gestational age at delivery, cesarean delivery, antenatal / early postpartum sleep disorder diagnosis, SMM (including transfusion), NMC), and neonatal (infant co-morbidity) variables.

Conclusions:
Postpartum anxiety impacts nearly 6% of commercially insured US patients and has increased four-fold since 2008. Future studies are needed to evaluate the impact of targeting the modifiable risk factors identified in this study to prevent postpartum anxiety.

References:

1. ACOG Committee Opinion No. 757: Screening for Perinatal Depression. *Obstet Gynecol.* 2018; 132(5):e208-e212.

2. de Avila Quevedo et al. *Psychiatr Q.* 2021;92(2):513-522.

3. CDC Maternal and Infant Health: Identifying Severe Maternal Morbidity (SMM). https://www.cdc.gov/maternal-infant-health/php/severe-maternal-morbidity/icd.html

4. Vogel et al., *Lancet Glob Health*. 2024 Feb; 12(2):e317-e330.

Prevalence and risk factors for postpartum anxiety among insured patients in the US Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 03

Refinement of a Single-Session, Exposure-Based Intervention for Reducing Anxiety in High-Risk Pregnancies Through a Participatory Research Design

Presenting Author: Cristina L. Wood, MD MS

Presenting Author's Institution: University of Colorado, Department of Anesthesiology - Arvada, Colorado

Co-Authors:

Abstract :
Refinement of a Single-Session, Exposure-Based Intervention for Reducing Anxiety in High-Risk Pregnancies Through a Participatory Research Design

Background: Perinatal mood, anxiety, and trauma symptoms (PMATS) are among the most common mental health disorders found in pregnant patients of reproductive age, affecting approximately 1 in 6 patients from pregnancy through the postpartum year.[1] According to a recent Centers for Disease Control and Prevention (CDC) report of 36 states in the United States (US) from 2017-2019, suicide was the most common cause of maternal mortality and suicide is strongly associated with the presence of PMATS.[2] Therefore, psychological interventions tailored to clinical settings are essential for addressing these perinatal mental health symptoms, particularly in high-risk pregnancies. This study focuses on refining a single-session, cognitive-behavioral intervention (CBI) designed to reduce anxiety sensitivity (“fear of fear”) in birthing individuals scheduled for cesarean delivery. The goal was to ensure acceptability, feasibility, and effectiveness, facilitating broader implementation in clinical practice. By enhancing psychological well-being, the intervention aims to improve patient experiences and outcomes during the perinatal period.

Methods: Iterative refinement of a single-session CBI involved integrating qualitative feedback from key stakeholders and local user-testing design participants. 46 participants from across the US were included in 12 professional and lived experiences workgroups. These workgroups included anesthesiologists, obstetric providers, obstetric nursing, mental health providers, hospital administrators, and individuals with lived experiences. They all provided structured feedback on intervention design, delivery, and perceived impact. Additionally, 12 local patients engaged in user-testing design sessions at a single tertiary care center. Qualitative data were collected via semi-structured discussions, transcribed, and analyzed iteratively to inform refinement of the intervention and its implementation strategy.

Results: Stakeholder feedback indicated high acceptability and feasibility of the intervention in clinical settings. Patients reported reductions in anxiety and increased preparedness for delivery. Key implementation challenges included ensuring consistency across sites, addressing institutional barriers to engagement, and optimizing data collection strategies to support widespread adoption.

Conclusions: Findings support the intervention's potential for reducing perinatal anxiety and improving patient experiences. The refined intervention will inform a future treatment development trial, with a focus on scalability, sustainability, and integration into standard obstetric care. (NIH Grant # R34MH133685).

References:

1. PMID: 32703202
2. Pregnancy-Related Deaths: Data From Maternal Mortality Review Committees in 36 U.S. States, 2017–2019 | Maternal Mortality Prevention | CDC.

Image 1 Phase I Iterative Refinement.pdf

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 04

Procedural Anxiety in High-Risk Pregnancies with Scheduled Cesarean Deliveries

Presenting Author: Cristina L. Wood, MD MS

Presenting Author's Institution: University of Colorado, Department of Anesthesiology - Arvada, Colorado

Co-Authors:

Abstract :

Background: Perinatal mood, anxiety, and trauma symptoms (PMATS) are among the most common mental health disorders found in pregnant patients of reproductive age, affecting approximately 1 in 6 patients from pregnancy through the postpartum year.[1] According to a recent Centers for Disease Control and Prevention (CDC) report of 36 states in the United States (US) from 2017-2019, suicide was the most common cause of maternal mortality and suicide is strongly associated with the presence of PMATS.[2] This study aimed to evaluate the feasibility and preliminary efficacy of a single-session cognitive-behavioral intervention designed to reduce preoperative anxiety in individuals with high-risk pregnancies undergoing scheduled cesarean deliveries at a fetal care center.

Methods: A pilot randomized controlled trial (RCT) was conducted with 20 participants who were randomly assigned to either the intervention group or the control group (care as usual) at a single fetal care center. Primary outcomes included preoperative anxiety (assessed on the day of delivery), and postpartum anxiety and trauma (assessed 6-8 weeks postpartum). Secondary outcomes focused on postoperative opioid consumption. Feasibility and acceptability were assessed by monitoring implementation variables, including intervention completion rates, session duration, and participant satisfaction. The intervention group participated in a 1-hour session, which included psychoeducation and in vivo exposure to the operating room, simulating the cesarean delivery process. The session, conducted 1 to 4 weeks prior to the scheduled delivery, was led by a psychologist and an obstetric anesthesiologist. The control group received care as usual. Anxiety, stress, and trauma were measured at multiple time points: on the day of delivery, immediately postpartum, and 6-8 weeks postpartum. Postoperative opioid consumption was tracked from postoperative day (POD) 0 to POD 4.

Results: Participants in the intervention group exhibited a 42% reduction in perioperative anxiety and a 40% reduction in anxiety at 6-8 weeks postpartum compared to the control group. Additionally, the intervention group demonstrated a 75% reduction in postoperative opioid use from POD 2 to POD 4 compared to the control group.

Conclusions: The cognitive-behavioral intervention was found to be both feasible and effective in reducing preoperative and postoperative anxiety in birthing individuals with high-risk pregnancies. The intervention also resulted in a significant reduction in opioid use. Future research will aim to expand this intervention to larger populations in diverse hospital settings and will involve a larger sample size to further assess efficacy and long-term outcomes.

References:

1. PMID: 32703202

2. Pregnancy-Related Deaths: Data From Maternal Mortality Review Committees in 36 U.S. States, 2017–2019 | Maternal Mortality Prevention | CDC.

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 05

Comparison of Models Estimating Six-Week Edinburgh Postnatal Depression Scores Based on Ante-Natal Anxiety and Depression Assessments and ObsQoR-10 at Discharge.

Presenting Author: Feyce M. Peralta, MD, MS

Presenting Author's Institution: Northwestern University Feinberg School of Medicine - Chicago, Illinois

Co-Authors: Ines Debbiche, BS - Northwestern University Feinberg School of Medicine
Robert J. McCarthy, PharmD - Rush University

Abstract :
Introduction: In-hospital ObsQor-10 assessments have been shown to be a useful indicator of postnatal depression screening at 6w using the Edinburgh Postnatal Depression Score (EPDS).[i][i] Ante-natal anxiety and depression have been shown to affect ObsQoR-10 values and the optimal combination of screening instruments for predicting 6w EPDS values has not been determined.[ii][ii] The purpose of this study was to evaluate the optimal combination of anxiety and depression screening assessed in the antenatal period with 6w EPDS scores.

Methods: We conducted a prospective, observational study between August 2022 through September 2024. After informed consent, subjects were asked to complete self-report questionnaires with sociodemographic information, obstetric history, history of anxiety and depression, the Patient Health Questionnaire (PHQ-4), the Generalized Anxiety Disorder (GAD-7), and the Pain Catastrophizing Scale (PCS). At discharge, they were requested to complete the ObsQor-10 questionnaire. Six weeks after discharge, subjects were asked to complete the EPDS. The latter scores were modeled using a generalized linear model using robust estimators. The base model consisted of the ObsQoR-10 alone, and subsequent models added the PHQ4, GAD-7, and the PCS baseline scores. The full model combined all predictive scores. Models were compared by assessing the Akaike Information Criteria (AIC), and the accuracy of the models for predicting EPDS ≥ 10 and ≥ 13 was determined.

Results: 412 subjects were included in the analysis. Median (IQR) EPDS scores at 6w were 5 (4, 8) with 88 (17%) having values ≥ 10 and 37 (7.3%) have values ≥ 13. Compared to the base model, the addition of an assessment of anxiety or depression at baseline improved the goodness of fit of the model for estimation of the EPDS at 6 weeks. McFadden pseudo R^2 was 0.24 for the ObsQoR-10 model, and were increased to 0.27, 0.30, and 0.31 with the addition of PHQ-4, PCS and GAD-7, respectively. Only the full model significantly increased the AUC compared to the ObsQoR-10 only model for EPDS ≥ 10.

Discussion: Screening for anxiety and depression in the ante-natal period can add significant information about the association of the ObsQoR-10 and the EPDS scale score at 6 weeks postpartum. Our findings support the use of the ObsQoR-10 in addition to pre-delivery GAD-7 for identifying high risk for post-partum depression.

References:

[i]. Ben Hayoun DH, Sultan P, Rozeznic J, Guo N, Carvalho B, Orbach-Zinger S, Weiniger CF. Association of inpatient postpartum quality of recovery with postpartum depression: A

prospective observational study. J Clin Anesth. 2023 Dec;91:111263. doi: 10.1016/j.jclinane.2023.111263. Epub 2023 Sep 15. PMID: 37717463.

[ii]. Debbiche I, McCarthy RJ, Peralta FM. Effect of anxiety on quality of recovery following vaginal delivery. American Society of Anesthesiology 2024 Meeting Abstract # A1123, October 20. https://www.abstractsonline.com/pp8/#!/20183/presentation/5811.2024

2025 SOAP Abstract Table.pdf

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 06

Reducing psychological trauma in women undergoing urgent or emergency cesarean sections: A qualitative study of stressors and possible solutions related to obstetrical care

Presenting Author: Pamela Angle, MD FRCPC MSc (oxon)

Presenting Author's Institution: Sunnybrook Health Sciences Centre - Toronto, Ontario

Co-Authors: Alexandria A. Au, n/a - Sunnybrook Research Institute
Gabrielle Barrieau, MD - University of Montreal
Christine Kurtz Landy, PhD, RN - York University, Faculty of Health
Brooke Pardy, MSc - Sunnybrook Research Institute

Abstract :

Introduction
Emergency cesarean section (CS) is an important predictor of psychological trauma and post-traumatic stress disorder in women [1]. While multiple risk factors, including obstetric-related complications, heighten this risk, improvements in the supportive care women receive during CS may mitigate their impact [2]. This qualitative study explored/described women's perspectives on stressful and helpful aspects of the interdisciplinary care they received *immediately before, during, and immediately* after urgent or emergency (UE) CS. Here we report findings related to women's experiences of obstetrical care as part of a larger study to develop an Interdisciplinary Patient Support Tool (IPST) to guide health care providers (HCP) caring for women during CS.

Methods
Women within 72 hours of UE CS completed face-to-face, in-depth interviews at our tertiary care hospital. Sampling was purposeful with maximum variation. Women were asked open-ended questions about the stressors and helpful aspects of the interdisciplinary HCP care they received during their CS. Participants were asked to complete a secondary, follow-up interview six weeks later. Thematic content analysis was used to analyze the verbatim transcripts.
Results

Our sample consisted of 36 women, 19 completed the secondary interview. Most women labored prior to surgery (69%, 25/36); common reasons for CS were: concerns around labor progress (39%, 14/36), atypical fetal heart rate (31%, 11/36) and/or preeclampsia (14%, 5/36). We identified five major stressor themes and corresponding actionable interventions relevant across all disciplines, including obstetricians. These were: *1) Feeling unprepared for CS* (prenatal and obstetrician education not informing them of CS risk); *2) Fear of the operating room* ("the cut", CS duration, safety); *3) Uncertain trust in HCP* (obstetrician/resident competency fears, uncertainty over CS clinical decision-making); *4) Loss of the expected birth experience* (grief over "missed moments"); and, *5) Inconsistent patient-centered care* (variability in supportive care), see Table 1. Potentially actionable interventions for obstetrician care included feedback about their changing risk for CS over time, anticipatory guidance, continuous support (e.g., intraoperative feedback), and efforts to preserve the CS birth experience whenever possible.
Conclusion
We report on obstetric-related stressors and potentially actionable solutions for women undergoing UE CS. These will inform the development of an IPST for all HCP caring for

women during CS.
Funding: AFP Innovation Fund, Ontario Ministry of Health, The Langar Foundation

References:

1. Carter et al. Mode of birth and development of maternal postnatal post-traumatic stress disorder: A mixed-methods systematic review and meta-analysis. doi:10.1111/birt.12649

2. Anderson et al. Risk factors for developing post-traumatic stress disorder following childbirth: a systematic review. doi:10.1111/j.1600-0412.2012.01476.x

Table 1_StressorQuotes.pdf

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 07

Association between Injectate Volume and Epidural Blood Patch Success: A Retrospective Cohort Study

Presenting Author: Amnon A. Berger, MD, PhD

Presenting Author's Institution: Beth Israel Deaconess Medical Center / Harvard Medical School - Boston, Massachusetts

Co-Authors: Samantha L. Armstrong, BS - Beth Israel Deaconess Medical Center
Yunping Li, MD - Beth Israel Deaconess Medical Center

Abstract :

Background: Neuraxial analgesia is the gold standard of labor analgesia. About 1% of procedures are complicated by post-dural puncture headache (PDPH), [1] which causes significant morbidity in the postpartum period, and is associated with chronic pain, neurological and psychiatric sequelae.[2,3] Epidural blood patch (EBP) is the most effective treatment for PDPH. Prospective trials aimed at identifying the ideal injectate volume are limited by design and participation factors.[4] Retrospective data can be analyzed to provide insights that are difficult to obtain in prospective trials.[5,6]

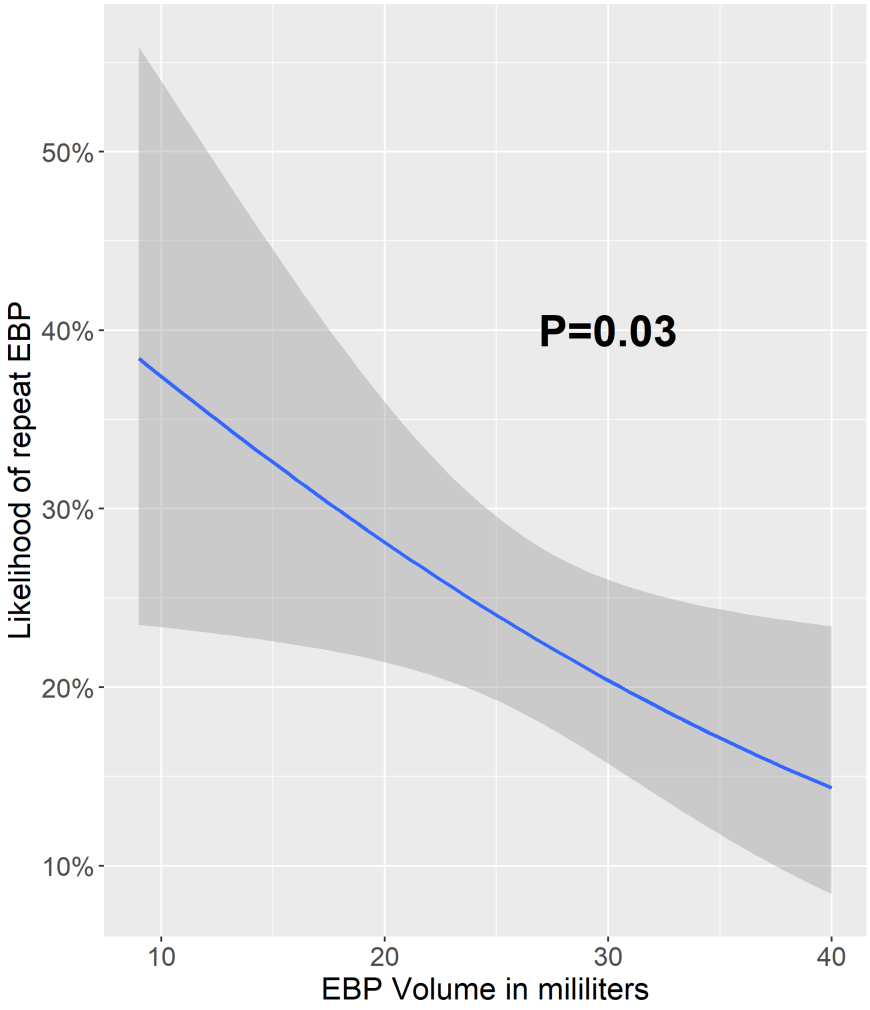
Objective: To determine whether higher injectate volume during epidural blood patch is associated with better outcomes.

Methods: This was a retrospective, single-center cohort study at a tertiary academic medical center with 5000 deliveries annually and 90% neuraxial analgesia rate. We reviewed records for patients receiving EBP after obstetric neuraxial procedures over a 10-year period (05/2014-02/2024). The primary outcome was receiving a repeat EBP. The secondary outcome was the resolution of symptoms following the first EBP. We calculated univariate odds ratio, as well as binomial generalized models to account for covariates. A $p< 0.05$ was considered significant.

Results: Records from 319 patients were available for analysis. Patients receiving single shot spinal (n=32) were excluded from the primary analysis for homogeneity. In 67 (21%) cases, patients received a repeat EBP. Pain resolution documentation was complete for 255 cases; in 141 (55%) resolution was achieved. Median injectate volume was 28mL (9-40mL range, 22-32mL IQR). Factors significantly associated with repeat EBP included 1)the volume of EBP injectate, 2)days from procedure to PDPH and 3)from PDPH to EBP. In multivariate analyses, injectate volume (OR 0.96 / 1mL injectate, p=0.028) and days from PDPH to EBP (OR 0.61 / 1 day, P=0.002) were significantly associated with lower incidence of repeat EBP. The resolution of symptoms after the first EBP was associated with injectate >30ml (OR 3.0, p=0.047). An analysis of the relationship between injectate volume and repeated EBP demonstrated a dose-response relationship (Figure).

Conclusion: We found an inverse relationship between increased EBP injectate volume and the likelihood of repeat EBP. Injection of more than 30ml was significantly associated with resolution of symptoms after the first EBP. Our findings support symptoms-based rather than volume-based injection and suggest that there may be an advantage in injecting volumes higher than 20mL as previously suggested.

References: 1. PMID 33221121
2. PMID 31335402
3. PMID 32858584
4. PMID 21596867
5. PMID 27378709
6. PMID 24631062



Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 08

QIPS: Improving Post Dural Puncture Headache Accountability Via a Universal Electronic Health Record.

Presenting Author: Jackson Prestwood, MD

Presenting Author's Institution: SAUSHEC - JBSA Fort Sam Houston, Texas

Co-Authors: James Parry, MD - SAUSHEC

Abstract :
We present a quality improvement project (QIP) implementing post dural puncture headache (PDPH) accountability guidelines as outlined in the ASA Statement on Quality Metrics released by the Committee on Obstetric Anesthesia in October, 2022.[1] Our academic, military institution did not have a protocol for accidental dural puncture (ADP), meaning patient education and follow up was unreliable and not tracked. Outcomes tracked for this QIP included days of post-procedure follow up, administered electronic health record (EHR) patient education, rate of epidural blood patches offered and received, and overall rate of ADP. Interventions included departmental policy changes, resident and staff education, a new EHR order set, and creation of a universal EHR patient education. After the project was implemented in November 2023, it was sustained for 12 months and tracked quarterly. By quarter four, 100% of patients were receiving discharge education paperwork and 5 days of follow up. Overall, we had a 1.8% ADP rate; 77% of our patients were offered an EBP and 29% received one. This QI project leveraged EHR resources to meet standard of care for patients with known or suspected ADP.

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[1]Committee on Obstetric Anesthesia. (2022, October 26). *Statement on Quality Metrics* [Review of *Statement on Quality Metrics*]. Statement on Quality Metrics; American Society of Anesthesiologists. https://www.asahq.org/standards-and-practice-parameters/statement-on-quality-metrics

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 09

Preventive Efforts for Post-Dural Puncture Headaches in High-Risk Obstetric Patients with Unintentional Dural Punctures

Presenting Author: Cristian E. Betancourt Perez, MD

Presenting Author's Institution: University of Tennessee Health Science Center (UTHSC) - Memphis, Tennessee

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Bhavya T. Donda, N/A - Collierville High School
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Jaineel Varshney, n/a - Franklin Regional Senior High School

Abstract :
Unintentional dural puncture (UDP) is a complication of epidural needle placement. UDP can lead to post-dural puncture headache (PDPH), which is associated with significant morbidity, delayed recovery, and prolonged hospital stays.[1-3] This study aimed to evaluate whether the insertion of an intrathecal (IT) catheter following UDP reduces the incidence of PDPH and the need for epidural blood patches (EBP).

We performed a retrospective study of patients who experienced UDP from 2018 to 2024 at a tertiary care university hospital (n = 96). Variables included the incidence and severity of PDPH, therapeutic interventions (epidural blood patches), and the duration for which the IT catheter was placed. The two groups were the IT catheter group (patients with intrathecal catheters placed following UDP) and the non-IT group (patients with epidurals replaced at a different level following UDP).

73% (70/96) of patients had an intrathecal catheter, while 27% (26/96) did not. PDPH occurred in 31% (22/70) of patients with an IT catheter, compared to 30.8% (8/26) of patients without. Both groups had similar rates of PDPH. Fisher's exact test between the two groups confirmed no statistically significant difference in PDPH occurrence ($p = 1.000$). The PDPH severity distribution in the IT group were 13.6% (3/22) mild, 54.5% (12/22) moderate, and 31.8% (7/22) severe. Four from the moderate group and seven from the severe group required EBP for relief. Thus, 15.7% (11/70) of patients with IT catheters required a blood patch, compared to 7.7% (2/26) of patients without. The percentage of patients requiring a blood patch was higher in the IT group, but the difference was not statistically significant ($p = 0.3407$). We compared patients with IT catheters maintained for ≥ 24 hours ($n = 30$) versus < 24 hours ($n = 40$) using a Chi-Square (χ^2) test, which revealed no statistically significant difference in PDPH rates between the two groups ($p = 0.153$).

Intrathecal catheters did not show a statistically significant reduction in PDPH or the need for an EBP. However, they might still provide practical advantages in certain patient populations with challenging epidural placements. A focus on communication, labeling, and protocols underscores the need for safety and proper management when using these techniques.

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Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 10

Improving Compliance in Documenting Unintended Dural Punctures Through Automated EHR Tools in the Context of Analyzing Obstetric Anesthesia Complications Database and Epidural Blood Patch Practices

Presenting Author: Shalonda Cook, MD

Presenting Author's Institution: UT Southwestern Medical Center - Dallas, Texas

Co-Authors: William Aiden Berry, n/a - Southern Methodist University
Patricia Fuentes, MD - University of Texas Southwestern
Shruthi Krishnamurthy, M.B.B.S - UTSW

Abstract :
Background:
Our high delivery volume, safety-net hospital maintains an Obstetric Anesthesia Complications Database to capture information about unintended dural puncture (UDP); post dural puncture headache (PDPH); and, most importantly, institutional epidural blood patch (EBP) practices. EBP is the gold-standard treatment for PDPH as untreated PDPH can have debilitating short and long-term consequences. Existing data suggests a disparity in EBP utilization with EBP being less frequently used in: teaching hospitals, amongst racial and ethnic minorities, and safety-net institutions. There is limited data on UDP self-reporting provider compliance.

The primary aim of this Quality Improvement (QI) initiative was to analyze the Obstetric Anesthesia Complications Database for institutional trends in EBP utilization and practices. The secondary aim was to improve provider compliance with UDP documentation after implementing an automated EHR tool.

Methods: Permission was obtained from the Office of Quality Improvement to analyze data from the Obstetric Anesthesia Complications Database in pregnant patients receiving neuraxial anesthesia between January 1, 2021 and December 31, 2024. This database, maintained by the obstetric anesthesia team, documents patients with UDP, PDPH and those receive an EBP during their delivery admission. Relevant anesthetic, demographic, and clinical data was collected from electronic health records (EHR). QI interventions included: earlier UDP rounding times throughout admission, consistent use of language interpreter services during follow up, and an automated “Notable Events” (EHR tool) trigger when an UDP was documented in the neuraxial procedure note. The pre-intervention group (Jan 2021–July 2024) was compared to the post-intervention group (Aug–Dec 2024) using two-sample proportion z-tests to assess differences in EBP administration and “Notable Event” documentation rates.

Results:
70.9% of PDPH patients received EBP in the pre-intervention vs. 74.1% in the post-intervention group ($P = .771$), showing a promising but non- statistically significant trend towards increased EBP administration. 18.1% of UDPs had EHR-documented “Notable Events” in the pre group compared to 90.9% in the post group ($P < .001$), reaching clinical and statistical significance.

Conclusion:

This study suggests that QI interventions and automated EHR tools may improve EBP utilization and provider compliance with UDP documentation at a high-volume, safety-net, teaching hospital. Although the trend toward increased EBP utilization is promising, statistical significance was not reached, likely due to the short study period and small sample size. Future research with a longer post intervention period and larger sample size may provide further insights into EBP practices, documentation trends, and the impact of targeted interventions on clinical outcomes.

References:

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Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 11

Prophylactic treatment of Neostigmine and Atropine to Postdural Puncture Headache in obstetrics a randomized controlled trial

Presenting Author: Mingpin Hu, certificate number：C3300058882

Presenting Author's Institution: Department of Anesthesia and Critical care, The Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University - Wenzhou, Zhejiang

Co-Authors:

Abstract :

Objective: To evaluate the effect of prophylactic treatment of neostigmine/atropine (NE) on the incidence of PDPH among obstetric patients with an accidental dural puncture (ADP). Method:This randomized clinical trial was conducted at a tertiary hospital in China between September 2nd, 2020, to December 31st, 2022. The parturients of 20 to 40 years of age, live, singleton pregnancies who were admitted to the hospital and received epidural analgesia during labour in this trial if confirmed accidental dural puncture (ADP) occurred were enrolled. Study recruitment and follow-up are complete.

The parturients were recruited in this trial and randomized into two groups (n=40 each): prophylactic NE treatment group(of which 36 received slow IV injection of 20 μg/kg neostigmine and 10 μg/kg atropine in 10mL of 0.9% saline after delivery) and the control group (37 received slow IV injection of 10mL of 0.9% saline after delivery). Both solutions were infused over 5 minutes.The primary outcome was the incidence of PDPH. Secondary outcomes included a visual analog scale score for headache, the requirement for an epidural blood patch (EBP) and length of hospital stay. The side effects of NE, such as, neck stiffness, dizziness, nausea and vomiting, diarrhea, abdominal cramps, abdominal pain, muscle twitches, tongue numbness and bronchospasm were compared in two groups.

Results: The incidence of PDPH was lower in the prophylactic NE treatment group (8/36 [22.2%]) than in the control group (30/37 [81.1%], odds ratio, 0.07; 95% CI, 0.022, 0.226; p< 0.001). In NE group, it also demonstrated reduced visual analog scale scores. The prophylactic NE treatment group exhibited a lower incidence of neck stiffness, abdominal cramps, muscle twitches, tongue numbness, and. No patient received an epidural blood patch. Other secondary outcomes showed no significant difference between two groups.

Conclusions: Prophylactic neostigmine/atropine treatment following ADP was associated with reduced the incidence of PDPH and lower VAS scores. Furthermore, prophylactic administration of neostigmine/atropine was found to be associated with a reduced incidence of potential clinical side effects related to the use of these drugs. The utilization of neostigmine/atropine may present a promising alternative for the prevention and treatment of PDPH.

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Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 12

Association between systolic blood pressure and lung water in patients with preeclampsia – a point-of-care USG-based observational study

Presenting Author: shreya Goswami, MD

Presenting Author's Institution: washington university school of medicine in st louis - Saint Louis, Missouri

Co-Authors: Danish jaffer, MD - washington university school of medicine in st louis
Arvind Palanisamy, MD, FRCA - washington university school of medicine in st louis
Preet Mohinder M. Singh, n/a - Washington University, St Louis

Abstract :

Background and Hypothesis:
Early detection of pulmonary edema is essential for preventing cardiopulmonary complications in pre-eclampsia (Pre-E). Point-of-care lung ultrasound (USG) studies suggest that extravascular lung water (EVLW) is significantly increased in patients with pre-E who exhibit severe features (BP ≥ 160/110 mm Hg)[1,2]. However, it remains unclear whether EVLW is increased in Pre-E patients without severe features and whether there is a correlation between systolic blood pressure (SBP) and EVLW. This knowledge would be clinically valuable in guiding fluid management, and for allowing risk stratification in settings where USG is not readily available, respectively. Here, we hypothesize that Pre-E patients without severe features will exhibit a correlation between SBP ≥ 140 mm Hg and increased EVLW.

Methods:
In this cohort study (IRB: HRPO# 202409220), patients at ≥ 20 weeks' gestation (both Pre-E and non-Pre-E controls) were enrolled following informed consent. BP criteria for Pre-E is ≥140/90 mm Hg. Exclusion criteria included patient refusal, clinical instability, and if ≥ 2 h after initiation of anti-hypertensive treatment. A simplified four-zone lung USG protocol, previously validated in critical care settings[3], was utilized. Scans were performed in the semi-recumbent position using a curvilinear probe as soon as patients presented to labor and delivery or within 2 h of receiving anti-hypertensive medication. The arbitrary choice of 2 h was a compromise based on the assumption that any treatment-associated changes in EVLW would take longer than 2 h to resolve, while allowing appropriate concomitant medical management. Bilateral intercostal spaces (ICS) were assessed between the 3rd-4th and 6th-7th ribs, within the parasternal to midclavicular regions. The total number of single and confluent B-lines per ICS was recorded, with scores ranging from 0 to 8 per ICS (maximum total score: 32 across 4 ICS). All scans were validated independently by two providers.

Results:
In this ongoing study, a total of 23 patients were recruited: 8 with Pre-E and 15 without Pre-E. Patients with Pre-E demonstrated higher EVLW scores than their non-Pre-E counterparts ($P < 0.001$), consistent with previous reports. We also observed that SBP ≥ 140 mm Hg was associated with significantly elevated EVLW ($P < 0.001$) **(Table 1).**

Conclusions:
This simplified bedside method demonstrated a correlation between SBP ≥ 140 mm Hg and increased EVLW in patients with Pre-E, suggesting that even patients without severe features may be at risk for pulmonary edema. At study completion, we will perform subgroup analysis

(Pre-E with/without severe features), correlation analysis between different SBP category and EVLW, propensity matching for confounders altering EVLW, and assess the impact of antihypertensive therapy on EVLW.

References:

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2. Laurent Z, *Anesthesiology* 2014;120:906–914
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Table 1 EVLW SOAP.pdf

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 13

A neonatal outcome-based definition of maternal hypotension during cesarean delivery- a pilot study

Presenting Author: Liz T. James, MD

Presenting Author's Institution: Ohio State University Wexner Medical Center - Columbus, Ohio

Co-Authors: Brett Worly, MD, MBA - Ohio State University Wexner Medical Center
Yun Xia, MD - Department of Anesthesiology The Ohio State University Wexner Medical Center

Abstract :

Background
Admission to the neonatal intensive care unit (NICU) is higher in scheduled cesarean deliveries (CD) compared to vaginal deliveries, particularly in women with hypertensive disorders of pregnancy (HDP). Spinal anesthesia (SAB) during CD can cause hypotension in up to 71% of patients, depending on definitions, leading to adverse neonatal outcomes and increased NICU admissions due to decreased uterine perfusion. Timely identification and treatment of maternal hypotension (HON) may mitigate its impact. Still, arm blood pressure (BP) measurements, the standard method, may not accurately reflect uterine perfusion, given factors such as left uterine displacement (LUD), patient shivering, obesity, or HDP. This prospective pilot study aimed to evaluate the correlation of HON with neonatal outcomes in obese patients with or without HDP, comparing BP measurements taken at the arm and ankle. Our null hypothesis is that poor neonatal outcomes are not associated with HON in obese women with or without HDP.

Methods
In this prospective observational cohort study of Class 2 obesity, BP was measured at the arm and left ankle, in supine and LUD positions, and at three time points: before and after SAB, and post-delivery. Primary outcomes were HON (defined using 11 criteria) and its association with neonatal outcomes including a composite FAAAN parameter (Fetal Heart Rate < 110, Apgar Score at 1 min, Apgar Score at 5 min, Airway Support, NICU admission). Secondary outcomes included nausea/vomiting, arm discomfort, and shivering. Statistical significance was set at $P < 0.05$.

Results
A total of 97 term patients (mean age 31 ± 5.1 years, BMI 43.1 ± 7.9) were enrolled, with HDP diagnosed in 38% (n=37). HON incidence varied from 0%–72.2% with 11 different definitions measured in the arm and the ankle related to 60-100 % of the baseline BP as well as systolic BP ≥ 100 mmHg. FAAAN was 35% in HDP vs. 12% in non-HDP cases and NICU admission rates of 22% vs. 7%, respectively. HDP was the sole predictor of FAAAN in both univariate and multivariate regression models. None of 11 definitions of HON were significantly associated with FAAAN. 15 degrees of LUD significantly increased BP before SAB but had no effect post-SAB. A more significant decrease in BP was seen at the arm than the ankle following SAB. With comparing before-after delivery, SBP was significantly higher at the ankle not at the arm site (Table 1).

Conclusions
Poor neonatal outcomes were linked to HDP rather than BP measurements at the ankle or arm, highlighting the need for improved monitoring and therapeutic strategies. LUD did not warrant changes in current practice, and ankle BP may provide better hemodynamic insights. Further research is needed to define the impact of BP on placental perfusion and neonatal outcomes in CD patients.

References:

1. Geller EJ, et al. Journal of Perinatology. 2010.
2. Klöhr SS, et al. Acta Anaesthesiologica Scandinavica. 2010.
3. Chooi C, et al. Cochrane Database of Systematic Reviews 2020.

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Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 14

Blood Pressure Trajectories at Delivery Hospitalization by Cardiovascular Health: Evaluating Blood Pressure for Postpartum Maternal Morbidity Prediction

Presenting Author: Marie-Louise Meng, MD

Presenting Author's Institution: Duke University Medical Center - Durham, North Carolina

Co-Authors: Matthew Fuller, n/a - Duke University
Johanna Quist-Nelson, MD - UNC Chapel Hill School of Medicine
Leyi Sun, MSc - Duke University School of Medicine

Abstract :

Background: Hypertensive disorders of pregnancy (HDP) are associated with cardiovascular (CV) morbidity.[1,2] We developed and validated models to predict CV morbidity within one year postpartum in individuals with HDP.[3] The next step in prediction is to identify variables to improve the model's fair performance (AUROC=0.73, AP=0.04). Blood pressure (BP) trajectories at delivery and postpartum are influenced by baseline CV health, presence of HDP and medications and may be important variables in prediction models. New BP nomograms are necessary for assessing care and outcomes due to updated BP goals in pregnancy and the declining CV health of women of childbearing years.[4,5] We hypothesized that BP trajectories at delivery hospitalization would differ by hypertensive disease status and that those with adverse CV outcomes would have different trajectories.

Methods: After IRB approval we collected BP data from all birth hospitalizations at our academic center from 2016-2020. BP trajectories were examined by groups: healthy, gestational hypertension (gHTN), preeclampsia without severe features (PEC), PEC with SF (SF), chronic hypertension (cHTN), cHTN/PEC and cHTN/SF. Patients with gHTN that developed PEC or SF were included in PEC or SF group. CV outcomes were identified by ICD10 codes: renal failure, heart failure, cerebrovascular events, within one-year postpartum.

Linear mixed models with participant-specific intercepts were used to quantify differences in BP trajectories between groups, and between all patients without outcome and with outcomes. Wald test was applied to determine whether effects were statistically significant.

Results: There were 24,608 deliveries (79.3% healthy n=19505, 7.4% gHTN n=1813, 3.1% PEC n=755, 3.9% SF n=968, 3.8% cHTN n=929, 1.1% cHTN/PEC n=277, and 1.5% cHTN/SF n=361). The average BP values (Figure) with group estimate increases are the following for systolic SBP: healthy 114mmHg, gHTN +14, PEC +15, SF +21, cHTN +13, cHTN/PEC +22, cHTN/SF +24 (all significant) and diastolic DBP: healthy 68mmHg, gHTN +8, PEC +9, SF +13, cHTN +7, cHTN/PEC +11, cHTN/SF +13 (all significant). Between all patients without outcome and with outcomes there were no clinically significant differences in SBP or DBP.

Conclusions: There were statistically and clinically significant differences for each hypertensive disease group compared to the healthy group for SBP and DBP. These data serve as new BP nomograms for similar populations. Across all patients without outcomes and with outcomes, there were no differences in SBP or DBP. Including BP trajectories to predicting CV outcomes postpartum is likely unnecessary, as CV outcomes and BP trajectories do not appear to be strongly associated beyond HDP diagnosis.

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References:

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2. Honigberg MC, et al. J Am Coll Cardiol 2019.
3. Meng ML, et al. Anesth Analg 2024
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SOAP MENG BP 2025.pdf

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 15

Environmental enrichment on oligodendrocyte maturation and myelination in offspring from preeclampsia-like mice

Presenting Author: Ziyi Wu, 1. Department of Anesthesiology, Shengjing Hospital of China Medical University

Presenting Author's Institution: Department of Anesthesiology, Shengjing Hospital of China Medical University - shenyang, Liaoning

Co-Authors:

Abstract :

Preeclampsia is a common obstetric complication affecting both the mother and offspring, with extensive research indicating its potential to significantly impact brain development and contribute to various neuropsychological outcomes. However, it remains unclear whether preeclampsia disrupts white matter development and whether the effect is gender-related. In this study, we investigated the effects of preeclampsia on offspring oligodendrocyte maturation and myelination, as well as neurobehavior. A preeclampsia mouse model was established by continuously infusing 125 mg/kg/day of N(G)-Nitro-L-arginine methyl ester (L-NAME) into dams from gestational day (GD) 10.5 to GD 17.5, based on systolic blood pressure and urinary protein levels. After completing the early postnatal reflex tests, we assessed adult offspring behavior and brain white matter development. Behavioral results showed that male offspring exposed to preeclampsia exhibited significant deficits in social exploratory behavior. Furthermore, there were sex differences in myelin integrity, axonal damage, and oligodendrocyte maturation, likely due to precursor cell reduced proliferation. It is inspiring that environment enrichment during adolescence improved social behavior and partially restored white matter development in preeclampsia-exposed offspring. In conclusion, our findings suggest that male mice exposed to preeclampsia are more likely to experience alterations in long-term behavior and white matter development. Environment enrichment warrants further investigation as a potential preventive or therapeutic approach for neurodevelopmental abnormalities in offspring affected by preeclampsia.

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 16

B-line Scores on Lung Ultrasound before and after Magnesium Treatment among Patients with Severe Preeclampsia

Presenting Author: yuguan zhang, n/a

Presenting Author's Institution: Peking Union Medical College Hospital - Boston, Massachusetts

Co-Authors: Michaela K. Farber, MD MS - Brigham and Women's Hospital
Michael J. Furdyna, MD - Brigham and Women's Hospital
Hope Y. yu, MD - Brigham and Women's Hospital

Abstract :

Background

Hypertensive disorders of pregnancy, including preeclampsia, are the second most common cause of maternal deaths worldwide. Preeclampsia with severe features is associated with pulmonary complications. Lung ultrasound (LUS) has emerged as a valuable tool for evaluating pulmonary pathology in preeclampsia[1], but the impact of intravenous (IV) magnesium (Mg) therapy on pulmonary interstitial syndrome (PIS) remains unclear. We hypothesized that LUS may detect an increased interstitial fluid burden after a loading dose of IV Mg, and identify patients at higher risk for developing pulmonary complications.

Methods

This prospective observational study is collecting LUS data from severely preeclamptic patients from 8/2024; recruitment ongoing with anticipated completion prior to April 2025. Ten-second cineloops were recorded from 4 intercostal spaces[2] before and 1.5-2 hours after an 4% Mg IV bolus (4–6 g over 20 minutes). Two independent observers assessed the number of single or confluent B-lines in each space and B-line scores were calculated accordingly to previous literature[1]. These findings were correlated with clinical signs, symptoms, and treatment data to evaluate the effects of Mg on PIS and pulmonary edema risk. Wilcoxon signed-rank was used to compare pre- and post-Mg B-line scores. Spearman correlation analysis was used to evaluate the relationship between the changes in B-line scores and (1) the changes in pulse oximetry values (SpO_2), (2) the changes in mean blood pressure (BP) and (3) the volume of IV crystalloid administered between the 2 LUS measurements.

Results

Fifteen of 30 women (10 pregnant, 5 postpartum) with severe preeclampsia have been enrolled to date. The median (interquartile range [IQR]) B-line scores before and after Mg bolus were 0 (0-6.5) and 1 (0-9), respectively (P=0.33). Seven participants (46.7%) experienced an increase in B-line scores following Mg bolus administration, and an insignificant upward trend was observed in the B-line scores (Figure).

No correlation was observed between changes in B-line scores and (1) SpO2 (rs=0.01, P=0.72), (2) mean BP (rs=-0.31, P=0.26) or (3) IV fluid volume (rs=-0.24, P=0.38).

Conclusion

Our preliminary findings suggest an increase in B-line scores following Mg bolus infusion; lack of statistical significance may be due to small sample size to date. Completion of our study will confirm whether Mg treatment is consistently associated with increased pulmonary interstitial burden among patients with preeclampsia with severe features. Bedside lung ultrasound assessment for pulmonary edema in such patients, before or after Mg therapy, may guide fluid and hemodynamic management. This and other characterization of lung ultrasound in preeclampsia will help refine its use as a diagnostic and management tool for obstetric anesthesiologists.

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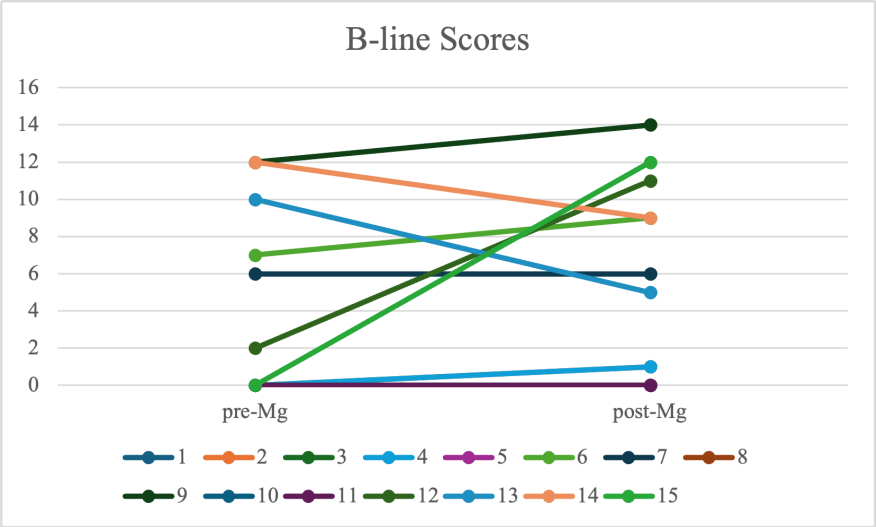

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 17

Safety of Deep Sedation for Advanced Second Trimester Uterine Dilation and Evacuation in Medically Complex Patients: A Retrospective Analysis at an Urban Center

Presenting Author: Hannah Nguyen, n/a

Presenting Author's Institution: Boston University Chobanian & Avedisian School of Medicine - Jamaica Plain, Massachusetts

Co-Authors: Rachel Cannon, n/a - Boston Medical Center
Eileen C. Liu, BS - Boston University School of Medicine
Mark Norris, MD - Boston Medical Center
Nicole Spence, MD - Boston University Chobanian & Avedisian School of Medicine
Elisabeth Woodhams, MD, MSc - Boston Medical Center

Abstract :

Background

Growing evidence suggests that uterine dilation and evacuation can be safely performed under deep sedation without advanced airway management up to 23 6/7 weeks gestation. However, data on the safety of dilation and evacuation performed under deep sedation are limited for patients at gestational ages beyond 24 0/7 weeks, particularly in populations with high rates of comorbidities such as obesity or substance use disorder. This study evaluated the incidence of anesthesia-related complications during dilation and evacuations using intravenous deep sedation in a medically complex and racially diverse patient cohort that includes pregnancy terminations performed beyond 24 0/7 weeks gestational age.

Methods

We conducted a single-center retrospective cohort analysis of uterine evacuations performed under intravenous deep sedation between 12 0/7 to 27 6/7 weeks gestation. The primary outcome was periprocedural anesthetic-related complications requiring endotracheal intubation. Secondary outcomes consisted of hypoxic episodes, including those that necessitated intervention by an anesthesiologist. A Fisher's exact test was used to determine the relationship between gestational age and hypoxic episodes.

Results

During the study period, 1,179 uterine evacuations were performed under deep sedation. Of these, 382 (32%) dilation and evacuations were completed between 20 and 27 6/7 weeks gestation with 104 (9%) conducted at greater than 24 0/7 weeks gestation. Additionally, 397 (33.7%) were performed on patients with body mass indices above 30 kg/m^2, and 104 (8.8%) occurred in patients with a self-reported history of substance use disorder. Four cases of anesthetic-related complications requiring intervention were identified: one case of emesis at the initiation of anesthesia requiring endotracheal intubation (0.08%, 95% CI 0.002% to 0.5%) and three cases of hypoxic episodes requiring intervention (0.3%, 95% CI 0.09% to 0.9%). The incidence of hypoxic episodes for gestational ages above 24 0/7 weeks was 4.8% (95% CI 2.0% to 11.0%); however, this was not significantly higher compared to uterine evacuations performed between 14 0/7 - 23 6/7 weeks (1.7%, 95% CI 1.0% to 2.8%) or 12 0/7 - 13 6/7 weeks gestation (1.3%, 95% CI 0.4% to 3.9%; p=0.08).

Conclusion

Intravenous deep sedation for the management of medically complex patients undergoing dilation and evacuations in the second trimester above 24 0/7 weeks gestational age has a low incidence of anesthetic-related complications, even in a population with high comorbidity rates, such as obesity and substance use disorder.

References: Aksel S, et al. Safety of Deep Sedation Without Intubation for Second-Trimester Dilation and Evacuation. Obstetrics & Gynecology 2018;132:171–8.

Gokhale P, et al. Intravenous Sedation Without Intubation and the Risk of Anesthesia Complications for Obese and Non-Obese Women Undergoing Surgical Abortion: A Retrospective Cohort Study. Anesthesia & Analgesia 2016;122:1957–62.

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 18

Intravenous dexamethasone does not acutely upregulate inflammatory mediators in the placenta at term

Presenting Author: Kathy Lee, BS

Presenting Author's Institution: BIDMC - Boston, Massachusetts

Co-Authors: Samantha L. Armstrong, BS - Beth Israel Deaconess Medical Center
Yunping Li, MD - Beth Israel Deaconess Medical Center

Abstract :

Background: Antenatal glucocorticoid treatment (betamethasone or dexamethasone) is recommended for patients experiencing threatened preterm delivery[1], with data to support improved neonatal survival as well as reduced frequency and severity of respiratory distress syndrome, intraventricular hemorrhage, and necrotizing enterocolitis[2-3]. However, concerns remain about potential adverse effects of antenatal steroids on the offspring, including placental and fetal growth restriction and long-term neurodevelopmental impairments[4-5].

In efforts to define the extent and mechanism of adverse effects and to determine an optimal drug regimen, some animal studies have suggested that dexamethasone (dex) can paradoxically increase inflammation in the placenta[6]. However, these data come from animal models with serial courses of steroids. We have a placenta biobank from healthy patients undergoing cesarean delivery, some of whom were received dex 4mg iv prior to delivery for nausea prophylaxis, which we leveraged to explore the acute effects of dex on placental inflammatory markers.

We hypothesized that a single dose of dex 4mg would not acutely upregulate placental inflammatory markers.

Methods: We isolated RNA from biobanked placentas and performed qPCR to compare expression of TNF-a, IL-1a, and IL-1b among patients who received dex and those who did not (n=14).

Results: Mean time from dex administration to delivery was 28 min. No inflammatory marker was upregulated in the dex group; TNF-a and IL-1b trended toward suppression with dex treatment (p=0.09 and 0.08, respectively).

Conclusion: In human subjects at term, 4mg of dex does not induce upregulation of inflammatory markers in the placenta, and a trend toward suppression was observed for IL-1b and TNF-a. Contrary to animal studies which have suggested that regulation of placental inflammation by corticosteroids in the late term placenta may be unconventional, these data more closely reflect the typical anti-inflammatory effects well described in other tissues. Further studies will be undertaken to assess a wider range of dosing regimens and the broader kinetics of these effects.

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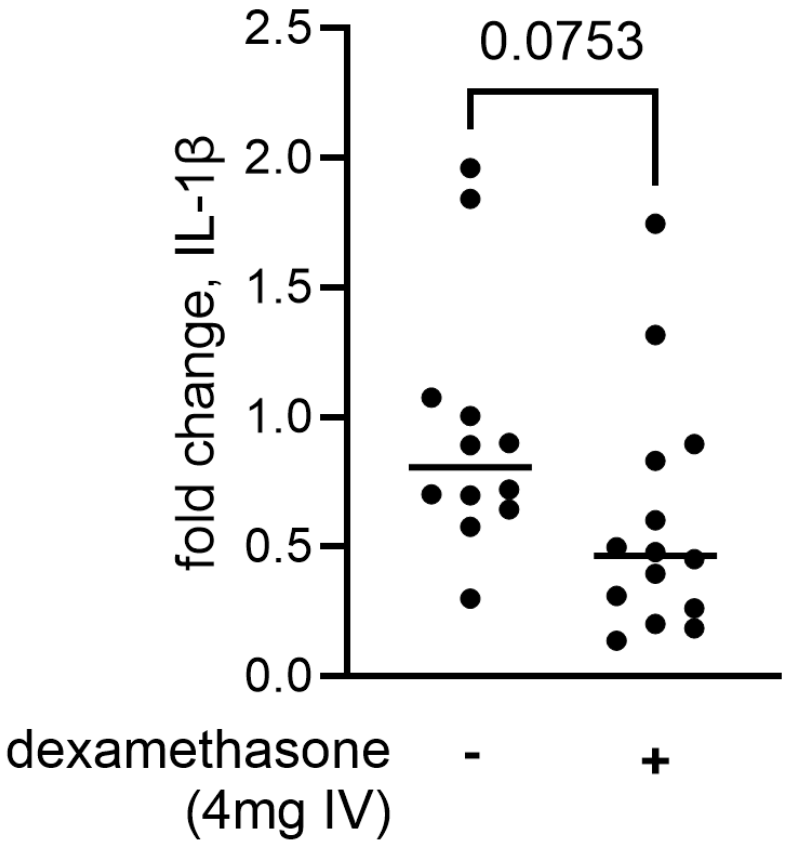

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 19

Stretching the limits: Anesthetic considerations in pregnant patients with Ehlers-Danlos Syndrome

Presenting Author: Shakthi Jayanthy Venkatachalam, MBBS

Presenting Author's Institution: Brigham and Women's Hospital - Boston, Massachusetts

Co-Authors: Ricardo Kleinlein, PhD - Brigham and Women's Hospital, Harvard Medical School

Abstract :

Introduction
Ehlers-Danlos Syndrome (EDS) is a group of inheritable connective tissue disorders, caused by abnormal collagen synthesis.[1] The molecular defect affects multiple organs, impacting anesthetic management during pregnancy.[2] This case series is a retrospective review of clinical manifestations and anesthetic management of a large cohort of EDS patients.

Methods
With IRB approval, we used a large language model to process clinical notes of patients delivering after 20 weeks' gestation in our healthcare system from 1994 to 2024.[3] We included patients with confirmed EDS diagnoses, validated through manual chart review and excluded cases with uncertain diagnoses. We used descriptive statistics to report outcomes.

Results
Between 1995 and 2024, 148 pregnancies were identified across 110 parturients with EDS. Diagnosed subtypes were established in 72 patients at the time of delivery, with hypermobile EDS being the most common (64,58%), followed by classical EDS (6,6%). The most common symptom was joint hypermobility (79,72%), followed by recurrent dislocations and fractures (59,54%). Other symptoms included chronic pain (43,39%), postural orthostatic tachycardia syndrome (32,29%), cardiovascular anomalies (11,10%), coagulation disorders (5,5%) and resistance to local anesthetics (2,2%). EDS characteristics are reported in Table 1.
Of 148 pregnancies, 78 (53%) were vaginal deliveries and 70 (47%) were cesarean deliveries. Epidural analgesia was administered in 65 cases (44%), dural puncture epidural (DPE) in 24 (16%), and combined spinal-epidural (CSE) in 19 (13%). Spinal anesthesia was administered for 37 deliveries (25%), and general anesthesia was required for 3 (1%). Neuraxial procedures were complicated by paresthesia in 4 (3%), and accidental dural puncture in 1 (0.7%). Additionally, multiple attempts were needed in 15 (10%) and ultrasound guidance in 5 (3%). Notably, no cases of resistance to local anesthetics or post-dural puncture headaches were reported.

Discussion
EDS are a group of connective tissue disorders with diverse manifestations across multiple organ systems, posing unique challenges in anesthetic management.[4] Existing literature reports notable concerns regarding neuraxial anesthesia in EDS patients.[2,4] In our cohort, neuraxial anesthesia was successfully administered in nearly all cases, with few significant challenges. While not powered to detect rare outcomes, our findings suggest that neuraxial anesthesia is generally safe and well tolerated in parturients with EDS, though technical challenges such as need for ultrasound guidance, multiple placement attempts, and epidural

catheter replacements persist. Our large retrospective case series aims to provide further insights to better guide anesthetic management in this rare patient population.

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Table 1- Ehlers- Danlos Characteristics in the Cohort.pdf

Abstract #: FRI - RA - BS 2 - BR 4 - Blues, PDPH & BP – 20

Obstetric Anesthesia Outcomes in Pregnant Patients with Spine Surgery and Hardware: A Retrospective Cohort Study

Presenting Author: Tyler Guidugli, DO

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Co-Authors: Daniel F. Berenson, MD, PhD - Brigham and Women's Hospital
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Ricardo Kleinlein, PhD - Brigham and Women's Hospital, Harvard Medical School

Abstract :
Introduction

Patients with prior spine surgery and indwelling hardware present unique challenges when presenting for neuraxial labor analgesia, and anesthesiologists have been cautious and even restrictive about use of neuraxial techniques in such patients.[1] Prior work suggests that in parturients with corrected or uncorrected scoliosis, neuraxial techniques are possible and function relatively well.[2] Our study reports the functionality and complication rate of neuraxial techniques in patients with prior spine surgery and hardware.

Methods For this retrospective cohort study, patients with prior spine surgery and hardware who had pregnancies beyond 20 gestational weeks and delivered at Mass General Brigham between January 2016 and May 2024 were identified. IRB approval was secured with a waiver of patient consent. We obtained all free-text discharge notes and searched using regular expressions (regex) for the following combinations of terms: spinal instrumentation including pedicle screws, spinal fusion, Harrington rods, or lumbar plates. We excluded patients without documented anesthetic management for delivery or whose spine surgery occurred after delivery. Extracted data included demographics, obstetric outcomes, neuraxial technique, and perioperative complications. Descriptive statistics were used to summarize findings.

Results There were 116 pregnancies in 111 patients. Of those, anesthesia records for 105 pregnancies were available for inclusion in the analysis. Ninety-nine (94%) received neuraxial analgesia or anesthesia, while 6 (6%) received general anesthesia. Among neuraxial techniques, 15 were combined spinal-epidural, 40 epidural, 18 dural puncture epidural, 25 spinal, and 1 intrathecal catheter. Nine patients with labor epidural analgesia required catheter replacement (9% of our cohort); one patient undergoing cesarean delivery had failed neuraxial requiring general anesthesia. Ultrasound guidance was described in 12 cases. No patient developed post–dural puncture headache (PDPH) or required an epidural blood patch.

Discussion. Our large retrospective cohort demonstrates that neuraxial anesthesia for labor and delivery is safe and can be accomplished successfully in most parturients with spinal hardware. Of note, such patients routinely receive careful pre-delivery planning and imaging as needed at our center. Further studies are warranted to explore predictive factors for success, optimal techniques, and long-term outcomes in these patients.

References: PMID 37705419

PMID 19923523

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 01

Amniotic Fluid Embolism: A Retrospective Single-Center Observational Description of Anesthetic Management and Outcomes

Presenting Author: Leila Katabi, MD

Presenting Author's Institution: University of Michigan - Ann Arbor, Michigan

Co-Authors: Thomas Klumpner, MD - University of Michigan
Carlo Pancaro, MD - University of Michigan
Shubhangi Singh, MBBS - University of Michigan, Department of Anesthesiology

Abstract :

Background

Amniotic fluid embolism (AFE) is a rare but life-threatening condition that occurs during labor or shortly after delivery. It presents with cardiovascular collapse, likely secondary to acute pulmonary hypertension, and a severe coagulopathy.[1]

Management requires advanced supportive care. This includes cardiovascular support with vasopressors, inotropes, and pulmonary vasodilators and administration of clotting factors and/or blood products to correct the coagulopathy and ensure adequate circulating volume. While recommendations for the acute management of AFE exist,[2,3] there is little published on the frequency at which they are required or the results of these interventions.

Major barriers to understanding management of AFE are the rarity of the condition and difficulty establishing an accurate diagnosis. ICD codes from large databases have identified large cohorts,[4] but the diagnostic accuracy and information from these databases is limited; conversely, case series have richer diagnostic and clinical information but are limited in size.

We hypothesized that ICD codes associated with AFE combined with anesthesia records with evidence of cardiopulmonary collapse and acute coagulopathy could identify a cohort of patients to investigate the acute management of suspected AFE.

Methods

Patients at our institution were retrospectively identified using ICD9/10 codes associated with AFE from 1/1/2000-1/31/2024. Acute coagulopathy was diagnosed from laboratory results and cardiopulmonary collapse was defined subjectively with agreement from 3 independent reviewers.

Results

ICD codes identified 38 patients, of which 16 patients had an obstetric anesthetic record. Six patients experienced cardiopulmonary collapse and acute coagulopathy consistent with a potential AFE.

Anesthetic management and patient outcomes are listed in Table 1. All patients remained intubated postoperatively, had arterial lines, required vasopressors, and received blood products. The majority received central lines and inotropes (5/6). Transesophageal

echocardiography was performed in 4 patients, of whom 3 required extracorporeal membrane oxygenation. One patient received a pulmonary vasodilator.

The average length of stay was 17 days. Half of the patients (3/6) had unplanned hysterectomies. One patient did not survive due to diffuse intracardiac/vascular thrombi.

Conclusion

The combination of ICD codes for AFE and an obstetric anesthetic record with evidence of cardiopulmonary collapse and coagulopathy effectively identified patients treated for suspected AFE. Our institutional cohort demonstrates the need for intensive cardiovascular support and correction of coagulopathy. Furthermore, we suggest that the combination of anesthetic records and ICD codes is a powerful strategy to investigate the acute management of AFE.

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AFE_Table 1 revised.pdf

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 02

Evaluating the Ability of Fibrinogen, ROTEM And SEER-Derived Parameters to Predict Severe Obstetric Hemorrhage.

Presenting Author: Marc Ghabach, MD

Presenting Author's Institution: Duke University Hospital - Durham, North Carolina

Co-Authors: Jerome Federspiel, MD, PhD - Duke University
Mary Yurashevich, MD, MPH - Duke University Medical Center

Abstract :

Introduction: Prediction of severe obstetric hemorrhage may facilitate timely interventions to reduce maternal morbidity. Both Clauss fibrinogen and FIBTEM measured using rotational thromboelastometry (ROTEM) have been proposed as biomarkers to predict severe obstetric hemorrhage. A novel viscoelastic testing (VET) hemostatic analyzer, Quantra Hemostatic Analyzer, utilizes Sonic Estimation of Elasticity via Resonance (SEER) to measure clot physical properties. The SEER-derived contribution of functional fibrinogen to overall clot stiffness (FCS) is highly correlated with fibrinogen levels in the non-obstetric population and may have potential benefits in hemorrhage risk prediction as well. This study aimed to evaluate the ability of the FCS, Fibtem A10 and Fibrinogen measured early in a hemorrhage to predict severe obstetric hemorrhage at our facility.

Methods: In this prospective, observational, IRB-approved study, we enrolled parturients experiencing an obstetric hemorrhage necessitating activation of the Stage 2 obstetric hemorrhage protocol (OHP) (criteria for activation: Quantitative (QBL) blood loss ≥ 1500 mL, hemodynamic instability or suspected coagulopathy) within 24 hours after delivery from June 2023 to March 2024. Maternal blood was collected from eligible patients as standard of care and hemoglobin, platelet count, prothrombin time, activated partial prothrombin time and a modification of Clauss fibrinogen were measured in addition to ROTEM (EXTEM and FIBTEM assays; ROTEM® Delta, Werfen, Inc.) and SEER QStat parameters (Quantra® Hemostasis, Hemosonics) at activation of OHP and every 30 minutes for up to 4 time points. For patients who subsequently consented to participation, we collected demographic, obstetric, transfusion and hemorrhage-related outcome data from the electronic medical record. Area under the ROC (AUROC) analysis was used to determine the ability of Fibrinogen, Fibtem A10 and FCS measured at OHP activation to predict severe obstetric hemorrhage based on: 1) QBL £ 2.5 L or >2.5L, 2) Transfusion of < or ³ 4 units Blood products, 3) Severe maternal morbidity (SMM) defined as transfusion of ³ 4 units Blood products, hysterectomy for hemorrhage control or ICU admission.

Results: We collected samples from 69 parturients, of whom 50 consented and were included. The AUROC, optimal cut points (defined by Youden's criteria) and initial lab values for fibrinogen, Fibtem A10 and FCS by severe obstetric hemorrhage outcomes are shown in the Table. For all outcomes, the AUROC was highest for fibrinogen, with similar performance for FCS and Fibtem A10.

Conclusion: The FCS and Fibtem A10 performed similarly in predicting severe hemorrhage. Clauss fibrinogen levels were more performant. All methods had good to moderate performance for QBL and transfusion, and poor performance for the SMM endpoint. The

SEER derived FCS may have a role in predicting hemorrhage related outcomes making it a viable alternative to fibrinogen and ROTEM.

References:

table.pdf

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 03

Prophylactic Strategies for Prevention of Postpartum Hemorrhage in Cesarean Delivery: A Bayesian Network Meta-analysis of 167 Randomized Controlled Trials

Presenting Author: Jessica Stockinger, MD

Presenting Author's Institution: Duke University Medical Center - Durham, North Carolina

Co-Authors: Sara Amaral, MD - Duke University Medical Center
Douglas Gewehr, MD - Federal University of Paraná
Rafael Lombardi, MD - University of Nebraska Medical Center
Henrique Provinciatto, MD - Barao de Maua University Center
Marcela Terres, n/a - UNISUL - Universidade do Sul de Santa Catarina

Abstract :

Background: Postpartum hemorrhage (PPH) is a leading cause of maternal mortality, particularly in low- and middle-income countries (LMICs). Several pharmacologic agents, such as oxytocin, ergot alkaloids, prostaglandins, and tranexamic acid (TXA), have been used prophylactically to prevent PPH. However, the optimal prophylactic regimen and the comparative efficacy of these agents and their combinations have not been fully elucidated for patients undergoing cesarean delivery.

Methods: We conducted a Bayesian network meta-analysis (NMA) of randomized controlled trials (RCTs) evaluating the relative effectiveness of different agents and their combinations for PPH prophylaxis in patients undergoing cesarean delivery. The primary outcome was PPH (blood loss of ≥ 1 000 ml after cesarean delivery). To assess the hierarchy of treatments based on efficacy, we estimated the surface under the cumulative ranking curve (SUCRA) probabilities.

Findings: 167 RCTs (44 817 patients) evaluating monotherapy or various combinations of oxytocin, carbetocin, carboprost, ergot alkaloids, misoprostol, and TXA were included. Oxytocin plus TXA (RR 0·44; 95% CrI 0·33–0·58) and carbetocin (RR 0·54; 95% CrI 0·37–0·74) were the only interventions that were more effective than oxytocin alone in reducing PPH. Oxytocin plus TXA ranked as the most effective intervention for PPH prophylaxis with a SUCRA probability value of 0·85. Most prophylactic combinations reduced intraoperative blood transfusions and the need for additional uterotonics. Two maternal deaths were reported among 29 412 patients. No significant heterogeneity was detected for PPH (I2 = 6%), blood transfusion (I2 = 0%), and additional uterotonics (I2 = 7%).

Interpretation: Carbetocin alone and oxytocin plus TXA were superior to oxytocin monotherapy for preventing PPH in cesarean deliveries. Oxytocin plus TXA ranked as the most effective intervention for PPH prevention. These results are critical in highlighting the comparative efficacy and hierarchy of prophylactic agents for PPH prevention, especially given the widespread availability and low cost associated with oxytocin and TXA.

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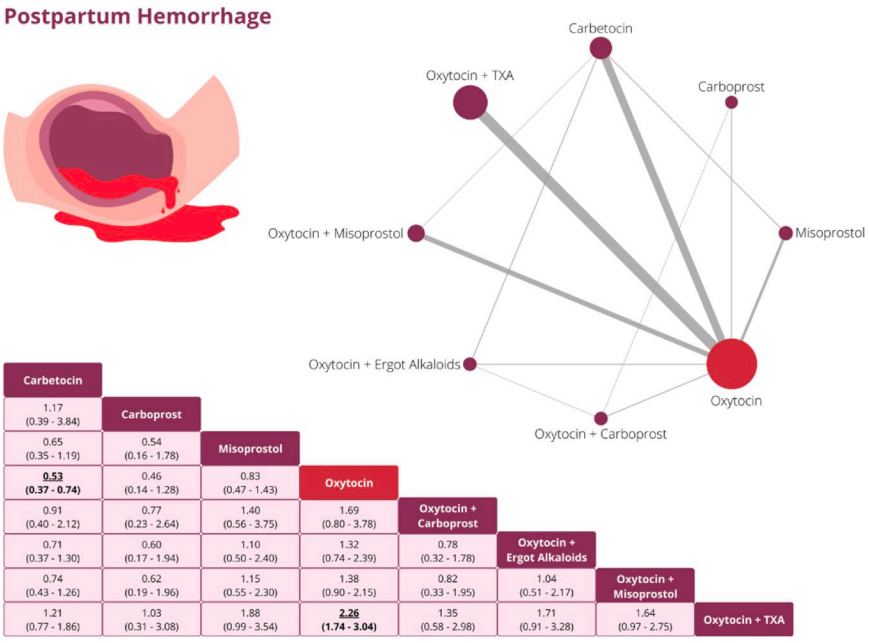

Carbetocin							
1.17 (0.39 - 3.84)	Carboprost						
0.65 (0.35 - 1.19)	0.54 (0.16 - 1.78)	Misoprostol					
0.53 (0.37 - 0.74)	0.46 (0.14 - 1.28)	0.83 (0.47 - 1.43)	Oxytocin				
0.91 (0.40 - 2.12)	0.77 (0.23 - 2.64)	1.40 (0.56 - 3.75)	1.69 (0.80 - 3.78)	Oxytocin + Carboprost			
0.71 (0.37 - 1.30)	0.60 (0.17 - 1.94)	1.10 (0.50 - 2.40)	1.32 (0.74 - 2.39)	0.78 (0.32 - 1.78)	Oxytocin + Ergot Alkaloids		
0.74 (0.43 - 1.26)	0.62 (0.19 - 1.96)	1.15 (0.55 - 2.30)	1.38 (0.90 - 2.15)	0.82 (0.33 - 1.95)	1.04 (0.51 - 2.17)	Oxytocin + Misoprostol	
1.21 (0.77 - 1.86)	1.03 (0.31 - 3.08)	1.88 (0.99 - 3.54)	**2.26 (1.74 - 3.04)**	1.35 (0.58 - 2.98)	1.71 (0.91 - 3.28)	1.64 (0.97 - 2.75)	Oxytocin + TXA

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 04

A pilot study evaluating the correlation of SEER Sonorheometry with ROTEM in Obstetric Hemorrhage

Presenting Author: Marc Ghabach, MD

Presenting Author's Institution: Duke University Hospital - Durham, North Carolina

Co-Authors: Jerome Federspiel, MD, PhD - Duke University
Mary Yurashevich, MD, MPH - Duke University Medical Center

Abstract :

Introduction: Rapid assessment of hemostatic function using viscoelastic testing (VET) devices has clinical utility in obstetrics, facilitating diagnosis and management of coagulopathy, predicting hemorrhage severity, and defining hemostatic parameters for intervention. Currently used VET technology is limited to rotational thromboelastometry (ROTEM) and thromboelastography (TEG). Sonic Estimation of Elasticity via Resonance (SEER) Sonorheometry is a novel VET modality, utilized by the cartridge-based Quantra Hemostasis Analyzer. SEER sonorheometry utilizes ultrasonic pulses to measure clot physical properties, and has potential benefits with respect to assay robustness and accuracy in obstetric hemorrhage. This study aimed to determine the correlation of SEER-based Quantra QStat cartridge parameters with those obtained from the ROTEM delta and other lab-based coagulation assays used as standard of care in obstetric hemorrhage at our facility.

Methods: In this single center, prospective, observational, IRB-approved study, we enrolled parturients experiencing an obstetric hemorrhage necessitating activation of the Stage 2 obstetric hemorrhage protocol (OHP) (blood loss ≥ 1500 mL) within 24 hours after delivery from June 2023 to March 2024. Maternal blood was collected from eligible patients as standard of care and hemoglobin, platelet count, prothrombin time, activated partial prothrombin time and fibrinogen were measured in addition to ROTEM (EXTEM and FIBTEM assays; ROTEM® Delta, Werfen, Inc.) and SEER QStat parameters (Quantra® Hemostasis, Hemosonics). For patients who subsequently consented to participation, we additionally collected demographic, obstetric, transfusion and hemorrhage-related outcome data from the electronic medical record. Pearson's correlation was used to assess the correlation between standard tests of coagulation, ROTEM, and SEER QStat parameters.

Results: We collected samples from 69 parturients, of whom 51 consented for inclusion in the study, but 1 patient was excluded after enrollment. The demographic, obstetric, transfusion and hemorrhage related outcome data for those 50 patients are summarized in the Table. There were strong correlations between QStat Clot Stiffness and EXTEM A10 (R=0.90) and EXTEM A20 (R=0.90), between QStat Fibrinogen contribution to clot stiffness and Fibrinogen (R=0.82), FIBTEM A10 (R=0.87), and FIBTEM A20 (R=0.87); and between QStat Platelet contribution to clot stiffness and platelet count (R=0.76) and PLATEM A20 (EXTEM A20 – FIBTEM A20) (R=0.87). QStat Clot Time only moderately correlated with aPTT (R=0.46).

Conclusion: Among patients experiencing obstetric hemorrhage, SEER-based clot stiffness parameters derived from the QStat cartridge demonstrated strong correlation with analogous ROTEM parameters, fibrinogen and platelet levels indicating SEER provides a viable VET option for managing obstetric hemorrhage patients.

References:

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Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 05

Association of Antepartum Anemia and Red Blood Cell Mass with Racial and Ethnic Disparities in Transfusion Rates after Cesarean Delivery: A Retrospective Cohort Study

Presenting Author: Hisako Okada, MD. PhD.

Presenting Author's Institution: University of Oklahoma Health Sciences Center - OKLAHOMA CITY, Oklahoma

Co-Authors: Amir Butt, MD, MPH - University of Oklahoma Health Sciences Center
Michaela K. Farber, MD MS - Brigham and Women's Hospital
Kaitlyn Kulesus, n/a - University of Oklahoma
Shashank S. Shettar, MD, FASA - University of Oklahoma Health Sciences Center
Kenneth E. Stewart, PhD, MPH - University of Oklahoma College of Medicine

Abstract:

Background: Antepartum anemia among patients undergoing cesarean deliveries has increased over the past decades in the United States.[1,2] We hypothesized that red blood cell (RBC) mass, which reflects both prepartum anemia and body mass index (BMI), predicts transfusion risk after cesarean delivery beyond racial/ethnic categories.

Study Design and Methods: A retrospective study of patients who underwent cesarean delivery from 2019 to 2021 was performed using the National Surgical Quality Improvement Program database. The outcome of interest was perioperative transfusion within 72 hours of surgery. Multivariable logistic regression models evaluated the potential added predictive value of race and RBC mass, alongside other known predictors of transfusion.

Results: Among 43,869 cesarean deliveries, the perioperative RBC transfusion rate was 3.3%. Anemia and high BMI were the most prominent in Black and Native American patients, and among women who received transfusions, the women of these two races had significantly larger ΔRBC mass (360 to 400 mL). Transfusion odds of cesarean delivery due to placental complication increased six-fold compared to those due to prior cesarean delivery. While race remained a significant predictor, a 400 mL increase in RBC mass was associated with a 35% decrease in transfusion odds across races.

Discussion: Antepartum anemia prevalence and BMI varied significantly by race/ethnicity, influencing peripartum RBC mass and transfusion rates. Despite the association of races or placental factors, our predictive model demonstrated significant reduction of transfusion odds with increased antepartum RBC mass. As a parameter that accounts for varied hemoglobin levels and BMI, estimated RBC mass may be a useful metric for assessing transfusion risk in racially diverse populations.

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Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 06

The Relationship between the High Frequency Heart Rate Variability Index (HFVI) and Epidural Analgesia in the Laboring Parturient

Presenting Author: Genevieve Monanian, MD

Presenting Author's Institution: Stony Brook Medicine - Stony Brook, New York

Co-Authors: Tiffany Angelo, D.O., FASA - Stony Brook Medicine
Elliott Bennett-Guerrero, MD - Stony Brook Medicine
Alexa Christophides, n/a - Stony Brook Medicine
Bahaa Daoud, MD - Stony Brook University
Samuel Stanley, M.S. - Stony Brook Medicine

Abstract :

Background: The Mdoloris HFVI monitor measures high frequency heart rate variability. These HFVI values have been shown to decrease significantly in response to painful stimulation and reflect the administration of analgesics in an anesthetized patient. However, few studies exist examining its use in awake patients.The ability to have a non-invasive, objective, physiologically-based measurement of nociception is highly useful. By examining the impact of epidural analgesia on HFVI scores from the Mdoloris monitor during the occurrence of painful uterine contractions, we aim to establish a correlation between HFVI value, nociceptive stimuli, and reported pain scores.

Methods: After local IRB approval, 20 parturients who requested epidural labor analgesia were recruited. Research personnel placed the HFVI monitor sensors on the consented patients. For at least 3 contractions prior to epidural placement, patients reported their numerical rating scale (NRS) pain scores at the beginning, the peak, and the resolution of uterine contraction.The same reporting resumed at least 15 minutes after epidural medication bolus administration for at least 3 contractions. HFVI scores were recorded in a blinded fashion throughout this time.

The primary outcome was the strength of correlation between NRS pain score and HFVI values prior to the placement of the epidural. The secondary outcomes were how HFVI values differ before and after the epidural placement, as well how the association of NRS pain scores and HFVI values varies before and after the epidural placement.

Results: Based on the mixed model utilized for the primary outcome data analysis, there was a significant ($P < 0.0001$) negative linear relationship between HFVI and NRS values in the setting of uterine contractions before epidural placement.
Based on the mixed model utilized for the secondary outcome data analysis, there was a significant ($P < 0.0001$) difference in the relationship between HFVI value and NRS pain score for post-epidural measurements compared to those taken before epidural placement.

Discussion: There is a significant association between HFVI values from the Mdoloris monitor and NRS pain scores reported by laboring patients prior to epidural analgesia. Furthermore, there is a negative linear relationship between Mdoloris HFVI values and NRS pain scores recorded in awake, laboring parturients both before and after epidural placement.This suggests that the Mdoloris monitor may have a role in creating a more objective and quantifiable means of measuring nociception in the awake, laboring patient.

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Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 07

Randomized Double-Blinded Clinical Trial of Oxytocin Bolus versus Infusion in Elective Cesarean (INBOX trial)

Presenting Author: Tiffany Angelo, D.O., FASA

Presenting Author's Institution: Stony Brook Medicine - Stony Brook, New York

Co-Authors: Bahaa Daoud, MD - Stony Brook University
Morgane Factor, MD - Stony Brook Medicine
Ayesha Khan, n/a - NYU
Samuel Stanley, M.S. - Stony Brook Medicine

Abstract :

Introduction: Oxytocin is the most widely used uterotonic agent worldwide for the prevention of postpartum hemorrhage. There is limited high quality data comparing bolus versus infusion administration of oxytocin. Given that uterine blood flow is between 500-700 mls/min, blood loss can be significant if adequate uterine tone is not achieved quickly. We designed a study to test the hypothesis that administration of oxytocin by bolus results in more rapid adequate uterine tone, which may result in decreased blood loss.

Methods: After IRB approval, we conducted a randomized double blinded clinical trial of 121 parturients having an elective cesarean section under neuraxial anesthesia. Patients were randomized (1:1) to either the bolus or infusion arm. Study drugs were prepared by the investigational drug pharmacy. Both the Anesthesiologists and Obstetricians were blinded. After cord clamping, patients received oxytocin by either bolus or an infusion per their randomization assignment. The primary end point was adequate uterine tone at two minutes. Quantitative blood loss was a prespecified efficacy secondary end point. Safety endpoints included changes in heart rate and blood pressure, total dose of phenylephrine, presence of chest pain and/or nausea/vomiting, and use of additional uterotonic agents.

Results: Overall, 121 patients were randomized and 115 were analyzable (6 screen failures did not receive any study drug). There were no crossovers, with almost all patients (114 of 115) receiving oxytocin per protocol except for 1 subject where the study protocol was terminated 5 minutes into the study drug administration. There were no significant differences between study groups in patient characteristics at baseline. The percentage of patients achieving adequate uterine tone at 2 minutes (primary end point, see Figure 2) was numerically higher in the bolus arm (83.3%) vs. infusion (78.2%), however this did not achieve statistical significance (p=0.483). Intraoperative blood loss (median, IQR), was statistically significantly lower in patients randomized to the bolus vs. infusion arm [558 ml (429-733) vs 687 ml (480-826), p=0.0438]. Patients randomized to the bolus arm did not exhibit more hypotension, total dose of phenylephrine, nausea, or need for additional uterotonic agents.

Discussion: In this double blinded randomized clinical trial, the administration of oxytocin by bolus was effective and reduced blood loss compared with administration by infusion. Prespecified safety endpoints were similar in both arms suggesting similar safety profiles for these two methods of administration.

IRB approval: 2021-00558 Approval date: 11/11/2021

Financial disclosure statement: The authors report not financial disclosures.

References:

INBOX Abstract Figure 2.pdf

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 08

Longitudinal Analysis of Viscoelastic Testing Utilization in Postpartum Hemorrhage Management: Trends Over Time

Presenting Author: Emily M. Kim, MS

Presenting Author's Institution: University of Texas Medical Branch - Galveston, Texas

Co-Authors: Briana Syed, BS - University of Texas Medical Branch

Abstract :

Background

Postpartum hemorrhage (PPH) is the leading cause of maternal morbidity and mortality worldwide, affecting 14 million women annually. Viscoelastic testing (VET), including thromboelastography (TEG) and rotational thromboelastometry (ROTEM), provides real-time evaluation of the coagulation process to facilitate expedient and precise transfusion interventions. Prior research has shown that VET has the potential to reduce blood loss and blood product waste, prevent maternal complications, and predict risk of PPH in asymptomatic patients [1-2]. However, the degree to which VET is utilized in clinical practice remains unclear. This study aims to quantify the usage of VET for managing obstetric complications such as PPH over time.

Methods

Data were collected from the TriNetX database on females aged 18-51 starting January 1st, 2010 to December 31st, 2023. Current procedural terminology (CPT) codes for PPH (O72 and O72.1) were used to build cohorts of patients receiving VET (85396) and those not receiving VET during episodes of PPH. Incidence data, patient demographics, and geographic data was collected for each year. Four-year cohorts were built from 2012-2015, 2016-2019, and 2020-2023 for both PPH only and VET with PPH groups. We employed Analysis of Variance (ANOVA) followed by Tukey's HSD post-hoc test to identify specific group differences.

Results

In total, 181,267 patients with PPH across 79 healthcare organizations (HCOs) comprised the cohort that did not utilize VET, and 768 patients across 12 HCOs comprised the cohort that did utilize VET. The average utilization of VET during all episodes of PPH was 0.35%, and annual utilization rates ranged from 0% in 2012 to 0.72% in 2023. Comparing 4 year-cohorts, the total number and rate of patients receiving VET during PPH events increased significantly from 2012-2015 (n=52, 0.15%) and 2016-2019 (n=203, 0.33%) to 2020-2023 (n=513, 0.58%) ($F(2, 9) = 12.70$, $p = 0.0024$). We observed regional differences in VET utilization; the South comprised 46.5% of total VET events and 35.4% of PPH only events, followed by the Northeast (26.3%, 29.2%), Midwest (19.2%, 17.7%), and West (17.7%, 8/1%), respectively.

Conclusions

Our study demonstrates that within the TriNetX database, VET utilization rates for PPH management have increased from 2012 to 2023. However, uptake of VET across the United States remains low. Limitations in uptake may be cost of TEG and ROTEM devices, training

considerations, and feasibility. Dissemination of research and standardization of VET protocols is needed to bridge the gap between practice changes and VET's promising utility to manage PPH.

References:

1. Barinov S, Zhukovsky Y, Dolgikh V, et al. Novel combined strategy of obstetric haemorrhage management during caesarean section using intrauterine balloon tamponade (2017).
2. Zhou J, Xin Y, Ding Q, et al. Thromboelastography predicts risks of obstetric complication occurrence in (hypo)dysfibrinogenemia patients under non-pregnant state (2016).

	PPH event	**Total VET events**	**Mean VET events per year**	**VET utilization Rate**
	Total patients (n)		Mean (n)	(%)
2012-2015	31354	52	13	0.15%
2016-2019	62500	203	51	0.33%
2020-2023	87413	513	128*	0.58%**

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 09

Perioperative and anesthetic management of placenta accreta spectrum at an academic center: a 11-year retrospective cohort study.

Presenting Author: Nicolas Muller, MD

Presenting Author's Institution: Department of Anesthesia and Pain Management, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada. - Toronto, Ontario

Co-Authors: Juan Pablo Ghiringhelli, MD - Department of Anesthesia and Pain Management, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada.
Anuja Mandavkar, Miss - Research student, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada.
Javiera Vargas, MD - Department of Anesthesia and Pain Management, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada.

Abstract :

Introduction: Placenta accreta spectrum (PAS) disorder represents a significant global threat due to its association with severe postpartum hemorrhage, contributing to maternal and perinatal mortality. Multidisciplinary care—including obstetric anesthesiologists, obstetricians, gynecological oncologists, radiologists, and critical care specialists—has been shown to improve clinical outcomes [1]. At our institution, anesthetic practices have evolved, emphasizing neuraxial techniques and pre-incision tranexamic acid use [2]. Since 2018, internal iliac artery (IIA) balloon placement has been discontinued, and cell salvage has become standard.

Aim: To evaluate the impact of anesthetic and surgical changes on maternal and perinatal outcomes.

Methods: After obtaining REB approval, this retrospective cohort study was done between Jan 2013 and Dec 2023. Inclusion criteria were patients with surgically and pathologically confirmed PAS undergoing emergency or elective procedures, including conservative (uterus-preserving) or non-conservative (cesarean hysterectomy) management. Variables such as surgical procedure, anesthesia drugs and technique, conversion to general anesthesia, transfusions and complications were collected, and outcomes before and after 2018 were compared. Continuous variables were summarized using mean (SD) or median [IQR], while categorical variables were expressed as frequencies (%). Statistical analyses included Fisher’s exact test and logistic regression. All analyses were performed using STATA 14.0

Results: 193 patients with PAS were identified during the study period: 2013-2017 (n=58) and 2018-2023 (n=135). Patient characteristics and perioperative outcomes are in Table 1. Regional anesthesia was planned in 94% cases, and 17% were converted to general anesthesia (GA); 73% of these conversions occurred post-delivery, mainly for intraoperative pain and major bleeding. Hysterectomy was performed in 84% of cases. Significant changes were identified across two time periods including increased use of IIA ligation (13% vs. 81%, $p< 0.01$), cell saver (64% vs. 84%, $p< 0.01$), and decrease in uterine artery ligation (60% vs. 21%, $p< 0.01$) and placement of IIA balloons (81% vs. 0%, $p< 0.01$) after 2018. Blood loss and transfusions remained unchanged. GA was associated with a higher blood loss than regional anesthesia by 882 ml.

Discussion: Changes in surgical technique did not affect patient outcomes including transfusions or complication rates. These findings suggest that advanced techniques can be used with ease in patients with PAS without the need for IIA balloon placement, while maintaining a low complication rate.

References:

< 1. Warrick CM et al. PAS Disorders: Knowledge gaps in anesthesia care. Anesth Analg. 2022;135:191-7.

< !2. Nguyen-Lu N et al. Mode of anesthesia and clinical outcomes of patients undergoing cesarean delivery for invasive placentation: a retrospective cohort study of 50 consecutive cases. Can J Anaesth. 2016;63:1233-44.

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Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 10

High-Dose Heparin in Pregnant Women: Implications for Neuraxial Analgesia Safety

Presenting Author: Kelly Li

Presenting Author's Institution: Harvard Medical School, Beth Israel Deaconess Medical Center - Brookline, Massachusetts

Co-Authors: Philip E. Hess, MD - Beth Israel Deaconess Medical Center
Yunping Li, MD - Beth Israel Deaconess Medical Center

Abstract :

Background:
The 2018 American Society of Regional Anesthesia guidelines recommend a 12-hour interval between high-dose subcutaneous heparin (SQH >15,000 IU/day) administration and neuraxial block placement (1). However, these guidelines do not account for the hypercoagulable state of pregnancy. While parturients receiving standard prophylactic doses of SQH (5000 IU BID or TID) typically do not require monitoring and delay in block placement, limited evidence exists on a safe interval to minimize hemorrhage risk and delays in pain relief for those on high-dose SQH.

Objective:

To assess the time required for partial thromboplastin time (PTT) normalization and evaluate the safety of neuraxial analgesia in pregnant women on high-dose SQH (>15,000 IU/day or >7,500 IU/dose BID).

Methods:

This retrospective cohort included parturients receiving high-dose SQH during delivery admissions at a single tertiary institution (Jan 2017–Jun 2022). Data extracted from electronic records included heparin dosing, serial PTTs, neuraxial timing, cervical dilation, hemorrhage outcomes, and potential confounders. Encounters with missing data were excluded. PTT < 40 seconds was considered safe. $P < 0.05$ was considered significant.

Results:

Sixty-eight pregnant women receiving high-dose SQH were included: 49 had a history of venous thromboembolism, 18 had known hypercoagulopathies, including Factor V Leiden and antiphospholipid syndrome, and 2 had a history of stroke (some patients had multiple indications). PTT normalization times varied significantly. Of the cohort, 14 had high PTTs (>40 s) during admission; the rest had safe levels. Mean time to PTT normalization was 25.0 hours (n = 8; SD: 16.9, range: 7.9–61.4) from last dose. A weak positive correlation was observed between daily heparin dose and PTT normalization time (Pearson $r = 0.19$, $p = 0.25$).

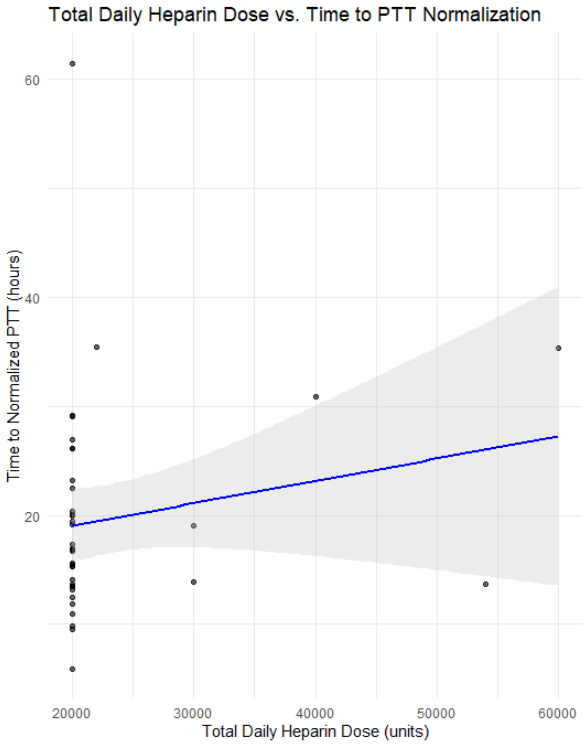
At the time of block placement, 50 patients had normalized PTTs, while 6 had PTT > 40 s. Neuraxial procedures (62% combined spinal-epidural, 17% epidural, 10% spinal) were performed at a mean cervical dilation of 3.7 cm. No spinal or epidural hematomas or severe

morbidity occurred. Delivery method and postpartum hemorrhage rates were comparable to the general population.

Conclusion:

Patients receiving high-dose SCH generally present with safe PTT levels at the time of labor and delivery, allowing for timely administration of neuraxial analgesia. PTT normalization time did not vary significantly with total heparin dose. No spinal or epidural hematomas were observed. Despite variable pharmacodynamics of high-dose SQH, these findings support the safety of neuraxial analgesia with appropriate monitoring. Data was limited by the scarcity of patients on doses >20,000 units/day and the infrequency of PTT testing, which impacts normalization time estimates. Further studies are necessary to refine pregnancy-specific anticoagulant guidelines and improve maternal outcomes.

References: 1. RAPM 2018;43:263-309.



Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 11

Evaluating Blood Hemostasis in Pregnant Women using the Thromboelastograph 6s System – A Prospective Observational Study.

Presenting Author: Teshi Kaushik, MD

Presenting Author's Institution: UAB Department of Anesthesiology - Birmingham, Alabama

Co-Authors:

Abstract :

Background: The TEG 6s Hemostasis Analyzer (Haemonetics Corporation) is a portable, point-of-care device used to assess blood clotting function.1 Beyond R time, K time, and maximal amplitude (MA), the system measures Maximum Amplitude Citrated Functional Fibrinogen (MA CFF), which assesses fibrin's contribution to clot strength. It also evaluates Maximum Amplitude Citrated Rapid TEG (MA CRT), reflecting the overall clot strength as determined by fibrin-platelet interaction, and Functional Fibrinogen Level (FLEV). We conducted an observational study to validate the use of the TEG 6s system in pregnant patients.

Methods: A total 180 patients were enrolled and categorized into three groups: healthy pregnant, pregnant with hypertensive disorders, and non-pregnant. Following written informed consent, the TEG 6s system was used to assess coagulation status. The TEG 6s values K time, R time, MA CRT, MA CFF and FLEV were compared between non pregnant and pregnant groups. Additionally, further the coagulation lab values of a portion of the hypertensive pregnant patients were collected and compared with their TEG values. We hypothesized that TEG 6s system will demonstrate hypercoagulability and TEG 6s could be used to assess coagulation in pregnant hypertensive patients with rapidly declining platelet counts. Kruskal Wallis test was used to compare TEG 6s values by group, and Spearman rank correlation was used to assess correlation between TEG 6s values and blood laboratory values.

Results: A total of 178 patients were analyzed in the study, two patients in the heathy pregnant and one patient hypertensive pregnant group opted out of the study___. K time was significantly less in both pregnant groups compared to non-pregnant group ($p< 0.0001$). MA CRT, MA CFF and FLEV were significantly higher ($p< 0.0001$) in both pregnant groups compared with the non-pregnant group, all signifying hypercoagulability during pregnancy (Figure 1). Additionally, in the hypertensive group of parturient, fibrinogen was positively correlated to MA CFF and FLEV (Spearman rank correlation $r=0.60$ and $r=0.55$ respectively). Platelet values were correlated negatively with K time ($r=-0.45$) and positively with MA CRT ($r=0.51$). There was no statistically significant difference between TEG values of Hypertensive and normal pregnant groups, as well as patients with and without severe features of preeclampsia.

Conclusion: TEG 6s system can be used to assess coagulation in pregnant patients. In pregnant patients with hypertensive disorders including preeclampsia, severe preeclampsia downtrending FLEV and MA CRT may be indicative of decreasing fibrinogen and platelet numbers and might be used for urgent procedures requiring neuraxial anesthesia placements.

References: 1. Neal MD, Moore EE, Walsh M, et al. A comparison between the TEG 6s and TEG 5000 analyzers to assess coagulation in trauma patients. J Trauma Acute Care Surg. 2020;88(2): 279285. doi:10.1097/TA.0000000000002545]

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Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 12

‘Is being awake the way forward?’ for the anaesthetic management of Placenta Accreta Spectrum-a cohort study of 53 women in a UK tertiary centre.

Presenting Author: Christine James, FRCA

Presenting Author's Institution: Guy's and St Thomas' Hospital - London, England

Co-Authors: Nhathien Nguyen-Lu, n/a - Guy's and St Thomas' Hospital

Abstract :

Introduction
Placenta Accreta Spectrum (PAS) has evolved to be one the major iatrogenic public health problems of the 21st century, due to the ubiquitous rise in caesarean sections (C/S).1 There remains no standardised anaesthetic protocol for managing PAS C/S Literature interpretation of incidence, diagnosis, management and outcomes is complicated by diverse terminology.2 Resultingly, identifying an optimal anaesthetic approach has proved challenging. This cohort study examined the role of regional anaesthesia (RA) on related maternal and neonatal PAS outcomes.

Methods
With local audit approval, data was collected prospectively from 2015-2024 of all women who presented with PAS, using electronic records. Demographics, surgical/ interventional radiology (IR) / anaesthetic methods, admission length and neonatal outcomes were analysed.

Results
A total of 53 women were identified. Thirty five (66%) were elective cases and 94% of those were conducted under RA. Balloon occlusion of internal iliac arteries and uterine artery embolization in IR was carried out in 22 (63%) elective cases. RA was used in 72% of emergency cases. Neonatal outcome for RA was assessed with a median gestation of 36 weeks. The median Apgar score is 9, with 84% of neonates remaining with their mother and 74% able to have skin-to-skin contact at delivery.

Table 1: Demographics & management of PAS patients

	Overall (n=53)	Regional Anaesthesia (n=43)	General Anaesthesia (n=10)
Age (yrs)	37.0 (4.5)	38 (6)	35 (4)
Previous C/S	46 (86%)	37 (86%)	9 (90%)
Hysterectomy	20 (38%)	14 (26%)	6 (60%)
Blood loss (L)	3 (2.2)	2.5 (0.6-6.5)	4.9 (1.5-11.6)
Packed Red blood cells(Units)	1.9 (2.2)	1.7 (0-9)	5.3 (0-18)
Fresh frozen plasma (Units)	1.6 (2.0)	1.4 (2.2)	3.8 (4.2)

Platelets (pools)	0.1 (0.3)	0.2 (0.3)	1 (2.6)
Cryo (packs)	0.4 (0.9)	0.4 (0.8)	0.8 (1.3)
Cell salvage (mLs)	190 (314)	187 (312)	203 (339)
Length of stay	6 (3.6)	6 (3.3)	8 (4)
ITU admission	5 (9%)	2 (5%)	3 (30%)
Surgical time (mins)	166 (78.8)	162 (80)	188 (68)
Values are expressed as n (%), mean (standard deviation) median (range)			

Discussion

In our institution, we found that RA demonstrated improvements in the reduction of blood loss, blood transfusion, admission to ITU and length of stay. Importantly, RA improves the maternal experience for patients by enabling bonding through skin-to-skin at delivery, better Apgar scores and reduced admissions to neonatal units. Our data suggests the use of RA alone with an awake mother is safe and tolerated well, even in complex surgery. We advocate that RA is the preferred anaesthetic for PAS patient management.

References:

1. Einerson, B., Gilner, J.B. and Zuckerwise, L.C.. Placenta Accreta Spectrum. Obstet Gynecol. 2023;142: 31–50.

2. Jauniaux E, Ayres-de-Campos D, Langhoff-Roos J, Fox KA, Collins S. FIGO Placenta Accreta Diagnosis and Management Expert Consensus Panel. FIGO classification for the clinical diagnosis of placenta accreta spectrum disorders.Int J Gynaecol Obstet. 2019; 146:20-24.

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 13

Risk Factors and Development of a Prediction Model for Postpartum Hemorrhage in Cesarean Delivery

Presenting Author: Brittany Burton, MD

Presenting Author's Institution: UCLA - Los Angeles, California

Co-Authors: Christopher Lee, MD - UCLA
Cristianna Vallera, MD - University of California Los Angeles
Tina Yu, MD - University of California Los Angeles

Abstract :

Background: Postpartum hemorrhage (PPH) continues to be a leading cause of postpartum morbidity during pregnancy, and from 2000 to 2019, the rate of PPH increased from 2.7% to 4.3%. While several studies have examined risk factors of PPH, more work is needed to accurately classify high-risk women. Prediction models may allow providers to risk stratify, plan, and optimize women for cesarean delivery.

Methods: We conducted a retrospective analysis of adult women from the National Inpatient Sample database for the years 2019 – 2020. The primary endpoint was PPH, defined as ≥ 1,000 mL blood loss. Variables known to be clinically significant and associated with the outcomes in previous research were incorporated into the analysis. The dataset was divided into a training set (70%) and a test set (30%), with the model developed on the training set. Backward model selection was performed to select the final model. Model performance was evaluated using the area under the receiver operating characteristic curve (AUC), accuracy, sensitivity, and specificity at the optimal threshold value. Model calibration was assessed using the Hosmer-Lemeshow goodness-of-fit test.

Results: The final multivariable model included race, age, income, insurance status, obesity, repeat cesarean delivery, multiparity, iron deficiency anemia, leiomyoma, post term pregnancy, hypertensive disorder of pregnancy, eclampsia, placenta previa, placental abruption, preterm delivery, prolonged labor, chorioamnionitis, uterine overdistention, and coagulopathy ($p < 0.05$). The AUC was 0.66 for the training and test sets, indicating modest discriminatory ability. The threshold used to classify PPH risk was 0.043 for the training set and 0.042 for the test set. Sensitivity was 0.57 in the training set and 0.63 in the test set, while specificity was 0.66 in the training set and 0.60 in the test set. The Hosmer-Lemeshow test yielded non-significant p-values ($p = 0.19$ for the training set and $p = 0.14$ for the test set).

Conclusion: This study offers valuable insights into risk factors for PPH and highlights the importance of prediction model. The modest discriminatory ability of our model underscores the need for continued refinement and integration of other potential risk factors for PPH. These findings have the potential to help better inform more targeted interventions, improve patient outcomes, and help reduce disparities in maternal care. Future studies with larger datasets may help elucidate unmeasured or unknown factors contributing to PPH, which will help to create more effective tools for its prevention and management.

References:

1. Declercq E, Zephyrin L, Maternal Mortality in the United States: A Primer (Commonwealth Fund, Dec. 2020). https://doi.org/10.26099/ta1q-mw24,.

2. Corbetta-Rastelli CM, Friedman AM, Sobhani NC, Arditi B, Goffman D, Wen T. Postpartum Hemorrhage Trends and Outcomes in the United States, 2000-2019. *Obstet Gynecol.* 2023;141(1):152-161.

Table 4.pdf

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 14

Plasma Transfusion in Obstetric Hemorrhage: A Single-Center Quality Audit of Dosing Practices and Outcomes

Presenting Author: Kelly A. Fedoruk, MD, FRCPC

Presenting Author's Institution: Stanford University - Menlo Park, California

Co-Authors: Joshua Nicholas, MD, FRCPC - University of Calgary
Nisha Panigrahy, BSc - University of Minnesota
Lynn Squires, MD FRCPC - University of Alberta

Abstract :

Postpartum hemorrhage remains the leading etiology of maternal mortality globally. Current transfusion guidelines in obstetric hemorrhage are extrapolated from trauma literature, recommending 1:1:1 blood product ratios in the context of massive transfusion. Outside this context, the suggested threshold for plasma administration is an INR of 1.8 with a target < 1.5 during ongoing bleeding. Although standard plasma dosing to achieve this target is 10-15 mL/kg (≥3 units for adults), the physiologic hypercoagulable state of pregnancy and elevated fibrinogen levels necessitate careful consideration of plasma administration. We performed a retrospective audit evaluating plasma transfusion practices and outcomes in the obstetric population at a single tertiary care center.

We analyzed 156 cases of plasma administration in our labor and delivery unit from January 2019 to December 2023. Data extraction included patient demographics, peripartum characteristics, and comprehensive transfusion parameters within 24 hours of administration. Cohorts were stratified by plasma volume: ≤2 units (n=80) versus >2 units (n=76).

Analysis revealed 51% of patients received ≤2 units of plasma, suggesting subtherapeutic dosing. In the ≤2 unit cohort, mean fibrinogen decreased marginally from 320 to 311 mg/dL with minimal INR improvement from 1.27 to 1.20. Conversely, patients receiving >2 units demonstrated more favorable coagulation parameters, with fibrinogen increasing from 232 to 270 mg/dL and INR normalizing from 3.13 to 1.27. The RBC:plasma ratio was 2:1 in the low-dose cohort versus 1.4:1 in the adequate-dose cohort.

This audit identifies significant opportunities for quality improvement in obstetric plasma administration, with potential subtherapeutic dosing in over 50% of cases. Further, ratio based resuscitation is not recommended outside of massive transfusion and the mean pre-transfusion INR of patients receiving ≤2 units of plasma does not meet indications for plasma administration. The differential impact on coagulation parameters between dosing strategies suggests the need for standardized protocols to optimize plasma utilization in obstetric hemorrhage management.

References:

Collis RE, Collins PW. Haemostatic management of obstetric haemorrhage. *Anaesthesia*. 2015/01/01 2015;70(s1):78-e28. doi:https://doi.org/10.1111/anae.12913

Triulzi D, Gottschall J, Murphy E, et al. A multicenter study of plasma use in the United States. *Transfusion*. Jun 2015;55(6):1313-9; quiz 1312. doi:10.1111/trf.12970

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 15

Association between pre- and post- delivery anemia and severe maternal morbidity among pregnant patients of different racial, ethnic, and socioeconomic groups determined by Area Deprivation Index

Presenting Author: Amy Krepps, MD, MSPH

Presenting Author's Institution: University of Colorado - Denver, Colorado

Co-Authors:

Abstract :

Objective

Anemia in pregnancy (AIP), is a predictor of maternal morbidity and mortality.[1] The incidence of AIP varies across racial, ethnic, and socioeconomic groups, potentially contributing to disparities in severe maternal morbidity (SMM).[2] We seek to estimate the impact of pre- and post-delivery anemia on maternal outcomes across these different groups.

Methods

Retrospective cohort study of 8,753 deliveries at single tertiary care center from 2021-2022. Pre-delivery anemia was defined by hemoglobin (Hb) nadir within one year before delivery and post-delivery anemia was defined by Hb nadir within 24 hours after delivery. The primary outcome was the incidence of AIP among births of at least 20 weeks gestation categorized by race (Black, Caucasian, Non-Black), ethnicity (Hispanic, Non-Hispanic), and Area Deprivation Index (ADI) quintiles. Secondary outcomes included maternal morbidity and mortality rates and their association with AIP across groups. Pre-delivery anemia was defined by hemoglobin (Hb) nadir within one year before delivery and post-delivery anemia was defined by Hb nadir within 24 hours after delivery.

Results

Of all patients, 89.5% (n = 7,760) had no pre-delivery anemia, 9.7% (n = 843) had mild pre-delivery anemia and 0.8% (n = 68) experienced moderate/severe pre-delivery anemia. Black patients and non-Black patients were more likely to experience pre-delivery anemia compared to Caucasian patients (OR 2.32, CI 1.92-2.80 and OR 1.52, CI 1.30-1.78, respectively). Post-delivery anemia affected 63.7% of patients, with 44.6% having mild anemia (n = 1,969) and 19.1% (n = 844) with moderate/severe anemia. Hispanic and non-black patients were more likely to experience post-delivery anemia compared to Non-Hispanic patients (OR 1.30, CI 1.13-1.50 and 1.35, CI 1.18-1.55, respectively).

Patients in higher ADI groups (7-8 and 9-10) exhibited significantly higher rates of pre-delivery anemia compared to those in lower ADI groups (1–2) (OR 2.69, CI 2.10-3.47 and OR 2.93, CI 2.22-3.89, respectively). Increasing ADI levels were associated with higher odds of SMM, with those in levels 9-10 more likely to experience an SMM compared to lower ADI groups (1-2) (OR 1.44, CI 1.06-1.95).

Conclusion

Anemia is a critical maternal health issue, with notable racial, ethnic and socioeconomic disparities. Black and non-Black patients had higher rates of pre-delivery anemia, while non-Black and Hispanic patients had a higher incidence of post-delivery anemia. Higher levels of ADI were associated with increased anemia prevalence and higher risk of SMM. For

anesthesiologists, it is essential to screen for anemia and risk stratify in the peripartum period, especially for those in high-risk racial, ethnic and socioeconomic groups. Further, acute management and prevention of anemia in the peripartum period can improve SMM outcomes in high-risk groups.

References:

1. PMID: 34293770
2. PMID: 38480029

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 16

Prevalence and trends of anemia, iron deficiency, and iron-deficiency anemia in non-pregnant US women of reproductive age: NHANES 1999-2023

Presenting Author: Alexander Butwick, MBBS, FRCA, MS

Presenting Author's Institution: University of California, San Francisco - San Francisco, California

Co-Authors: Jason Bentley, PhD - Child Population and Translational Health Research, Children's Hospital at Westmead Clinical School, Faculty of Medicine and Health, University of Sydney, NSW, Australia
Andrew D. Leavitt, n/a - University of California San Francisco

Abstract :

Introduction:
Anemia, iron deficiency (ID), and iron deficiency anemia (IDA) are global health problems associated with cognitive and physical impairment and adverse perinatal outcomes during pregnancy (1). Women of reproductive age (WRA) are at risk of anemia, ID, and IDA due to menstrual loss, uterine bleeding, and pregnancy (2). However, it is unclear whether the prevalence of anemia, ID, and IDA has changed over time in US WRA. Therefore, we sought to investigate trends in anemia, ID, and IDA between 1999 and 2023 for US WRA.

Methods:
We analyzed data from 11 National Health and Nutrition Examination Survey (NHANES) cycles from 1999 to 2023. Since 1999, NHANES has continuously collected cross-sectional health and nutrition-related data from a nationally representative cross-sectional sample of the US non-institutionalized civilian population. Anemia was classified as hemoglobin < 12 g/dL, ID as ferritin < 15 ng/mL, and IDA as both hemoglobin < 12 g/dL and ferritin < 15 ng/mL. The 2000-2001, 2011-2012, and 2013-2014 NHANES data cycles were not included in ID and IDA analyses as ferritin levels were not measured. Sample weights were applied in accordance with NHANES analytic guidelines. We calculated unadjusted prevalence estimates for each NHANES cycle overall and by race/ethnicity. Trends for anemia adjusted for age, marital status, insurance, race, ethnicity, education level, and household income to poverty ratio were tested using logistic regression modeling, with the survey period considered as a continuous variable.

Results:
Data from 8,200 participants (mean age 32.2 years, 60.1% non-Hispanic White (NHW)), representing an estimated 33.5 million individuals were analyzed. The overall prevalence of anemia, ID, and IDA was 9.8%, 17.3%, and 6.2%. Between 1999-2000 and 2021-2023, the anemia prevalence increased from 8.0% to 14.2% (p=0.001), and IDA prevalence rose from 4.3% to 9.1% (p< 0.001), whereas the ID prevalence remained stable (17.9% vs. 18.8%; p=0.60, Figure 1). In subgroup analyses, from 1999 to 2023, the prevalence of anemia rose significantly in non-Hispanic black (NHB) women (23.0% to 38.7%; p=0.001), with non-significant change among Hispanic women (8.5% to 14.8%, p=0.10) and NHW women (5.1% to 5.6%; p=0.75). In logistic regression models, the odds of anemia were highest in NHB women (aOR: 6.34, 95% CI: 5.36 – 7.49), Hispanic women (aOR: 2.34; 95% CI: 2.03 – 2.97) and other racial groups (aOR: 2.39; 95% CI: 1.92 – 2.98) compared to NHW women.

Conclusions: Over the last 20 years, the prevalence of anemia and IDA have increased 1.8-fold and 1.5-fold in the US. Disparities persist in anemia prevalence, with black WRA being at highest risk for anemia. These findings highlight the pressing need for improved surveillance and management of anemia, ID, and IDA among WRA and population-based research to understand the reasons for the observed disparities.

References:

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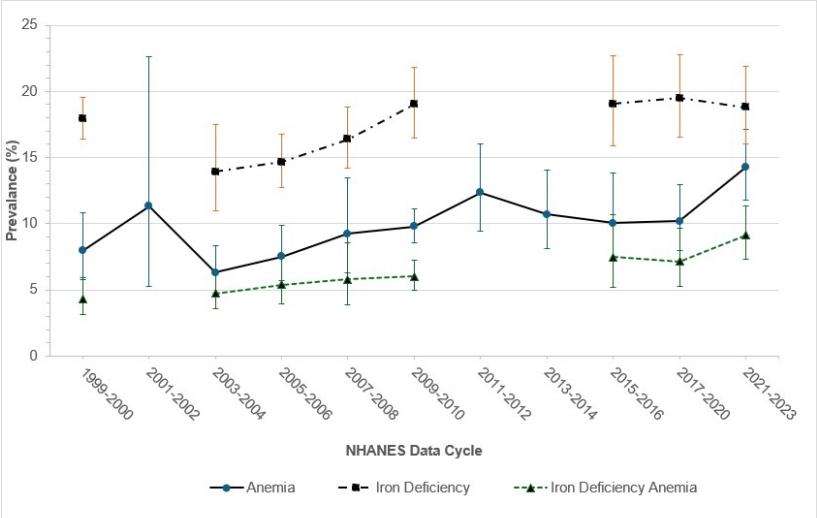

Figure 1. Prevalence of Anemia, Iron Deficiency, and Iron Deficiency Anemia in US Women of Reproductive Age (20-45 years) from 1999-2000 Through 2021-2023

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 17

Factors and Outcomes Associated with Blood Product Transfusion Ratios During Massive Postpartum Hemorrhage: A Multicenter Regression Analysis

Presenting Author: Michael J. Furdyna, MD

Presenting Author's Institution: Brigham and Women's Hospital - Jamaica Plain, Massachusetts

Co-Authors: Samuel Justice, PhD - Brigham and Women's Hospital
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Shubhangi Singh, MBBS - University of Michigan, Department of Anesthesiology

Abstract :
Background

There is limited consensus on optimal transfusion ratios in postpartum hemorrhage (PPH), particularly as the degree of resuscitation escalates. Transfusion strategies may not account for the unique coagulation parameters in the peripartum period. Our study aims to describe the factors associated with varying blood product transfusion ratios in massive PPH, as well as associated outcomes, in a large, contemporary sample of US deliveries in the Multicenter Perioperative Outcomes Group (MPOG) database.

Methods

In this multicenter, retrospective, observational study, we queried the MPOG database for all obstetric anesthetic records for delivery, as well as associated records within 48 hours, for patients aged 15-50 who delivered between 1/1/2016 and 12/31/2023. We identified cases of massive postpartum hemorrhage, defined as those who received an estimated 4 or more units of red blood cells (RBCs), inclusive of cell salvage; patients with initial coagulopathies or who received whole blood were excluded. Fresh Frozen Plasma (FFP) to RBC ratios were classified as underbalanced (< 0.75) or balanced (0.75-1.34). We calculated frequencies, 95% confidence intervals, and multivariable associations between patient, case, and institutional characteristics and balanced transfusions, as well as multivariable associations with clinical outcomes evaluating transfusions both as a binary balance and a continuous ratio.

Results

We identified 926,880 delivery hospitalizations across 64 institutions. Of these, 1,277 had anesthetic records meeting criteria. 32.2% of these cases received balanced transfusions. Labor-to-Cesarean conversions (aOR 1.72 [1.06-2.79]), placenta previa and/or placenta accreta spectrum (aOR 1.43 [1.03-1.09]), and ASA IV/V status (aOR 1.60 [1.07-2.39]) were among the factors most strongly associated with a balanced transfusion. Binary transfusion balance was not associated with our clinical outcomes including length of stay, ICU admission, and composite respiratory failure; however, FFP:RBC as a continuous ratio was associated with an increased risk of respiratory failure (aOR 1.15 [1.02-1.30]). The rate of new-onset International Normalized Ratio (INR) ≥1.5 was < 20%. There was a marked increase in this incidence in patients who received ≥12 RBCs, regardless of transfusion balance.

Conclusions

There exists significant variability in transfusion management of massive PPH, even adjusting for a variety of patient conditions and comorbidities. Such variability likely represents individual provider and institutional practice patterns. Additionally, there was evidence of adverse outcomes with increasing FFP administration; every 1 additional unit of FFP per 4 RBCs was associated with a 15% increase in the odds of respiratory failure. Our findings emphasize the need for targeted, rational approaches to PPH management across a wide variety of practice settings.

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Factors and Outcomes Associated with Blood Product Transfusion Ratios During Massive Postpartum Hemorrhage.pdf

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 18

Fresh Frozen Plasma Utilization and Factor Deficiency Coagulopathy in Severe Postpartum Hemorrhage from 2016 to 2024: A Retrospective Cohort Study

Presenting Author: Lillian Liao, MD, MS

Presenting Author's Institution: Brigham and Women's Hospital, Department of Anesthesiology - Boston, Massachusetts

Co-Authors: Michaela K. Farber, MD MS - Brigham and Women's Hospital
Vesela P. Kovacheva, MD PhD - Brigham and Women's Hospital, Harvard Medical School

Abstract :

Introduction:

Postpartum hemorrhage (PPH), defined as blood loss ≥1L, occurs in approximately 4% of deliveries and can develop into severe PPH requiring transfusion in 2%.[1] Current recommendations for fresh frozen plasma (FFP) transfusion include elevated aPTT, PT, or INR >1.5x normal value[2], with some suggesting FFP transfusion prior to hemostatic lab results when coagulopathy is clinically suspected[3] and in the setting of severe hypovolemia.[4] However, early, formulaic, and liberal use of FFP results in unnecessary transfusion of FFP in women with normal hemostasis.[5] In the non-pregnant population, FFP has been shown to increase the risk of adverse outcomes including 30-day postoperative mortality, venous thromboembolism (VTE), pulmonary embolism (PE), and disseminated intravascular coagulation (DIC).[6] We describe institutional FFP usage for PPH since 2016 and associated adverse outcomes.

Methods:

Patients with PPH who received transfusion during delivery admission between January 1, 2016, and May 31, 2024 were identified. Baseline characteristics, blood loss, products transfused, and adverse outcomes including intensive care unit (ICU) admission, postoperative ventilation, VTE, and acute kidney insufficiency (AKI) were extracted. Elevated INR was defined as INR>1.5 following delivery. Patients with elevated INR prior to delivery were excluded.

Results:

We identified 56,600 deliveries from 2016 to 2024. 7% (n=3,827) had PPH and 1% (n=581) also received transfusion. Elevated INR following delivery did not occur in 92% of our cohort, yet 37% of these patients received FFP. Among these patients, first postpartum FFP administration occurred at median time of 68 [38-114] minutes post-delivery, prior to availability of INR data which occurred at 86 [60-134] minutes. Patients without elevated INR who received FFP were associated with an increase in ICU admission (aOR 11.1 [2.4-51.8], $p < 0.01$) and composite adverse outcomes (aOR 17.8 [4.0-79.4], $p<0.0001$) compared to those who did not receive FFP, even after adjusting for differences in year of delivery, blood loss, preterm delivery, placenta previa, and placenta accreta.

Conclusion:

In patients with PPH who received a transfusion, 92% did not develop an INR>1.5, yet one-third received FFP. Notably, administration of FFP among many of these patients occurred prior to availability of post-delivery INR data. Consistent with prior studies, these patients had a higher odds of adverse outcomes.[6] Our study suggests the initiation of FFP administration for PPH is not guided by explicit elevation in INR in a majority of cases and adds further

evidence that avoidance of FFP in PPH without elevated INR may minimize associated adverse outcomes. Further studies are warranted.

References:

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2. Leal R. Transfus Med. 2023.
3. Mavrides E. BJOG: Int J Obstet Gynaecol. 2017.
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Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 19

Incidence of Postpartum Hemorrhage in Parturients Evaluated by an Antenatal Anesthesiology Consultation

Presenting Author: Domenic J. Pedulla, MD

Presenting Author's Institution: Brigham and Women's Hospital - Boston, Massachusetts

Co-Authors: Jean M. Carabuena, MD - Brigham and Women's Hospital
Trey Hale, n/a - Harvard Medical School
Ayana Watkins, n/a - Harvard Medical School

Abstract :

Introduction

Postpartum hemorrhage (PPH) is a leading cause of morbidity and mortality among parturients in the United States, arising as a complication in approximately 3% of births (1,2). While many risk factors for PPH have been identified, up to 74% of all deliveries complicated by PPH have no identifiable risk factors (2). Recent studies have sought to leverage electronic medical record data to better predict PPH risk, using machine learning and statistical methods to develop and validate predictive models that may demonstrate superiority over existing clinical risk assessment tools (3,4). Obstetric anesthesiologists play a crucial role in the peripartum management of PPH, but their role in antenatal consultation varies greatly and is frequently dependent on the referral of patients deemed high risk for PPH by their obstetricians. This study sought to describe the incidence of PPH in patients referred for an antenatal anesthesiology consultation for elevated PPH risk.

Methods

We created a retrospective cohort of all patients referred for a high-risk obstetric anesthesiology consultation for elevated PPH risk between 08/2021 and 06/2024 using IRB protocol #2020P002859 with waiver of patient consent. We extracted all structured data from the medical record, and the outcome and the main risk factors were manually validated. The primary outcome was the incidence of PPH, defined as cumulative blood loss of at least 1000 mL within 24 hours after birth through estimated or quantitative methods. Descriptive statistics were used to analyze the outcome.

Results

We identified a total of 136 patients who were seen as antenatal anesthesia consults due to a high risk of postpartum hemorrhage. The majority of the patients (N=120, 88.2%) had prior uterine surgery; additionally, 68 (50%) had a suspicion of placenta accreta, and 22 (14.7%) had placenta previa. The average blood loss was 1178 ± 841 ml (SD), and 54 (39.7%) patients developed PPH. Despite this cohort being high-risk, no patient needed ICU admission, and there were no deaths.

Conclusions

These findings illustrate that some patients at high risk for PPH can be identified before delivery and referred for specialized obstetric anesthesiology consultation. Such antenatal

planning may optimize resource allocation and patient preparedness, potentially improving maternal health. Future work should focus on refining the criteria for referral to ensure that high-risk patients receive standardized, evidence-based anesthesiology evaluation, counseling, and pre-delivery planning.

References:

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HRC PPH Table I.pdf

Abstract #: FRI - RA - BS 2 - BR 5 - Blood & Co – 20

Prophylactic Tranexamic Acid for Reduction of Intraoperative Blood Loss during Cesarean Delivery: A Retrospective Analysis

Presenting Author: Haley Mullins

Presenting Author's Institution: Boston University Chobanian & Avedisian School of Medicine - Boston, Massachusetts

Co-Authors: Suzette Desty, MD - Resident
Erin Dienes, Ph. D. - Boston Medical Center
Emily Ha, BS - Boston University Chobanian & Avedisian School of Medicine
Mark Norris, MD - Boston Medical Center

Abstract :

Background

Postpartum hemorrhage (PPH) is the second most common cause of pregnancy related mortality in the United States.[1] Prophylactic administration of tranexamic acid (TXA) has been associated with a lower incidence of calculated blood loss or red blood cell transfusion.[2] This study aimed to evaluate the incidence of PPH and red blood cell transfusion with the administration of prophylactic TXA during cesarean delivery at our institution.

Methods

We conducted a single-center retrospective analysis of patients who underwent cesarean delivery between January 2020 and July 2024. An intravenous dose of tranexamic acid (1g) administered at umbilical cord clamp, was administered to all patients undergoing cesarean delivery starting October 2021. This change in protocol was implemented following institutional aims on reducing PPH based on recent evidence supporting the efficacy of prophylactic TXA.[1] The primary outcomes were PPH defined as gravimetrically estimated blood loss greater than 1000 ml, and administration of red blood cell transfusion within two days of delivery. Secondary outcomes included the use of additional uterotonic agents, postpartum transfusion of all blood products, and incidence of thromboembolic events.

Results

Of the 4180 women who underwent cesarean delivery, 2859 (69%) received prophylactic tranexamic acid. The primary outcomes of PPH and red blood cell transfusion within two days of delivery occurred in 42.4% (1206/2847) and 8.9% (255/2859) in the TXA group and 26.6% (343/1288) and 2.2% (29/1321) in the control groups respectively. The utilization of additional uterotonic agents occurred in 38.8% (1108) in the TXA group versus 19% (251) in the control group, and postpartum transfusion of all blood products occurred in 9.1% (261) versus 2.5% (33) in the TXA versus control groups respectively. The incidence of thromboembolic events occurred in 0.49% (14) versus 0.68% (9) in the TXA versus control groups respectively.

Conclusion

Prophylactic administration of tranexamic acid did not decrease postpartum blood loss or red blood cell transfusion post cesarean delivery. Previous studies demonstrating improvement in

these outcomes administered tranexamic acid prior to the onset of surgery and tailored the administration of tranexamic acid to women at high risk of postpartum hemorrhage.[3,4]

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3. Franchini, M et al Blood Transfus 2018 Apr 3;16 (4):329-337

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Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 01

Is cesarean delivery during the second stage of labor associated with increased requirements for sedation and intravenous analgesia?

Presenting Author: Cristina Hajjar, MD

Presenting Author's Institution: University of Washington - Seattle, Washington

Co-Authors: Paige Keasler, MD - University of Washington
Wil Van Cleve, MD - University of Washington
Tina Vu, MD - University of Washington

Abstract :

Background: Pain during cesarean delivery (CD) occurs in up to 15% of cases, contributes to post-traumatic stress disorder, and is a leading cause of litigation against obstetric anesthesiologists (1). Effective epidural conversion to surgical anesthesia is key to minimizing general anesthesia (GA) use. Second-stage CD is linked to longer operative times and higher intraoperative risks, including uterine atony, hysterotomy extensions, and cystotomy. We sought to evaluate whether anesthetic needs for patients with an indwelling epidural during second-stage CD differed from those in the first stage of labor.
Methods: We analyzed data from all intra-partum CD patients with pre-existing epidurals at our referral center (2022–2024), including maternal demographics (age, weight, gravidity/parity, labor induction/augmentation, opioid use, prior CD) and obstetric factors (second-stage duration, operative delivery rates, surgical time, hysterotomy extensions). Anesthetic interventions included neuraxial technique, block duration, epidural top-ups, IV analgesics (fentanyl, morphine, ketamine), IV sedatives (dexmedetomidine, propofol, midazolam, ketamine), and GA conversion. Data were stratified by labor stage at CD. Continuous variables were reported as median/interquartile range, categorical as frequency (percent).
Results: A total of 968 CDs were identified, with second-stage CD comprising 26% (n=254). No significant differences were found in demographics, obstetric outcomes, or anesthetic interventions between groups. Intra-operative analgesia (29% vs 34%) and sedation (19% vs 24%) rates were similar. IV analgesic use increased with neuraxial block duration (Table). GA conversion rates did not differ significantly (9.1% vs 11%). However, second-stage CD patients had twice the rate of hysterotomy extensions compared to first-stage CD (20% vs 44%, $p < 0.001$).
Conclusions: In our sample of patients with pre-existing epidurals undergoing CD, labor stage did not impact use of IV analgesia, sedation, or GA conversion rates. However, prolonged neuraxial analgesia correlated with increased intra-operative IV sedation and analgesia use. Given the psychological and medicolegal risks of intra-operative pain, obstetric anesthesiologists must proactively mitigate these issues, as addressed in recent guidelines (2). While our GA conversion rate exceeds published benchmarks (3), patient comfort remains the priority. Special care is needed for prolonged labor epidurals, including frequent assessments, top-up monitoring, early replacement consideration, and shared decision-making.

References:

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Table.2ndstagecesareananesthesia.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 02

Comparing Dexmedetomidine to Opioids as Neuraxial Adjuvants to Local Anesthetics for Perioperative Pain Management During C-sections: A Systematic Review of Randomized Controlled Trials

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Co-Authors: Jennifer Bratton, BA - VCU School of Medicine
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Andrew Pidutti, BS - VCU School of Medicine
Mustafa Sadat, BS - VCU School of Medicine
Dean Zhang, BS - VCU School of Medicine

Abstract :

Introduction

Perioperative pain management for c-sections can be supplemented by adjuvant neuraxial opioids. However, opioids are not desirable for all patients, especially those with opioid use disorder or allergy. Meanwhile, dexmedetomidine is a highly specific and selective α2 agonist that is considered a safe and effective adjuvant. Currently, there is a need for a comprehensive systematic review that compares these medications in this setting but does not limit itself to either one opioid or a preidentified dose combination.

Objective

To better inform indications for dexmedetomidine by comparing the efficacy and adverse effects of dexmedetomidine to opioids as neuraxial adjuvants for c-sections.

Methods

Embase, CENTRAL, Web of Science, and MEDLINE were searched on 08/29/24. 1599 studies were imported to Covidence. Only RCTs that compared dexmedetomidine to opioids as neuraxial adjuvants during c-sections were eligible for inclusion with no restriction on local anesthetic, time of administration of adjuvant, or dosing. Two reviewers independently evaluated each article for abstract/full text screening, data extraction, and risk of bias. Conflicts were resolved by a third reviewer or mutual consensus. Pain outcomes, sedation, onset/duration of motor/sensory block, and adverse effects were recorded. A p-value of < 0.05 represented statistical significance. Prospero number is CRD42024590544.

Results

The final analysis included 17 RCTs. Fifteen evaluated intrathecal administration with standard opioid dosing per SOAP guidelines while dexmedetomidine dosing was 2.5-10μg. For these intrathecal studies, the comparators were fentanyl/sufentanil in 13, morphine in 2, and meperidine in 1 (one compared fentanyl, morphine, and dexmedetomidine). Two studies compared PCEA dexmedetomidine to morphine. Across dosing ranges and routes, dexmedetomidine had superior pain scores and analgesia duration in the majority of studies with these variables. None found inferiority. Dexmedetomidine prolonged motor block in the

majority of studies with this variable. In a minority, it reduced shivering. It reduced pruritus vs morphine and meperidine. No adjuvant was consistently superior in onset of analgesia/motor block, hemodynamic effects, nausea/vomiting, or respiratory depression. For PCEA, dexmedetomidine produced deeper, less desirable sedation.

Conclusion

Neuraxial dexmedetomidine offers comparable-to-superior perioperative pain control vs standard dose fentanyl, sufentanil, morphine, or meperidine as c-section adjuvants. Its most common adverse effect is prolonged motor block. Therefore, intrathecal adjuvant dexmedetomidine at 2.5-10μg is a reasonable alternative in cases of contraindications to opioids or where further surgical intervention is expected such as tubal ligation.

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 03

Is Neuraxial Dexmedetomidine Administration Safe?

Presenting Author: Samantha L. Armstrong, BS

Presenting Author's Institution: Beth Israel Deaconess Medical Center - Boston, Massachusetts

Co-Authors: Maria C. Borrelli, DO - Harvard Medical School
Meir Douek, MD - Beth Israel Deaconess Medical Center
Philip E. Hess, MD - Beth Israel Deaconess Medical Center
Yunping Li, MD - Beth Israel Deaconess Medical Center
Simon Zec, MD - Beth Israel Deconess Medical Center

Abstract :

Introduction: Dexmedetomidine (DEX) is a highly selective alpha-2-adrenoceptor agonist with anxiolytic, sedative, and analgesic properties.[1] Intravenous (IV) DEX use in obstetrics remains limited. Animal studies have shown that neuraxial administration is safe,[2] and limited studies in humans have demonstrated safe IV use for intraoperative shivering.[3] Case reports and expert opinion indicate that DEX may be an adjunct for the parturient and hasten onset, enhance, and prolong neuraxial analgesia and anesthesia.[4] We reviewed the use of DEX in the peripartum period for indications for use, benefits, and adverse events.

Methods: We performed a single-center cohort study at a tertiary academic medical center, reviewing the safety of DEX administration for either analgesia or anesthesia. All administered doses of DEX were identified between September 2021 and May 2024. Charts were manually reviewed to abstract dose, route, and indication use. We abstracted adverse events related to DEX use, including maternal sedation, bradycardia, or hypotension, and fetal heart rate abnormalities, mode of delivery, and non-reassuring fetal heart tracing (Category II or III) leading to cesarean delivery.

Results: 1,176 records were available for review and 1,076 were analyzed due to exclusion criteria and incomplete data. There were 492 IV administrations, 569 epidural, and 15 intrathecal. Of these, 168 were for labor analgesia, 639 for cesarean section. 24 patients received DEX both in the labor and operating room. Specifically, 15 doses for labor analgesia were IV, 164 epidural, and 2 intrathecal. For cesarean sections, 352 administrations were IV, 305 epidural, and 14 intrathecal. In total, 496 administrations during cesarean section were for anesthesia, while 147 were for the management of intraoperative shivering. Doses for both IV and neuraxial ranged from 4 to 75 mcg.

Adverse events were infrequent, with 6.1% of patients experiencing heart rate abnormalities including tachycardia, 7.2% hypotension, 1.2% sedation and 1.8% developing bradycardia. One patient received 0.2mg glycopyrrolate after 30 mcg of IV and epidural DEX. Two patients received esmolol with 30 mcg administrations of DEX due to tachycardia. Adverse events were less common in neuraxial as compared to IV. For fetal outcomes, 34% of neonates had non-reassuring fetal heart rate (NRFH) tracings, and 25% of patients required a cesarean section for NRFHR tracing. Including cesarean deliveries, the fetal outcomes are comparable to the larger population of patients who did not receive DEX in a similar state of labor.

Discussion: Our clinical experience demonstrated very few adverse events that might be traced to the administration of either IV or neuraxial DEX. IV was associated with far more events. Larger doses would be more likely to induce side effects, so the minimum effective dose should be used.

References:
References:

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Adverse Events .pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 04

Spinal Anesthesia for Obstetric Fistula Repair in Rwanda

Presenting Author: Richard M. Smiley, MD, PhD

Presenting Author's Institution: Columbia University - White Plains, New York

Co-Authors: Kelly Gallant, PhD, CRNA - Northeastern University
Denise Jenn, n/a - Providence Portland Medical Center
David Le Roi, n/a - University of Rwanda
Richard Nduwayezu, n/a - University of Rwanda
William R. White, n/a - Brigham and Women's Hospital

Abstract :

BACKGROUND: The International Organization for Women and Development (IOWD, iowd.org) sends medical teams to Kigali, Rwanda three times a year. The major focus is surgery to repair obstetric fistulas and related childbirth injuries. These repairs are performed vaginally or intra-abdominally (or both). The anesthetic of choice has been spinal anesthesia, for the usual reasons that spinal anesthesia is preferred in resource-limited locales; limited number of medications, less reliance on sometimes poorly maintained or calibrated anesthesia machines, ventilators and monitors, and occasional electrical outages. As surgery may take several hours, it is desirable to deliver a spinal anesthetic with a relatively long duration. This has typically been hyperbaric bupivacaine (B) and fentanyl (F), with addition of epinephrine (E) for anticipated longer cases. This case series describes the anesthetic management of 53 procedures performed during the September 2024 IOWD mission, with the major innovation this year being the addition of 5 mcg dexmedetomidine (D) to the anesthetic when the duration of surgery was expected to be more than 2 hours. Intrathecal D has been shown to prolong anesthesia and improve postoperative analgesia.[1]

CASE SERIES: 53 surgical cases were performed during the 9 surgical days, with 45 initiated under spinal anesthesia. Moderate sedation was also administered to most patients (Table) especially as communication with patients was difficult as all spoke Kinyarwanda and none spoke English. The 8 patients who did not get spinal anesthesia were undergoing short procedures, mostly cystoscopies, and received mild sedation or no anesthesia. Descriptive data is in Table 1. There were 5 conversions of spinal anesthesia to general anesthesia. All occurred in the 28 patients receiving our "maximum" spinal doses of 15 mg B, 15 mcg F, 200 mcg E and 5 mcg D. One was due to initial failure with induction of GA before surgical incision. One occurred less than 90 minutes after spinal. The other three required conversion at 224 minutes, 241 minutes and 274 minutes after spinal injection; 4 were intraabdominal surgery cases and one was a TVH.

DISCUSSION: This case series demonstrates that it is possible to provide spinal anesthesia for relatively prolonged, complex procedures with a low conversion rate to general anesthesia. We believe that the addition of D prolonged and may have improved the quality of the anesthetic and post-operative analgesia. We did not note any worrisome side effects (bradycardia, hypotension) that could have been attributed to the addition of D. While a controlled randomized trial would of course be preferable to confirm the efficacy of D in this context, this was not practical, as an ethical trial would have likely required the performance of combined spinal-epidural anesthesia using the epidural catheter as a "rescue" anesthetic, and this equipment was not available to our mission team.

References:

1.1. Clin Ther 2020; 42: 676-690 e5

Table1.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 05

Intrathecal dexmedetomidine as an adjuvant for cesarean delivery: a scoping review

Presenting Author: Paul Vozzo, MD
Presenting Author's Institution: Columbia NewYork-Presbyterian - New York, New York
Co-Authors: Shelly Zilber, BA - Touro College of Osteopathic Medicine

Abstract :

Background

Pain during cesarean delivery (PDCD) and acute post-cesarean pain are the focus of much clinical research for better prevention and management during the perioperative period.1,2 Strategies to prevent PDCD, reduce hyperalgesia and acute pain, and promote opioid-reduction include neuraxial α2-adrenergic agonists.3 Intrathecal dexmedetomidine (ITdex) has been studied though its use is uncommon for cesarean delivery (CD) in North America. We performed a comprehensive review of all published evidence on ITdex administration in CD.

Methods

Following PRISMA-Scr guidelines, we searched PubMed and Embase in October 2024 for all articles reporting on the administration of ITdex for CD and conducted a scoping review to identify all outcomes reported in clinical trials and case series using ITdex for CD. Studies were excluded if dexmedetomidine was given by another route (intravenous, intranasal, epidural) with no ITdex. 17 key questions were asked, and outcomes were extracted and frequencies tabulated.

Results

Our search identified 49 publications in English between 2015 and October 2024 (Table 1 lists all studies). There were 5 studies from Europe or North America, 43 randomized controlled trials, 3 observational trials, 3 case reports or series, resulting in a total of 1,982 patients receiving ITdex. The dose of dexmedetomidine ranged between 2.5-25mcg. There were 4 dose-ranging studies. We identified 1 study with IT fentanyl and ITdex co-administration, 0 studies with IT morphine and ITdex co-administration, 3 studies comparing ITdex vs IT clonidine (clonidine dose ranged between 15-75mcg). There were 32 studies reporting on the effect of ITdex on sensory and/or motor block onset and/or duration, 34 evaluated postoperative analgesia, 0 assessed PDCD, and 35 reported on intraoperative shivering.

Discussion

Dexmedetomidine may be a valuable intrathecal adjuvant for CD, but the quality of study design in the 49 publications identified in our search was extremely poor (e.g. some studies had no identified primary outcome). Compared with intrathecal clonidine, ITdex may achieve faster onset and longer sensory-motor block (though doses were likely not equipotent). Though we identified 43 randomized controlled trials with at least one arm receiving ITdex, none of the studies incorporated current ERAC protocols with multimodal analgesia with opioid-sparing strategies (i.e. intrathecal fentanyl and morphine), therefore significant gaps remain. Further research is needed to establish its safety profile, identify the optimal dose, and define its value to prevent PDCD and decrease post-CD opioid use.

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1. https://www.asahq.org/standards-and-practice-parameters/statement-on-the-use-of-adjuvant-medications-and-management-of-intraoperative-pain-during-cesarean-delivery

2. Anesthesiology, 2024 1;140:1236-7

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Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 06

Factors associated with no in-hospital opioid use after cesarean delivery and relationship between in-hospital opioid use and opioid use after discharge

Presenting Author: RUTH LANDAU, MD

Presenting Author's Institution: Columbia University - New York, New York

Co-Authors:

Abstract :

Background

Improving pain trajectories after cesarean delivery (CD) with minimal to no opioid use is challenging: opioid reduction may result in uncontrolled pain, yet in-hospital opioid use may be associated with persistent opioid use after discharge. Our objectives were to (1) evaluate whether no in-hospital opioid use is associated with no post-discharge opioid use, and (2) identify patient obstetric and anesthesia-related factors associated with no opioid use. Additionally, we evaluated the relationship between acute post-cesarean pain and in-patient MME use.

Methods

This is secondary analysis of a controlled trial in patients with CD at 31 U.S. hospitals (2020-2022), randomized to an individualized opioid prescription (0-20 tablets) or a fixed quantity (20 tablets) at discharge (PACT trial).[1] In this analysis, patients were categorized into one of 2 groups based on opioid use (morphine milligram equivalents [MME]), with MME = 0 indicating no in-hospital opioid use. Primary outcome was post-discharge MME = 0 up to 90 days. Univariable and multivariable logistic regression analyses with backward selection were performed to identify factors associated with no in-hospital opioid use. Univariable modeling estimated the association between in-hospital MME = 0 and outpatient opioid use, as well as pain.

Results

In-hospital MME = 0 rate was 19% (n=1023/5515) and post-discharge MME = 0 rate was 34% (n=1752). Overall, 76% (n=710/1023) of patients with in-hospital MME = 0 used none post-discharge, though 54% filled an opioid prescription (Table 1). In-hospital MME = 0 was associated with lower post-discharge opioid use, higher odds of MME = 0 and lower median MME dose (Table 1). On multivariable analysis, Black race, government insurance, anxiety/depression, and preterm birth were associated with decreased odds for MME = 0 (Table 2). In contrast, Hispanic ethnicity, spinal or CSE, and neuraxial morphine administration were associated with increased odds for MME = 0. Participants with Brief Pain Inventory (BPI) score ≥ 4 or Pain Catastrophizing Scale (PCS) score ≥ 13 were more likely to use opioids (Table 3).

Conclusions

In-hospital opioid use was associated with post-discharge opioid use. Patient-specific factors, including anxiety/depression were associated with increased in-hospital opioid use, while anesthesia technique (spinal/CSE, neuraxial morphine administration) were associated with reduced opioid use. No in-hospital opioid use was not associated with higher in-hospital pain or pain catastrophizing scores. Though one third of patients did not use any opioids post-discharge, this non-use was not associated with higher pain scores at any time point up to 90 days post-discharge. Further efforts are needed to align opioid prescriptions with actual post-discharge opioid use.

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PACT tables.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 07

Anesthesia outcomes and peripartum opioid use in patients with a diagnosis of opioid use disorder: a retrospective cohort study (2020-2024)

Presenting Author: Brian Waldman, MD

Presenting Author's Institution: Columbia University - New York, New York

Co-Authors: Joseph Ryu, Student - Columbia University

Abstract :

Background

Management of peripartum pain in patients with opioid use disorder (OUD), whether methadone or buprenorphine for medication assisted therapy (MAT), prescribed opioids for chronic pain, or illicit opioids, is challenging.[1] There is much focus to propose strategies for patients on MAT, emphasizing superior outcomes with buprenorphine, though analgesia may be challenging. There is less data to suggest strategies for patients with OUD not on MAT. Though our center is not a referral center for OUD cases, we have a standardized approach to minimize withdrawal, pain, and opioid relapse, which includes neuraxial clonidine and epidural morphine dosing for 48-72 hours postpartum. We hypothesized that patients with a diagnosis of OUD but not on MAT have higher oistpartym opioid use and more adverse obstetric and anesthesia outcomes.

Methods

Searching for OUD and substance use disorder in EMR, all OUD cases since 2/2020 were identified. Demographic, obstetric and anesthetic data (neuraxial analgesia/anesthesia, general anesthesia), opioid use during pregnancy, opioid use at the time of delivery and postpartum (MAT, systemic MME, neuraxial opioids) was extracted and analyzed.

Results

Of 27,586 deliveries in the study period, 94 cases had a diagnosis of OUD (0.34%) (Table 1). Among patients with MAT, 18 were on methadone (range 30-140mg) and 10 on buprenorphine (range 4-24mg) Most patients were using non-prescribed drugs (n=52) of which half had previously been on MAT but not consistently during this pregnancy. We included cases with prescribed opioids for pain (n=14). While patients with non-prescribed (illicit) opioids appeared to use less opioids after delivery than those on methadone, buprenorphine or prescribed opioids for pain management, a very high proportion had a positive urinary toxicology screening on admission. The cesarean delivery rate was overall high (59%) with over 30% of emergent cases for fetal heart rate issues (associated with positive urinary toxicology screening). Analgesic/anxiolytic supplementation occurred in 48% of cesarean deliveries, and the general anesthesia rate was 20% (for emergencies and intraoperative pain).

Discussion

Contrary to our expectations, few patients were maintained on buprenorphine (10.7%) and most OUD patients were using illicit drugs at the time of delivery (55.3%). Their postpartum

opioid use was rather low when compared with MAT and chronic opioid patients. In addition, the cesarean delivery rate was high (59%) and the general anesthesia rate 10 times greater than our usual rate (20% vs 2.5%). Raising awareness that patients with OUD are at higher risk for emergent cesarean delivery for fetal issues and insufficient neuraxial anesthesia is key to improve peripartum care and reduce avoidable general anesthetics.

References:

1. Consensus Statement on Pain Management for Pregnant Patients with Opioid-Use Disorder from SOAP/SMFM/ASRA. Anesth Analg 2024.

Table 1 OUD.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 08

Maternal and Neonatal Outcome Effects of Substance Use Disorder in Pregnancy: A Quality Assurance/Improvement Study

Presenting Author: Manuel C. Vallejo, Jr., MD, DMD

Presenting Author's Institution: West Virginia University - Wexford, Pennsylvania

Co-Authors: Jamie M. Ciamarra, MHA - WVU Medicine Children's Hospital
Mayura Damanhuri, MBChB - Universiti Malaya, Kuala Lumpur
Christa Lilly, PhD - West Virginia University
Linda S. Nield, MD - West Virginia University School of Medicine
Mark Zakowski, MD FASA - Cedars-Sinai Medical Center

Abstract :

Introduction: Substance use disorder (SUD) is characterized by the continued use of substances despite the presence of significant harm to the individual and others. SUD affects 14.5% of the United States population (1) and involves substances such as alcohol, cannabis, opioids, stimulants (including nicotine, tobacco, cocaine, and amphetamines), benzodiazepines, barbiturates, and other substances. SUD in pregnancy is associated with preterm birth, delayed mental development, and congenital disorders. This quality assurance improvement study aimed to compare maternal and neonatal outcomes in parturients with positive urine toxicology screens to those without.

Methods: After local Institutional Review Board approval, data from 2023 was collected from 75 parturients who tested positive in their urine toxicology, matched to 75 controls. Measured variables included maternal age, race, ethnicity, insurance type, gestation, labor type, anesthesia type, delivery method, birth weight, live birth status, breastfeeding before hospital discharge, Apgar scores at 1 and 5 minutes, NICU admission, and total hospital stay. Interval data was analyzed using t-test, nominal data with Chi-square and Fisher's exact tests for small cell sizes. A $p < 0.05$ was significant.

Results: Substances identified in urine samples included amphetamines (33%), barbiturates (1%), buprenorphine (22%), cannabinoids (49%), cocaine (11%), fentanyl (18%), methadone (4%), oxycodone (4%), and other opiates (7%). No differences were observed between groups regarding maternal age, race, ethnicity, 5-minute Apgar score < 7, or total length of hospital stay. Significant differences occurred in parturients who tested positive with respect to gestational age (36.4 ± 3.3 weeks vs. 38.1 ± 2.4 weeks, $p = 0.0006$), insurance type (42% vs. 20% Medicaid/Medicare, $p = 0.002$), labor type (33% vs. 14% cesarean delivery without labor; 25% vs. 60% labor induction; 41% vs. 31% spontaneous labor, $p = 0.0015$), anesthesia type (46% vs. 62% epidural; 32% vs. 21% spinal; 11% vs. 1% general anesthesia; 12% vs. 16% no anesthesia, $p = 0.025$), delivery method (47% vs. 30% cesarean; 53% vs. 70% vaginal, $p = 0.031$), birth weight (2726.2 ± 747.8 gm vs. 3257.9 ± 592.5 gm, $p < 0.0001$), 1-minute Apgar score < 7 (29% vs. 12%, $p = 0.008$), NICU admission (46% vs. 16%, $p < 0.0001$), and breastfeeding (36% vs. 65%, $p = 0.0004$), (Table).

Discussion: Parturients with SUD are more likely to deliver preterm ($p = 0.0001$), have Medicaid or Medicare insurance ($p = 0.002$), require general anesthesia ($p = 0.04$), undergo cesarean delivery ($p = 0.03$), have a birth weight ≤ 2,500 grams ($p = 0.0001$), require NICU admission ($p = 0.0001$), and not breastfeed ($p = 0.0004$).

Conclusions: Increased awareness of these risk factors and policy modification can improve maternal and neonatal care.

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SOAP Table.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 09

Enhanced Recovery After Cesarean Delivery Impacts Foley Removal Times and Urinary Retention

Presenting Author: Grace Kim, n/a

Presenting Author's Institution: Larner College of Medicine, University of Vermont - Burlington, Vermont

Co-Authors: Marjorie C. Meyer, MD - University of Vermont
Patrick C. Payne, MPH - University of Vermont

Abstract :

Introduction
SOAP guidelines for Enhanced Recovery after Cesarean Delivery (ERAC) prescribe neuraxial long-acting opioid (NLO) and Foley catheter removal by 6-12 H after delivery (CD)[1] to promote comfort and mobility while reducing opioid use, hospital stays and UTIs.[2] Studies supporting early Foley removal often exclude the use of NLO, known to impair voiding function.[3,4] This project aimed to compare time to initial Foley removal (iFR) and need for nursing voiding interventions before versus after the implementation of ERAC.

Hypothesis
Time to initial Foley removal is reduced while bladder emptying procedures are increased after the implementation of Enhanced Recovery after Cesarean delivery.

Methods
This IRB-approved, single-site retrospective cohort study extracted demographic and outcomes data from EMRs of CD patients before and after implementation of ERAC with neuraxial morphine. Outcomes data were iFR times, and straight catheterization (SC) and Foley reinsertion (FRI) rates. Inclusion criteria were CD under neuraxial anesthesia. Exclusion criteria were C-Hyst, postop epidural, iFR > 20 H after CD, failure to use NLO post-ERAC, and use of buprenorphine/methadone.

T- and chi-squared tests were used for demographics. Logistic and linear regressions assessed the impact of hematocrit, BMI, planned versus unplanned, and cesarean ordinality on outcomes.

Results
The pre-ERAC cohort had delayed iFR ($p < 0.0001$), fewer SC ($p < 0.0001$), and no significant difference in FRI ($p = 0.07$) compared to the post-ERAC cohort with 11.2% SC and 2.89% FRI.

Discussion
ERAC implementation was associated with a lower iFR time. The increased incidence of SC without an increase in FRI post-ERAC likely reflects NLO-induced initial urinary dysfunction which wanes 14-18 H post-administration.

Conclusion
Urinary catheter removal by 12 H after CD with NLO results in low SC and FRI rates and should be emphasized. Further research will explore the impact of labor epidural on iFR by 12 H and nursing interventions for retention after CD.

References:

References

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Enhanced Recovery After Cesarean Delivery Impacts Foley Removal Times and Urinary Retention.TABLE.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 10

Effectiveness of Neuraxial Morphine Re-dose for Patients with Placenta Accreta Spectrum Undergoing Cesarean Hysterectomy.

Presenting Author: Sabrina Antonio, MD

Presenting Author's Institution: UCSD - Hillcrest, California

Co-Authors: Elsie R. Bigelow, MD - UCSD
Rodney A. Gabriel, MD, MAS - University of California, San Diego

Abstract :
Introduction: Placenta accreta spectrum (PAS) disorders affect 1 in 500 pregnancies.[1] At our institution, cesarean hysterectomy (C-Hyst) for PAS is performed under neuraxial anesthesia, with or without conversion to general anesthesia for multivessel embolization and hysterectomy. We had previously compared functional recovery in patients receiving lumbar combined spinal epidural (CSE) to thoracic epidural and lumbar single spinal anesthetic (double-stick, DS), with underwhelming outcomes for the DS group. Currently, we hypothesize a re-dose of neuraxial morphine 24 hours after initial CSE may offer non-inferior functional outcomes while eliminating the procedural risk of the DS.

Methods:
This was a retrospective cohort study of patients with PAS who underwent C-Hyst from 2018 to 2025 at a single institution. We compared opioid consumption postoperative days [POD] 0-2 (morphine equivalents [MME]), hospital length of stay (LOS), time to ambulation, and average pain scores POD0-2 (numeric rating scale [NRS]). The three cohorts were: lumbar CSE without a re-dose of neuraxial morphine (Group 1), lumbar CSE with a re-dose of neuraxial morphine (Group 2), and thoracic epidural with SSS (Group 3). For each outcome, the median was compared across the three cohorts using Analysis of Variance (ANOVA). To control for potential confounders, a multivariable linear regression was performed to measure the association of the cohorts with each outcome.

Results:
There were 37 patients, in which there were 13 (35.1%), 10 (27.0%) , and 14 (37.8%) patients in Group 1, 2, and 3, respectively. The median POD0-2 MME in Group 1, 2, and 3 were 126.mg, 22.5mg, 52.0mg (P=0.55). The median LOS were 5, 6, and 5.5 days (P=0.59). The median of time to ambulation were 0, 1, and 1 day (P< 0.001). The median pain scores on POD0 were 3.4, 2.3, and 1.2 (P=0.14). The median pain scores on POD1 were 5.4, 1.6, and 4.6 (P=0.04). The median pain scores on POD2 were 4.0, 2.5, and 3.5 days (P=0.70). When controlling for multiple confounders using linear regression, Group 2 was associated with a 105mg decrease in MME during POD0-2 (P=0.03). Group 3 was associated with an 0.96 increase in days for time to ambulation (P=0.009), and Group 2 was associated with a 2.9 decrease in average pain scores on POD1 (P=0.04). No other significant differences were found on multivariable linear regression.

Conclusions:
Patients who underwent C-Hyst for known PAS with re-dose of neuraxial morphine had decreased MME POD0-2 and a decrease in average pain scores POD1. All three groups had similar pain scores on POD2. Larger sample sizes are needed, but the re-dose of neuraxial morphine in this patient population via a lumbar CSE may confer decreased opioid consumption and decreased pain postoperatively.

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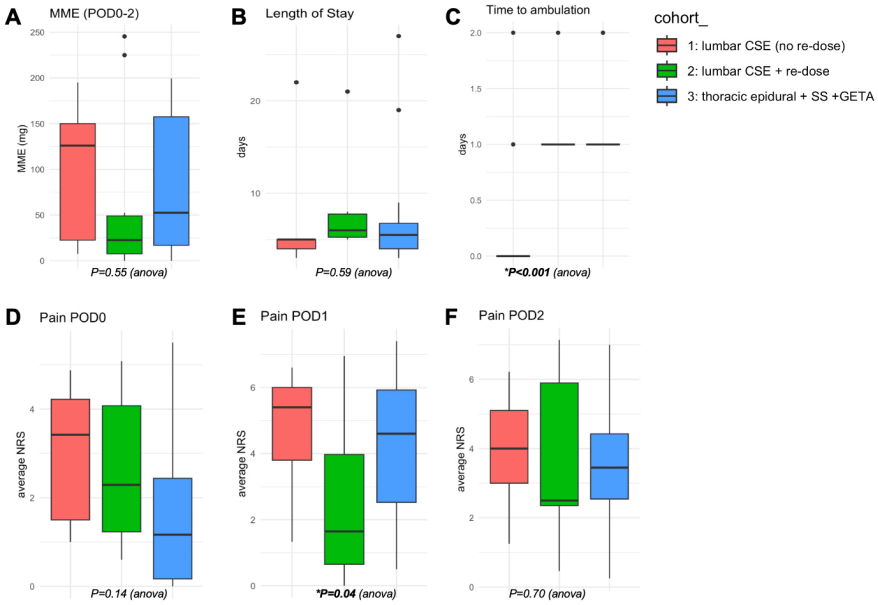

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 11

Pain Management and Opioid Requirements Following Perineal Lacerations: A Retrospective Cohort Study

Presenting Author: Kelly A. Fedoruk, MD, FRCPC

Presenting Author's Institution: Stanford University - Menlo Park, California

Co-Authors: Brendan Carvalho, MBBCh, FRCA - Stanford University
Lynn Squires, MD FRCPC - University of Alberta
Pervez Sultan, MBChB - Stanford University School of Medicine

Abstract :

Introduction

Perineal lacerations complicate most vaginal deliveries and can significantly impact postpartum recovery. Previous studies suggest increased opioid requirements with severe lacerations, but pain outcomes in the setting of scheduled multimodal analgesia remain unclear.

Methods

We conducted a retrospective cohort study of vaginal deliveries at a single institution from January 2019 to October 2023, examining the relationship between perineal laceration severity and postpartum pain management in the context of scheduled acetaminophen and NSAIDs.

Results

Among 14,477 vaginal deliveries, 3,899 (27%) had no perineal tears, 9,996 (69%) had first- and second-degree tears, and 582 (4%) had third- and fourth-degree tears. The primary outcome, proportion of patients requiring postpartum opioids, was significantly higher in patients with third- and fourth-degree tears (19%) compared to those with no tears (10%) or first- and second-degree tears (7.5%) ($p< 0.001$). In adjusted analysis, patients with third- and fourth-degree tears had 1.6 times higher risk of opioid use compared to those with no tears (95% CI 1.33-2.00, $p< 0.001$). There was no significant difference in opioid use between patients with first- and second-degree tears versus no tears (RR 0.95, 95% CI 0.86-1.05, $p=0.315$).

Discussion

Among patients requiring opioids, median time to first analgesia request was shortest in first- and second-degree tears (1.3 hours) compared to no tears (1.8 hours) and third- and fourth-degree tears (1.7 hours) ($p< 0.001$). Opioid doses were similar between groups in the

first 24 hours but higher for third- and fourth-degree tears in the 24-48 hour period (15 mg vs 7.5 mg morphine equivalents, p=0.009). Patients with third- and fourth-degree tears reported consistently higher average and worst pain scores throughout the first 72 hours postpartum.

Despite scheduled multimodal analgesia, patients with severe perineal lacerations demonstrate significantly higher opioid requirements and pain scores postpartum. These findings suggest the need for enhanced pain management strategies and closer monitoring in this population.

References: doi:10.1080/03007995.2020.1754185

Perineal Lac Abstract 2024 SOAP_KF Submitted.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 12

Postpartum Recovery Profiles: a multicenter assessment of postpartum recovery using the STanford Obstetric Recovery checKlist (STORK)

Presenting Author: Phillip Callihan, MD PhD

Presenting Author's Institution: Stanford University - Menlo Park, California

Co-Authors: Brendan Carvalho, MBBCh, FRCA - Stanford University
Nan Guo, Ph.D. - Stanford University
Danielle M. Panelli, MD, MS - Stanford Medicine Division of Maternal-Fetal Medicine and Obstetrics

Abstract :

Background

Maternal mortality in the US primarily occurs after hospital discharge and an estimated 84% of these deaths are preventable.[1] Our ability to predict worse outpatient postpartum recovery has been limited by the lack of adequate measures. The STanford Obstetric Recovery checKlist (STORK) is a novel validated measure of outpatient postpartum recovery.[2] The primary aim of this study was to identify risk factors for worse outpatient postpartum recovery at 6 weeks postpartum, identified using STORK.

Methods

This prospective observational cohort study was performed at 3 US academic centers following IRB approval as a planned analysis of the clinical validation study for the STORK. Participants were English speaking women who delivered a live neonate via all delivery modes and included all modes of labor analgesia or cesarean anesthesia. Participants were enrolled 12 to 36 hours following delivery, after which they completed the STORK at two timepoints: 1) during inpatient postpartum hospitalization; and 2) at 6 weeks postpartum. Baseline demographic, obstetric, and anesthetic data were collected from medical records. Variables with $p < 0.2$ in the univariate model were included in the multivariate model to identify risk factors for the lowest 25th percentile of STORK scores at 6 weeks postpartum.

Results

525 patients were enrolled, and 314 patients completed the STORK at 6 weeks postpartum (60% response rate). Table 1 summarizes the unadjusted and adjusted variables for worse 6-week STORK scores. After adjusting for confounders, the independent predictors for worse recovery at 6 weeks postpartum were ASA class III and lower inpatient STORK score.

Conclusions

We found that a low inpatient STORK score was associated with worse recovery at 6 weeks postpartum. This provides an opportunity for early identification of patients at risk of poor outpatient postpartum recovery and informs future studies to develop and implement targeted interventions to improve outpatient postpartum recovery.

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Postpartum recovery profiles- a multicenter assessment of postpartum recovery using the STORK Table 1.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 13

The Effectiveness of Abdominal Wall Blocks on Post Cesarean Section Pain : A Retrospective Analysis

Presenting Author: Haley Mullins

Presenting Author's Institution: Boston University Chobanian & Avedisian School of Medicine - Boston, Massachusetts

Co-Authors: Stephanie Amaefuna, MD - Boston University Chobanian and Avedisian School of Medicine
Erin Dienes, Ph. D. - Boston Medical Center
Mark Norris, MD - Boston Medical Center

Abstract :
Ineffective postoperative analgesia management after cesarean delivery can lead to delayed ambulation[1], postpartum depression[2], and challenges with breastfeeding.[3] Transversus abdominis plane (TAP) and quadratus lumborum (QL) blocks are abdominal wall plane blocks that have been shown to reduce opioid consumption and pain intensity as part of a multimodal analgesic regimen post cesarean delivery.[4,5] The aim of this study was to evaluate the efficacy of TAP and QL blocks after cesarean delivery at our institution.

Methods

We conducted a single-center retrospective analysis of all patients who underwent cesarean delivery between November 2019 to July 2024. Elective, unscheduled, urgent and emergent cesarean deliveries were included. Bilateral transversus abdominal plane or quadratus lumborum blocks were performed at the discretion of the anesthesiologist within the first hour post cesarean delivery with 20ml of 0.25% bupivacaine. All patients received a postoperative analgesic regimen of ibuprofen, acetaminophen and oxycodone. The primary outcome was the total quantity of opioids administered during the first 24h post cesarean delivery calculated in morphine milligram equivalents (MME). The secondary outcome was the measurement of numeric rated scale (NRS) pain scores at 0, 6, 12, 24 and 48h after delivery. Pain scores were recorded periodically, and an average was calculated of all pain scores recorded within an hour of the time point of interest.

A total of 4460 births from 4203 women were evaluated: 3955 (94.1%) had one delivery, 239 (5.7%) had two, and 9 (0.2%) had three. TAP or QL blocks were performed in 415 (9%) cases. The cumulative MME consumption in 24h for the TAP/QL block group was 43.7 ± 22.2 compared to 43.2 ± 19.6 in patients with no TAP/QL block. No significant differences in numeric rated scale pain scores were shown between both groups at 0,6,12 ,24 and 48h. Notably, when comparing NRS scores recorded at 12 h post-delivery between women with two separate deliveries during this time period, an unadjusted difference of -2.6 was observed, with a 95% confidence interval (CI) of -0.1, and a p-value < 0.05.

At our institution, abdominal wall plane blocks did not effectively reduce cumulative MME consumption at 24 hours or lower NRS pain scores during the first 48 hours post-delivery. Previous studies have shown that QL blocks are more effective than TAP blocks in reducing post-operative opioid consumption.[6] However, TAP blocks have been found to be effective in reducing opioid use in parturients receiving general anesthesia for cesarean delivery[7].

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Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 14

Ilioinguinal-Iliohypogastric Nerve Block for Post-Cesarean Delivery Pain Control: A Systematic Review

Presenting Author: Adi Alduayji, MBBS

Presenting Author's Institution: LHSC - London, Ontario

Co-Authors: Kamal Kumar, MD - Western University
Hanshin Lee - Department of Anesthesiology, Western University
Cheng Lin, MD FRCPC - Western University
Priyanka Singh, MD - Schulich School of Medicine and Dentistry

Abstract :
Introduction: Cesarean deliveries are among the most common surgeries worldwide; however, they are often associated with substantial postoperative pain which can impede maternal recovery. This may delay mobilization, disrupt mother-baby interaction, and increase the risk of persistent postsurgical pain[1]. Ilioinguinal-Iliohypogastric (IIH) nerve blocks have been proposed to alleviate postoperative pain and reduce analgesic requirements in cesarean delivery patients. However, their effectiveness compared to other pain management modalities remains uncertain. This systematic review aims to evaluate the existing literature on the efficacy of IIH blocks for managing post-cesarean delivery pain.

Methods: A systematic review was conducted following PRISMA guidelines. PubMed, Embase, and the Cochrane Library were searched from inception to December 2024 for randomized controlled trials assessing ultrasound-guided IIH blocks for post-cesarean pain management. Two independent reviewers screened and selected studies based on inclusion criteria: English-language RCTs using ultrasound-guided regional techniques. The risk of bias was evaluated with the Cochrane Risk of Bias Tool. Outcomes assessed included postoperative pain scores, time to first analgesic, analgesic consumption, and adverse events.

Results: A total of 78 articles were identified and screened by two independent reviewers, with 34 progressing to full-text review and eight meeting the inclusion criteria, encompassing 647 patients. Four studies compared IIH to TAP blocks: two favored IIH, showing better analgesic scores, reduced rescue analgesic use, and prolonged time to first analgesic; one found comparable results, while another reported better outcome with TAP. Two studies compared IIH to quadratus lumborum block (QLB), with QLB demonstrating superior analgesic outcomes. One study found no added benefit of adding IIH to intrathecal morphine. Another study showed improved analgesic markers when IIH was added to TAP versus TAP alone. Lastly, one study found IIH superior to no block in analgesic outcomes.

Discussion: The findings suggest that IIH blocks may provide effective postoperative pain relief after cesarean delivery, particularly when compared to TAP blocks, though results remain mixed. While some studies demonstrated superior analgesic outcomes with IIH, others favored alternative techniques such as QLB or TAP. This variability underscores the need for high-quality randomized trials to better define the comparative efficacy of IIH blocks and their role in multimodal analgesia for cesarean delivery.

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Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 15

Implementation of an opioid-sparing clinical pathway reduces inpatient administration and favors multimodal pain control in post-Cesareans

Presenting Author: Simon Dang, n/a

Presenting Author's Institution: Creighton Medical School - Omaha, Nebraska

Co-Authors: Saad Khan, MD - University of Nebraska Medical Center
Austin Veire, n/a - Creighton Medical School

Abstract :

It is estimated that nearly one third of births in the United States are by cesarean delivery.[1] With such a large cohort of surgical deliveries, appropriate postoperative pain management remains an integral component in caring for the recovering parturient.[2] Opioid analgesics have been a mainstay for the management of pain for peripartum and postpartum patients. However, opioid use can result in increased rates of complications and subsequent opioid misuse or dependence.[3] Recent studies have shown non-opioid analgesics to be as effective in treating postpartum pain.[4] For reasons such as this, many institutions have moved away from opioid monotherapy as first-line analgesia. This has led to new enhanced recovery protocols that now favor utilization of a multimodal approach to postoperative pain management that relies on nonopioid analgesics.

Prior to the publication of recent enhanced recovery recommendations, our institution redesigned the order set used for cesarean section pain management, with the primary objective of improving pain control and reducing the exposure of opioids in postpartum patients. In this project, we performed a retrospective analysis of 1029 patients who underwent a cesarean delivery with spinal anesthesia at a tertiary hospital from 2017 to 2021.Prescriptions for opioid and non-opioid analgesics were collected and compared by year to assess the degree of change caused by the remodeled order sets. Our data shows an approximate 8-fold decrease in the administration of opioids in the inpatient setting after the implementation of this new order set, with additional outcome and statistical analysis pending at the time of writing. Furthermore, we found a significant increase in the administration of non-opioid analgesics, with the majority of patients managed without the use of post-operative opioids.

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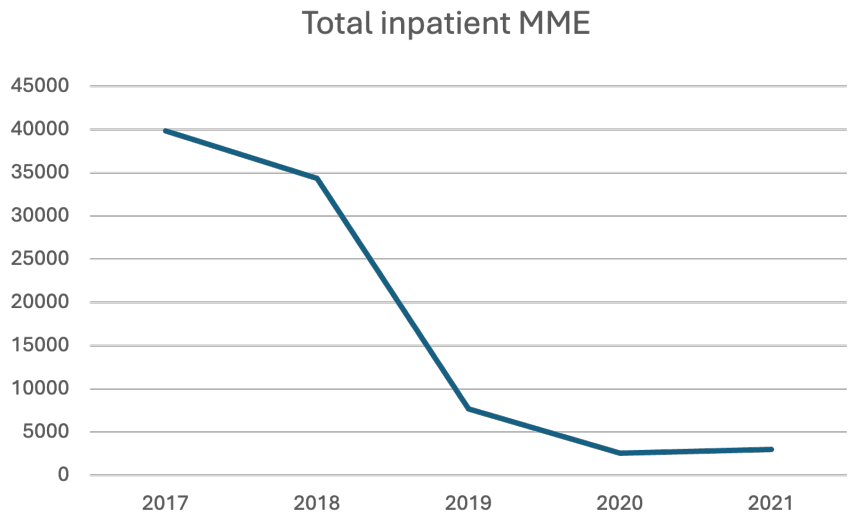

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 16

Developing a conceptual model for acute to chronic postsurgical pain after cesarean delivery: a qualitative study

Presenting Author: Sarah Ciechanowicz, MA BMBCh FRCA MRes

Presenting Author's Institution: Stanford University School of Medicine - London, England

Co-Authors: Phillip Callihan, MD PhD - Stanford University
Brendan Carvalho, MBBCh, FRCA - Stanford University
Guillermina Michel, BS - Stanford University School of Medicine
Danielle M. Panelli, MD, MS - Stanford Medicine Division of Maternal-Fetal Medicine and Obstetrics

Abstract : **Background:** Chronic postsurgical pain (CPSP) is a common complication following surgery (1). While caesarean delivery (CD) is the most performed inpatient surgery, the transition from acute to CPSP after CD is still under-explored. We lack a biopsychosocial conceptual model that could inform measurement, prevention and treatment strategies. This study aimed to elicit concepts describing patient experience in the transition from acute to chronic postsurgical pain after CD using qualitative methods.

Methods: Participants were recruited from two independent prospective studies with matching inclusion criteria (post CD, ≥18 years old, all ethnicities, English or Spanish speaking). Following ethical approval, we approached participants that screened positive for CPSP, which was defined as pain that developed after CD and lasted >3 months after surgery, distinctive from pre-existing pain conditions before surgery. Semi-structured interviews were conducted (October 2023 to January 2025) at >3 to ≤6 months postpartum. Interviews were transcribed verbatim into Word documents and translated if required using online software. Thematic analysis was performed by 4 investigators and recorded in Excel. Theoretical saturation was defined as three consecutive interviews with no new concepts, confirming adequate participant numbers to meet our objectives. Elicited symptoms and Health Related Quality of Life (HRQoL) impacts were used to develop a conceptual model.
Results: Twenty-four participants (19 English, 5 Spanish-speaking) were included. Interviews ranged from 10 to 23 minutes in duration and conceptual saturation was achieved. Key concepts were elicited following 6 rounds using thematic analysis with agreement between investigators (Figure). Nine key themes emerged: pain characteristics, physical interference, psychological interference, social/cultural factors, maternal-infant factors, protective factors, pain management, postpartum care and medical factors. There was emphasis on the physical limitations from pain, particularly in relation to infant care and family interactions; the benefit of family support; and expectations of pain recovery differing from reality. There was a perceived lack of medical postpartum care for pain experienced.

Conclusions: This study provides a preliminary conceptual model for CPSP after CD, which could help guide development of future interventions such as physical therapy as a preventative strategy for patients at risk of deconditioning from physical interference of CPSP. Participants reported a diverse range of symptoms and HRQoL impacts. More research is needed to quantify patient burden and develop specific measures including a core outcome set to help monitor and screen patients and improve maternal health outcomes.

References: 1. Glare P, Aubrey KR, Myles PS. Lancet. 2019;393(10180):1537–46.

model.pdf

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 17

Investigating analgesia adequacy and intraoperative pain during caesarean delivery: single-centre pilot and feasibility study

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Susanna Stanford, n/a - Patient Representative

Abstract :

Introduction

The incidence and sequelae of intraoperative pain during caesarean delivery (CD) with neuraxial anaesthesia (NA) is unknown, and no studies use patient-reported measures to investigate this.

Methods

After ethical approval, (IRAS 265964) this single centre study evaluated the incidence and sequelae of pain during CD under NA. Demographic and perioperative data were collected from all patients having CD for 26 days in July 2024. Patients then completed questionnaires about their intra- and postoperative experience at 24 hours after surgery; and at 6 weeks postpartum they completed screening tools for depression, anxiety and Post-Traumatic Stress Disorder (PTSD).

Results

In total 156 patients were included; 100 provided data at 24h; 80 provided data at 6 weeks. Fourteen of 156 patients (9%) had clinician-reported pain; in three patients NA was converted to general anaesthesia before surgery started. Three patients had NA repeated due to inadequacy, and eight had intraoperative pain requiring unplanned analgesia.

Table 1 compares patient responses to question 5 of the Maternal Comfort questionnaire ("I got enough pain relief during my caesarean section in the operating room"); where a score of 7 = strongly agree

Maternal satisfaction scores were significantly higher in those who: received spinal anaesthesia vs epidural top up (122.8 vs 108.9, p=0.02, 95%CI 2.4- 25.3); were managed by consultant care vs ST4-7 residents care (123.4 vs 111.4, p=0.01, 95%CI (21.6 -2.6); and had elective vs non-elective surgery (126.6 vs 115, p=0.002, 95%CI 4.7- 20.3).

At six-week follow-up, 8/80 patients (10%) screened positive for postpartum depression, 8/80 (10%) for anxiety, and 2/80 (2.5%) for PTSD.

Discussion

This pilot study found the incidence of patient-reported inadequate analgesia to be higher than clinician reported neuraxial inadequacy (19% vs. 9%). Only 5% of patients who did not strongly agree that they had sufficient analgesia in the operating room were documented as having pain by their anaesthetist. 6-week follow-up data were consistent with estimates from prior literature. The study was feasible, had high consent and follow-up rates, and supports delivery of an international multicentre study.

Funding: Obstetric Anaesthetists Association and the NIHR Central London Patient Safety Research Collaboration.

References:

Group	MCSQ5 <7 group (n=19)	MCSQ5=7 group (n=81)	
First language: n(%)			
English	16 (84.2)	75 (92.6)	χ^2 = 0.495
Not English	3 (15.8)	6 (7.4)	P=0.481
Primary mode of anaesthesia: n(%)			
Spinal/CSE	16 (84.2)	67 (82.7)	χ^2=2.64
Epidural top-up	3 (15.3)	14 (17.3)	p=1
Clinician documented intraoperative pain? : n(%)			
Yes	1 (5.3)	3 (3.7)	
No	18 (94.7)	78 (96.3)	
Pain score at rest at 24 hours			
Median (IQR)	3.5 (2.25- 6)	3.0 (IQR 2-6)	Wilcox p=0.748
Pain score on moving at 24 hours			
Median (IQR)	6 (5-7)	7 (5-8)	Wilcox p=0.212
"I was pain-free in the operating room' (Likert score 1-7 where 1 is strongly disagree and 7 is strongly agree):			
Median (IQR)	5 (4-6.5)	7 (6-7)	Wilcox p=0.00037
Maternal Satisfaction score: median (IQR)	117 (100.5 – 129)	124(104-137)	Wilcox p=0.2817
'Did you tell your anaesthetist you had pain?': n(%)			
Yes	8 (42.1)	12 (14.8)	
No	6 (31.6)	19 (23.6)	
Not answered	5 (26.3)	50 (61.6)	
'Were you offered more pain relief?: n(%)			
Yes	8 (42.1)	14 (17.3)	
No	6 (31.6)	14 (17.3)	
Not answered	5 (26.3)	53 (65.4)	
6-WEEK OUTCOME DATA			
Total patients	14	66	
EPDS score; median (IQR) (>/=10 == risk of depression)	7 (5-9)	5 (2-8)	Wilcox p=0.154
GAD7 score; median (IQR) 0–4: Minimal anxiety. 5–9: Mild anxiety. 10–14: Moderate anxiety 15–21: Severe anxiety	3 (2.25-5)	3 (1-6)	p=0.9022

Abstract #: FRI - RA - BS 2 - BR 6 - ERAC, Opioids, Pain – 18

The Effect of Neuraxial Anesthesia on Urinary Catheter Removal After Caesarean Delivery – A Comparison Between Spinal and Epidural Anesthesia: A Systematic Review"

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Abstract :

Abstract:

Background: Caesarean delivery (CD) is a common procedure with potential complications. Enhanced Recovery after Surgery (ERAS) guidelines recommend immediate removal of urinary catheters after CD. However, there is limited evidence supporting this practice. Prolonged catheterization increases the risk of urinary tract infections (UTIs) and other complications, while premature removal can lead to urinary retention. Anesthetic type, such as spinal or epidural, may influence urinary retention.

Objective: This systematic review aims to compare the effect of neuraxial anesthesia on urinary catheter removal after CD, focusing on spinal and epidural anesthesia.

Search Strategy: This systematic review follows Cochrane Collaboration and PRISMA guidelines. Eligible studies include randomized controlled trials (RCT), cluster-RCT, controlled non-randomized clinical trials, cluster trials, case reports, observational cohort studies (controlled/uncontrolled), cross-sectional studies, commentary, or letters to editors. A comprehensive search was conducted in PubMed/Ovid Medline, EMBASE, Scopus, and The Cochrane Library databases from July 2010 to July 2024.

Selection Criteria Data extraction involved study characteristics, anesthetic practices, and outcomes such as catheterization duration, urinary retention, and urinary tract infection.

Data Collection and Analysis: Out of 10,919 papers initially identified, seven studies were included in this systematic review. Although this review showed that neuraxial anesthesia in CD leads to higher rates of urinary retention and longer catheterization duration, especially in epidural anesthesia, the lack of enough studies directly comparing spinal and epidural anesthesia, as well as the heterogeneity in study populations, anesthetic methods, and definitions of urinary retention precluded quality quantitative comparisons.

Main Results: Our review finds inconsistent and insufficient evidence on whether epidural anesthesia increases post-operative urinary retention compared to spinal anesthesia. Factors like anesthesia type, catheter removal timing, and patient characteristics affect outcomes.

Conclusion: Our review has exposed significant gaps and deficiencies in the current literature, which is valuable information for the research community. Further research is needed, and until clearer evidence emerges, physicians should use clinical judgment in anesthesia and post-operative care for Cesarean deliveries.

Keywords: neuraxial anesthesia, cesarean delivery, urinary catheter, spinal anesthesia, epidural anesthesia

References:

< !Ljungqvist O, Scott M, Fearon KC. Enhanced Recovery After Surgery: A Review. *JAMA Surg.* 2017;152(3):292–298. doi:10.1001/jamasurg.2016.4952

<Wilson RD, Caughey AB, Wood SL, et al. Guidelines for antenatal and preoperative care in caesarean delivery: Enhanced Recovery After Surgery Society recommendations (part 1). Am J Obstet Gynecol. 2018;219:523. e1–523.e15.

Literature Review of Neuraxial Anesthesia 1.pdf

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Founding Member, Mass General Brigham

HARVARD MEDICAL SCHOOL

Adjuvant Analgesic, Anxiolytic, and Sedative Medications Administered During Cesarean Delivery

A Retrospective Report from the Multicenter Perioperative Outcomes Group Research Consortium

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*No disclosures

Background

- Neuraxial anesthesia is the preferred anesthetic technique for cesarean delivery
- IV or inhalational medications may be used to supplement when neuraxial is inadequate
  Supplemental analgesia is a recommended ASA quality metric
- Data regarding frequency and factors driving their use are lacking

Aims:
1. Estimate the percentage of patients who received adjuvant medications and/or were converted to general anesthesia
2. Estimate the association of patient, case, and hospital-level characteristics

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Methods

Inclusion criteria:
- All anesthetic records for cesarean delivery under neuraxial anesthesia
- 2018-2023

Exclusion criteria
- Institutions with less than 500 total cases
- Repeat procedures for the same patient

Medications:
- Opioids
- Midazolam
- Propofol
- Ketamine
- Dexmedetomidine
- Nitrous oxide

Conversion to GA

AMPOG MULTICENTER PERIOPERATIVE OUTCOMES GROUP

Brigham and Women's Hospital
Founding Member, Mass General Brigham
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Results

166,196 Cesarean deliveries under neuraxial anesthesia

Spinal **58%** CSE **34%** Epidural **8%**

33 555 cases of adjuvant medication and/or conversion to GA (**20%**)

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Results – Patient Characteristics

	Odds Ratio (99% CI)	p-value
BMI (Ref < 30)		
40-50	**0.69 (0.65, 0.73)**	< 0.01
50+	**0.65 (0.60, 0.72)**	< 0.01
Race (Ref White)		
Asian/Pacific Islander	**0.70 (0.65, 0.76)**	< 0.01
Black	1.10 (1.05, 1.15)	< 0.01
Hispanic	0.95 (0.87, 1.03)	0.11
ASA Class (Ref 1/2)		
3	1.12 (1.08, 1.17)	< 0.01
4	**1.90 (1.58, 2.29)**	< 0.01

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Results – Comorbidities

	Odds Ratio (99% CI)	p-value
Preterm Delivery	**1.34 (1.26, 1.42)**	< 0.01
Preeclampsia	**1.12 (1.06, 1.18)**	< 0.01
Chorioamnionitis	**1.32 (1.21, 1.43)**	< 0.01
Labor to Cesarean	1.03 (0.92, 1.15)	0.53
Induction of Labor	**1.29 (1.18, 1.41)**	< 0.01

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Results – Anesthesia Factors

	Odds Ratio (99% CI)	p-value
Time of Day (Ref Day 0700 – 1659)		
Evening (1700 – 2259)	1.17 (1.12, 1.22)	< 0.01
Overnight (2300 – 0659)	**1.22 (1.16, 1.28)**	< 0.01
Anesthesia Technique (Ref Spinal)		
Combined Spinal Epidural	**1.47 (1.42, 1.54)**	< 0.01
Epidural	**2.96 (2.76, 3.18)**	< 0.01
Medical School Affiliation	**0.63 (0.40, 0.98)**	0.01

Conclusions

20% of patients under neuraxial anesthesia required supplementation and/or conversion to GA

Highlights the important of providing high quality neuraxial anesthesia

Adjuvants can have undesirable side effects

Opportunities for improvement?

- Frequency of labor epidural analgesia evaluation
- Block testing technique

Co-Investigators:
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Nadir Sharawi, MBBS | Samuel Justice, PhD
Kara Fields, MA | David Stein, PhD
Michael Furdyna, MD | Sharon Reale, MD

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Frequency of Adherence to Obstetric Anesthesia Best Practices for Cesarean Delivery: *A Multicenter Retrospective Cohort Analysis*

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*No disclosures

Background

PRACTICE PARAMETERS

Practice Guidelines for Obstetric Anesthesia

An Updated Report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society for Obstetric Anesthesia and Perinatology

SOCIETY FOR OBSTETRIC ANESTHESIA AND PERINATOLOGY
CENTER of EXCELLENCE

Aims:

- Estimate **adherence** to guidelines for cesarean delivery
- Estimate **association** with case- and hospital-level factors
- Estimate **variability** due to case, anesthesiologist, and hospital

ASA & SOAP *Anesthesiology* 2016 | Carvalho *Anesth Analg* 2019

Methods

Inclusion Criteria

- All cesarean deliveries at MPOG sites
- January 2015 to December 2022
- Ages 15 to 44

MPOG MULTICENTER PERIOPERATIVE OUTCOMES GROUP

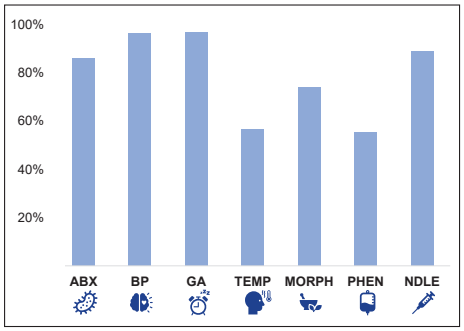
"Best Practices"

- Timely antibiotic administration
- Maintenance of SBP > 90 mmHg
- Avoidance of general anesthesia
- Hypothermia prevention
- Low-dose neuraxial morphine
- Post-spinal phenylephrine infusion
- Use of 25G (or smaller) spinal needle

Results

- Total CDs: 289,047
- Average Age: 31
- Average Deliveries: 1,377
- CDs at Hospitals with OB Anes Fellowship: 86,713
- CDs at Hospitals with COE Status: 141,455

Rates of Adherence



Abbreviations: CD: Cesarean delivery; **OB:** Obstetric; **COE:** Centers of Excellence; **ABX:** Timely antibiotics; **BP:** Hypotension avoidance; **GA:** General anesthesia avoidance; **TEMP:** Hypothermia avoidance; **MORPH:** Low-dose neuraxial morphine; **PHEN:** Post-spinal phenylephrine infusion; **NDLE:** Spinal needle ≥ 25 gauge

Results

Adherence Odds Ratios

	ABX	BP	GA	TEMP	MORPH	PHEN	NDLE
Race (Reference White)							
Black	0.99	***0.85***	***0.85***	***0.88***	1.03	1.03	0.90
Asian and PI	1.04	0.95	1.14	1.04	***1.22***	***1.09***	1.02
Body Mass Index (Reference BMI < 30 kg/m²)							
BMI 35-40	***1.10***	***0.90***	***1.28***	***1.09***	0.98	0.98	0.86
BMI 40+	***1.08***	***0.70***	***1.37***	***1.12***	0.96	1.01	***0.37***
American Society of Anesthesiologists Physical Status (Reference ASA PS 2)							
ASA PS 3	0.97	1.01	***0.77***	***0.95***	0.99	***1.15***	0.86
ASA PS 4+	***0.59***	0.78	***0.39***	***0.77***	0.97	***1.41***	***0.39***

** ***Underlined values are statistically significant***

Results

Adherence Odds Ratios

	ABX	BP	GA	TEMP	MORPH	PHEN	NDLE
Time of Day (Reference Day Cases)							
Evening	***0.87***	***1.12***	***0.81***	1.01	***1.08***	***0.60***	0.94
Overnight	***0.82***	***1.14***	***0.78***	1.01	***1.10***	***0.44***	***0.80***
Annual Volume (Per 1,000 Additional Patients who Delivered)							
Annual Volume	***1.49***	1.00	***1.35***	***0.38***	***2.00***	***2.70***	***4.90***
Institution Characteristics (Reference "No")							
OB Fellowship	1.00	***1.26***	0.84	1.15	***1.49***	***4.40***	***7.10***
COE Status	***1.18***	***1.19***	***1.45***	1.00	***4.89***	0.78	***0.14***

** ***Underlined values are statistically significant***

Image created with Google AI, Gemini 2.0

Full Results

451 #SOAPAM2025

Results

"Perfect" Adherence

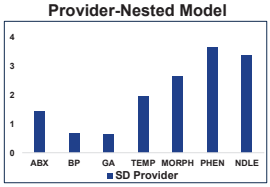
Characteristic	7 out of 7 Adherence
BMI 40+	***0.73***
Black Race	***0.68***
Evening Case	***0.63***
Overnight Case	***0.42***
Annual Volume	2.70
OB Fellowship	24.2
COE Status*	***10.1***

* Out of 3,541 total CDs

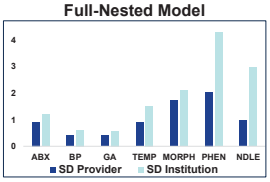
Model Goodness of Fit

Best Practice	Fixed Effects R^2	Provider Nested R^2	Full Nested R^2
ABX	0.08	0.44	0.45
BP	0.02	0.16	0.17
GA	0.06	0.20	0.22
TEMP	0.18	0.60	0.54
MORPH	0.22	0.74	0.75
PHEN	0.25	0.83	0.89
NDLE	0.14	0.80	0.77

Provider-Nested Model



Full-Nested Model



Conclusions

Overall adherence to obstetric anesthesia "best practices" was variable

Factors associated with **improved adherence**: higher volume, OB fellowships, and COE status

Factors associated with **decreased adherence**: race, ASA physical status, and time of cesarean delivery

Future Directions

- Mixed effects model with fellowship-trained anesthesiologists
- Additional cesarean delivery "best practices"
- Vaginal delivery "best practices"

Co-Investigators

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References

Efficacy and safety of dexmedetomidine or sufentanil in combination with ropivacaine with dural puncture epidural technique for labor analgesia

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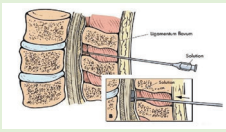
Background

- Dural puncture epidural (DPE) technique provides superior labor analgesia compared to traditional epidural technique.[1]
- Dexmedetomidine use as an adjuvant to ropivacaine in epidural labor analgesia has been proven to offer effective pain relief.[2]
- This randomized study was conducted to compare the efficacy and safety of dexmedetomidine or sufentanil in combination with ropivacaine with the DPE technique for labor analgesia.



Methods

- Randomized double-blinded study
- 25G Whitacre needle used for DPE technique
- Primary outcome: time to adequate analgesia was defined as a VAS score ≤ 3 during two consecutive contractions
- Secondary outcomes: VAS scores, ropivacaine consumption, Ramsay sedation scale (RSS), anesthesia satisfaction score, side effects, neonatal outcomes, and obstetric outcomes.
- Groups and pump parameter

Dexmedetomidine group (Group D)	Sufentanil group (Group S)
-Initiated with 10 mL of 0.08% ropivacaine and 0.4 μg/mL of sufentanil	-Initiated with 10 mL of 0.08% ropivacaine and 0.4 μg/mL of dexmedetomidine

-Maintence with PIEB (8ml every 60 min)
-PCEA (8ml/push, lockout interval 20min)
-Breakthrough pain (5 mL boluses of 0.1% ropivacaine)

Results

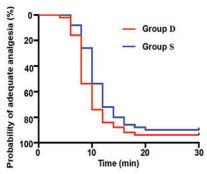


Fig 1 Kaplan–Meier curves for time to adequate analgesia

Adequate anesthesia was achieved faster in Group D than Group S (hazard ratio = 1.440; 95% confidence interval [CI], 0.9517–2.178; P = 0.035).

Table 1 Secondary outcomes

	Group D (n=50)	Group S (n=50)	P
Labor, first stage (min)	369 ±69	405 ±77	0.022
Labor, second stage (min)	43 (37.49)	42 (37.43)	0.183
RSS	2 (2,3)	2 (2,2)	0.011
Pruritus	1 (2%)	6 (12%)	0.117
Nausea or vomiting	2 (2.5%)	7 (14%)	0.162
Hypotension	2 (4%)	4 (8%)	0.674
Maternal bradycardia	3 (6%)	1 (2%)	0.610
Fetal bradycardia	5 (10%)	2 (4%)	0.433
Satisfaction score	10 (9,10)	9 (8,10)	0.039

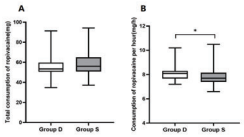


Fig 2 Consumption of ropivacaine in the two groups.

Study limitations

Since contraction frequency varies among patients and VAS scores rely on self-reports, this introduces potential inaccuracies in evaluating analgesic efficacy.

Conclusions

• In labor analgesia using the DPE technique, the combination of dexmedetomidine and ropivacaine provided rapid pain relief, shortened the first stage of labor, and increased patient satisfaction compared to sufentanil and ropivacaine.
• Importantly, this combination did not lead to significant maternal or neonatal side effects.
• The findings indicate that dexmedetomidine could be more beneficial than sufentanil as an adjuvant in labor analgesia with the DPE technique.

Reference

[1] Song YJ, ANESTHESIA AND ANALGESIA. 2021;132:971-8.
[2] Zhang T, DRUG DESIGN DEVELOPMENT AND THERAPY. 2019;13:1171-5.

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Comparison of Dexamethasone vs Ondansetron as the First-Line Antiemetic to Prevent Postoperative Nausea and Vomiting after Cesarean Delivery – A Double-Blinded Randomized Controlled Trial

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May 2nd, 2025

1

Background

Intra- and post-operative nausea and vomiting are common in cesarean deliveries. [1]

Untreated Nausea & Vomiting		
Intraop	Nausea	44%
	Vomiting	21%
Postop	Nausea	38%
	Vomiting	26%

Ondansetron (OND) and dexamethasone (DEX) are effective in decreasing PONV.[2,3]

PONV Reduction	Relative Risk	95%CI
OND	0.47	0.3 to 0.7
DEX	0.68	0.5 to 0.9

2

Hypothesis

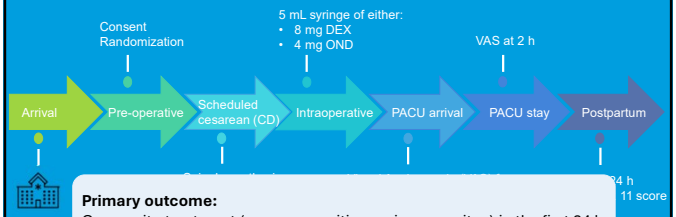
Robust Enhanced Recovery After Cesarean (ERAC).
Gap in knowledge for optimal first-line antiemetic.[4]
Ondansetron (OND) and dexamethasone (DEX) similar efficacy.
Dexamethasone reduces postoperative pain and opioid consumption.[5,6]

Hypothesis: **Postoperative global recovery improved with DEX as first line agent**

3

Methods

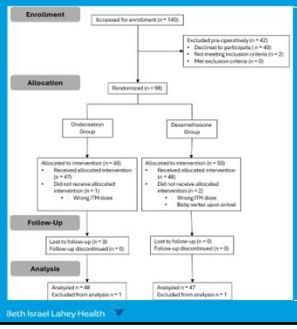
Prospective randomized double-blind



Primary outcome:
Composite treatment (nausea, vomiting, pain, or pruritus) in the first 24 h

4

Results

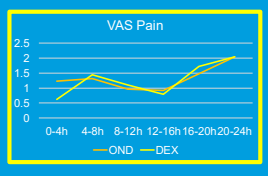


Characteristic	Ondansetron n=48	Dexamethasone n=47	P-value
Age (y)	34.5±4.3	36.3±3.5	0.01
Height (in)	63.8±2.4	64.9±2.8	0.04
Weight (lbs)	171.5±26.0	178.1±26.9	0.23
BMI	29.5±3.8	29.6±3.9	0.90
Gestational age (weeks+days)	39 [38+2d to 39+2d]	39+1d [39 to 39+2d]	0.33
Nulliparous	15 (31.3)	10 (21.3)	0.35
Age (y)	34.5±4.3	36.3±3.5	0.01
Height (in)	63.8±2.4	64.9±2.8	0.04
Hispanic	7 (14.6)	0	
High school or less	9 (18.8)	0	
Post-graduate	19 (39.6)	29 (61.7)	
Neonatal weight (kg)	3.2 [2.9 to 3.6]	3.6 [3.4 to 3.8]	0.001
Post-graduate	19 (39.6)	29 (61.7)	
Not specified	1 (2.1)	2 (4.3)	
Primary cesarean	16 (33.3)	14 (29.8)	0.83
Surgical duration (min)	91.0±23.3	85.2±19.1	0.14
Neonatal weight (kg)	3.2 [2.9 to 3.6]	3.6 [3.4 to 3.8]	0.001
QBL	435 [275 to 700]	500 [286 to 639]	0.89
Uterine exteriorized	42 (87.5)	34 (72.3)	0.08
IONV	11 (22.9)	18 (38.3)	0.12

5

Results

Pain/PONV/Pruritus treatment (P=0.96)



Outcome		OND n=48	DEX n=47	P-value
Pain	0 h	0.22 ± 0.7	0.19 ± 0.7	0.32
	2 h	1.31 ± 1.5	0.92 ± 1.3	0.19
	24 h	3.11 ± 1.9	2.92 ± 2.0	0.59
Nausea	0 h	0.53 ± 1.1	0.81 ± 1.3	0.14
	2 h	0.74 ± 1.3	0.69 ± 1.3	0.69
	24 h	0.12 ± 0.3	0.01 ± 0.03	0.16
Pruritus	**0 h**	**2.7 ± 2.2**	**1.9 ± 2.1**	**0.05**
	2 h	2.8 ± 2.0	2.2 ± 1.9	0.13
	24 h	1.4 ± 1.8	1.8 ± 2.0	0.57

ObsQoR11	OND n=48	DEX n=47	P-value
Total	85.9±17.7	88.0±20.1	0.61

6

Discussion

OND and DEX have equivalent efficacy for IONV and PONV prophylaxis.

DEX immediate postoperative pruritus – exploratory.

Robust ERAC reduces pain & side effect scores.

Very low rates of side effects / pain – do we need either?

Beth Israel Lahey Health

7

7

Thank you

References
1.PMID: 10422935
2.PMID: 33177330
3.PMID: 34002866
4.PMID: 24991614
5.PMID: 31058317
6.PMID: 38091865

Beth Israel Lahey Health

8

8

The Effect of Sufentanil for Combined Spinal-Epidural Anesthesia on Fetal Heart Rate During Labor Analgesia

Jian Xu[1],Mingjun Xu[1]
1. Department of Anesthesiology, Beijing Obstetrics and Gynecology Hospital, Capital Medical University

Introduction

- The use of intrathecal opioids for labor analgesia is currently a commonly employed method.
- There is evidence that this technique may cause fetal bradycardia.
- Possible mechanism：rapid onset of analgesia leads to a decrease in catecholamine levels, enhanced uterine contractions, and a subsequent reduction in fetal heart rate[1].
- Intrathecal administration of local anesthetics alone for labor analgesia can also produce a rapid onset of action，but limited studies have indicated an increased incidence of fetal bradycardia.

Methods

Primary objective： To investigate whether intrathecal sufentanil administration during CSEA affects fetal heart rate, while simultaneously monitoring maternal hormonal changes and uterine contractions to explore potential mechanisms.

Study design： Prospective, randomized, controlled clinical study.

Population： primiparous who voluntarily request labor analgesia, with a singleton term pregnancy, cervical dilation of 2 – 3 cm. Unless complicated by severe hypertension, diabetes, hyperthyroidism, or hypothyroidism.

Exclusion criteria： Inadequate monitoring data due to a shortened labor, either before or after analgesia, and the use of oxytocin from 30 minutes before to 30 minutes after analgesia.

Randomization： The parturients were divided into three groups using a random number table method: the sufentanil 8 μg group (S8 group), sufentanil 5 μg group (S5 group), and ropivacaine 3 mg group (R3 group).

- S8 group：Intrathecal administration of 8 μg sufentanil for CSEA

Primary outcomes： Fetal heart rate changes 30 minutes after labor analgesia.

Secondary outcomes：

- Maternal hormone levels，uterine contraction status, and VAS scores before labor analgesia, and at 5, 15, and 30 minutes after labor analgesia.
- Hypotension, pruritus, conversion to cesarean section, and newborn Apgar scores.

Results

Table 1 Patient characteristics

Group	Age (years)	Height (cm)	BMI (kg/m²)	Before labor analgesia		
				FHR (bpm)	SBP (mmHg)	DBP (mmHg)
S8 (n=30)	30.9±2.8	161±4	26.5±2.3	153±4	121±8	73±6
S5 (n=30)	30.5±3.2	163±4	26.3±2.8	152±4	122±7	72±5
R3 (n=30)	30.5±2.3	164±5	26.5±2.4	152±3	120±7	72±5

Table 2.
Major Outcomes and Some Secondary Outcomes After Labor Analgesia in the Three Groups of Parturients

Group	Cases	Fetal heart rate abnormalities	Pruritus	Cesarean section	Hypotension	Uterine hypertonus
S8	30	3	7	6	4	3
S5	30	0	3	10	3	3
R3	30	1	0	3	3	2
P value		0.215	0.010[a]	0.062	0.918	0.812
X^2		2.96	8.54	5.57	0.34	0.49

S8 Group: 8 μg sufentanil group; S5 Group: 5 μg sufentanil group; R3 Group: 3 mg ropivacaine group;
[a]Compared with the S5 group and R3 group, P < 0.05

Results

Table 5 Maternal Hormone Levels Before and After Labor Analgesia in Three Groups ($\bar{x}\pm s$)

	Group	T_0	T_1	T_2	T_3
Epinephrine (μg/L)	S8	50±15	50±14	50±14	49±13
	S5	50±16	50±14	49±13	50±14
	R3	51±13	48±14	48±13	48±14
Norepinephrine (pmol/L)	S8	1 348±429	1 367±506	1 314±474	1 268±440
	S5	1 424±421	1 451±421	1 495±486	1 403±431
	R3	1 346±365	1 313±455	1 350±439	1 260±413
Oxytocin (ng/L)	S8	77±40	77±37	76±35	75±38
	S5	72±31	74±35	72±32	72±33
	R3	66±28	64±31	63±24	64±31
PGE2 (ng/L)	S8	233±98	230±99	223±93	232±105
	S5	227±78	217±90	221±91	212±71
	R3	220±87	212±83	209±79	206±75

T0: Before labor analgesia; T1: 5 minutes after labor analgesia; T2: 15 minutes after labor analgesia; T3: 30 minutes after labor analgesia; PGE2: Prostaglandin E2

Fig1. S8 group hormone level changes

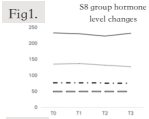


Fig2. S5 group hormone level changes

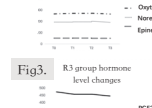


Fig3. R3 group hormone level changes

Discussion

- The study found that the use of sufentanil for CSEA in the intrathecal does not lead to an increased incidence of abnormal fetal heart rate.
- The use of 8 μg or lower doses of sufentanil for CSEA in the intrathecal is safe and effective; however, higher doses of sufentanil should be avoided to prevent the occurrence of abnormal fetal heart rates[2].
- After labor analgesia, there was no significant change in uterine contractions or maternal hormone levels. It is possible that the pharmacological mechanism of sufentanil or other underlying mechanisms contribute to the occurrence of fetal heart rate abnormalities after labor analgesia.

Limitations

- The sample size of this study was relatively small. Future research with larger sample sizes and multi-center studies is warranted for more in-depth investigation.
- The monitoring period after labor analgesia was relatively short.
- There are many factors that can influence the monitoring of uterine contractions in parturients.

References

1. Hattler et al. Anesth Analg, 2016, 123(4): 955-964. DOI:10.1213/ANE.0000000000001412.
2. Hembrador et al. Rom J Anaesth Intensive Care, 2020, 27(2): 27-33. DOI:10.2478/rjaic-2020-0015.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THANK YOU

Abstract #: FRI – GMRC – 01

Adjuvant Analgesic, Anxiolytic, and Sedative Medications Administered During Cesarean Delivery: A Retrospective Report from the Multicenter Perioperative Outcomes Group Research Consortium

Presenting Author: Eric Y. Chen, MD, MBA

Presenting Author's Institution: Brigham and Women's Hospital - Boston, Massachusetts

Co-Authors: Michael J. Furdyna, MD - Brigham and Women's Hospital
Samuel Justice, PhD - Brigham and Women's Hospital
Nadir Sharawi, MB BS, FRCA, MSC - UAMS
Pervez Sultan, MBChB - Stanford University School of Medicine
Mohamed Tiouririne, MD - UVA Medical Center

Abstract :

Adjuvant Analgesic, Anxiolytic, and Sedative Medications Administered During Cesarean Delivery: A Retrospective Report from the Multicenter Perioperative Outcomes Group Research Consortium

Background: Neuraxial anesthesia is the preferred anesthetic technique for cesarean delivery (CD); however, inadequate anesthesia can result in patient discomfort and trauma. While intravenous (IV) or inhalational medications may be used to supplement the neuraxial anesthesia, wide-scale contemporary data regarding frequency and factors driving their use are lacking.

Methods: Following IRB approval, we conducted a US multicenter, retrospective, observational study using the MPOG database. Patients who underwent CD under neuraxial anesthesia between 1/1/18-12/21/23 were identified. Our primary aim was to estimate the percentage of patients who underwent CD under neuraxial anesthesia and received adjuvant medications and/or were converted to general anesthesia (GA). We also estimated the association of patient- (demographic), case- (medical, anesthesia, surgical factors), and hospital-level variables with the odds of adjuvant administration and/or conversion to GA and estimated the percentage of unexplained variability in their use that can be attributed to the patient, case, and hospital factors.

Results: We identified 166,196 CDs across 61 institutions, of which 33,061 (19.9%) had the composite outcome of receipt of ≥1 IV or inhaled analgesic, anxiolytic, or sedative medication adjuvant, and/or conversion to GA. Adjuvants used included: opioids (11.7% of cases), midazolam (7.7%), ketamine (2.1%), propofol (2.8%), dexmedetomidine (1.9%), and nitrous oxide (1.2%). 1.2% were converted to GA. Factors most strongly associated with adjunct administration/GA included: CSE mode of anesthesia (vs spinal), ASA class 4, preterm delivery, chorioamnionitis, induction of labor, and overnight surgery (Table). High BMI and Asian/Pacific Islander races were associated with lower OR of adjuncts/GA.

Conclusion: In our large, multicenter sample, we found that almost 20% of patients who underwent CD under neuraxial anesthesia required supplementation and/or conversion to GA. This is higher than previously reported rates of 11-15% (1, 2) and highlights the importance of providing high quality neuraxial anesthesia for CD, as adjuvants can have side-effects such as somnolence, respiratory depression, amnesia, pruritus, and nausea/vomiting. Future studies

are needed to identify strategies (such as frequency of labor epidural analgesia evaluation and technique of block testing prior to surgery) that may help to reduce the need for adjuncts during CD.

References:

References

1. Patel et al, Anaesthesia 2022

2. Bauer et al, IJOA 2012

SOAP Table.pdf

Abstract #: FRI – GMRC – 02

Frequency of Adherence to Obstetric Anesthesia Best Practices for Cesarean Delivery: A Multicenter Retrospective Cohort Analysis

Presenting Author: Jordan A. Francke, MD MPH

Presenting Author's Institution: Brigham & Woman's Hospital - Boston, Massachusetts

Co-Authors: Brendan Carvalho, MBBCh, FRCA - Stanford University
Michael J. Furdyna, MD - Brigham and Women's Hospital
Samuel Justice, PhD - Brigham and Women's Hospital
Thomas Klumpner, MD - University of Michigan
Brandon M. Togioka, MD - Oregon Health & Science University

Abstract :

Background

Increasingly, protocols and guidelines have been developed to optimize maternal obstetric care.[1] However, there is a paucity of data on the rates of adherence to these guidelines. The primary aims of this study were to utilize the Multicenter Perioperative Outcomes Group (MPOG) database to estimate (1) the percent adherence to obstetric anesthesia best practice guidelines for cesarean delivery (CD) (2) the association of case- and hospital-level factors with adherence, and (3) the percentage of variability in adherence that can be attributed to the case, anesthesiologist, and hospital levels.

Methods

We performed a multicenter, observational cohort study utilizing the MPOG database to review all CDs in women aged 15-44 between 1/1/15-12/31/22. Best practice adherence was recorded as follows: timely antibiotic administration (within one hour of skin incision), post-spinal systolic blood pressure (SBP) maintenance >90 mmHg, avoidance of general anesthesia (GA) for CD, prevention of perioperative hypothermia, and use of low-dose morphine (≤ 150 mcg intrathecally or ≤ 3 mg epidurally), phenylephrine infusion post-spinal (vs. boluses), and spinal needle ≥ 25-gauge.

Covariates of interest included patient-, institutional-, and case-level factors. To evaluate their influence on guideline adherence, we used hierarchical linear modeling with case nested within anesthesiologist and anesthesiologist nested with institution.

Results

We analyzed a total of 371,824 CD cases in the MPOG database. The following adherence rates to obstetric anesthesia best practices were observed (Table): timely antibiotic administration, 86.2% (99%CI: 86.0-86.3%); maintenance of post-spinal SBP, 96.7% (99%CI: 96.6-96.8%); avoidance of GA, 97.0% (99%CI: 96.9-97.0%); avoidance of perioperative hypothermia, 56.7% (99%CI: 56.5-56.9%); use of low-dose neuraxial morphine, 74.2% (99%CI: 74.0-74.5%); use of post-spinal phenylephrine infusion, 55.4% (99%CI: 55.1-55.8%); and use of ≥ 25-gauge needle for spinal anesthesia, 89.0% (99%CI: 88.6-89.4%). Poorer adherence to best practices was associated with factors at the patient- (ASA Physical Status ≥

4, BMI ≥ 40 kg/m^2), case- (evening or overnight CD), and institution-level (absence of obstetric anesthesia fellowship or “Center of Excellence” status).

Discussion

Among our large cohort of CD cases, overall adherence to guideline-supported obstetric anesthesia best practices was high, which may be secondary to an increasing prevalence of societal recommendations and national efforts to standardize care. However, opportunities for improvement remain, particularly use of low-dose neuraxial morphine, hypothermia avoidance, and use of post-spinal anesthesia phenylephrine infusion. Measures to target specific factors associated with poor adherence will help ensure higher quality and more equitable care.

References:

1. Practice Guidelines for Obstetric Anesthesia. *Anesthesiology*. 2016.

Francke MPOG OB Best Practices SOAP Abstract Table 1 29 2025D Final.pdf

Abstract #: FRI – GMRC – 03

Efficacy and Safety of Dexmedetomidine or Sufentanil in Combination With Ropivacaine With Dural Puncture Epidural Technique For Labor Analgesia: A Randomized Controlled Trial

Presenting Author: Yongxin Liang, n/a

Presenting Author's Institution: Women and Children's Hospital, QINGDAO UNIVERSITY - Qingdao, Shandong

Co-Authors:

Abstract :

BACKGROUND: The dural puncture epidural (DPE) technique, a modification of the combined spinal-epidural approach, is increasingly used in labor analgesia. DPE technique is associated with a faster onset, better sacral spread, and lesser unilateral or patchy sensory blockade than the conventional epidural technique. Dexmedetomidine, a highly selective α2 adrenergic receptor agonist, exhibits notable effects in anti-anxiety, sedation, and analgesia. Its use as an adjuvant to ropivacaine in epidural labor analgesia has been proven to offer effective pain relief with minimal side effects. However, the efficacy and safety of dexmedetomidine as an adjuvant to ropivacaine with the DPE technique have not been previously studied. This randomized study was conducted to compare the efficacy and safety of dexmedetomidine or sufentanil in combination with ropivacaine with the DPE technique for labor analgesia.

METHODS: Nulliparous women requesting labour analgesia were allocated randomly to either the Dexmedetomidine or Sufentanil group. In the Dexmedetomidine group, analgesia was initiated with 10 mL of 0.08% ropivacaine with 0.4 μg/mL of dexmedetomidine, maintained at 8 mL/h. The Sufentanil group received 10 mL of 0.08% ropivacaine with 0.4 μg/mL of sufentanil, also maintained at 8 mL/h. A 7 mL patient-controlled epidural analgesia (PCEA) bolus with a 30-minute lockout was programmed. Breakthrough pain not amendable by PCEA was treated with provider boluses of 5 mL of 0.1% ropivacaine. The primary outcome, "time to adequate analgesia," was defined as a VAS pain score ≤ 3 during two consecutive contractions and analyzed using Kaplan–Meier curves and a log-rank test. Secondary outcomes included VAS scores, ropivacaine consumption, sensory block, the proportion of PCEA and provider interventions, mode of delivery, labor duration, Bromage scores, RSS sedation scale, Apgar scores, incidence of side effects, and maternal satisfaction with anesthesia.

RESULTS: A total of 100 women were included (50 in the Dexmedetomidine group, 50 in the Sufentanil group). Adequate anesthesia was achieved faster in the Dexmedetomidine group than in the Sufentanil group (hazard ratio = 1.440; 95% confidence interval [CI], 0.9517–2.178; P = 0.035). The dexmedetomidine group was associated with faster first stage of labor, higher RSS sedation scores, and better patient satisfaction (both $P < 0.05$). Sufentanil group was associated with the lower hourly ropivacaine consumption (both $P < 0.05$). No significant differences were observed in other aspects of the secondary outcomes.

CONCLUSIONS: In labor analgesia using the dural puncture epidural (DPE) technique, the combination of dexmedetomidine and ropivacaine provided rapid pain relief, shortened the first stage of labor, and increased patient satisfaction compared to sufentanil and ropivacaine. Importantly, this combination did not lead to significant maternal or neonatal side effects.

Abstract #: FRI – GMRC – 04

Rac1 Facilitates YAP1 mediated Piezo1 overexpression in the uterus contributes to myometrium contraction and inflammation-associated preterm birth

Presenting Author: Yanmei Bi, N/A, n/a

Presenting Author's Institution: West China Second University Hospital - Chengdu, Sichuan

Co-Authors: Min Diao, n/a - West China Second University Hospital
Hao Li, n/a - West China Second University Hospital

Abstract :

Background: Preterm birth is the leading cause of perinatal mortality and morbidity, and often associated with inflammation and aberrant myometrial contractions. Our previous work demonstrated that the overexpression of Piezo1 in mice uterus plays an important role in myometrium contraction and inflammation-associated preterm birth. And Piezo1 promotes myometrial contraction by mediating Ca^{2+} influx and amplifying the inflammatory response of uterine smooth muscle cells. However, the upstream regulators of Piezo1 and its mechanisms remain unknown. In this study we investigate the role of Rac1/YAP1 signal on the overexpression of Piezo1, myometrium contraction and inflammation-associated preterm birth.

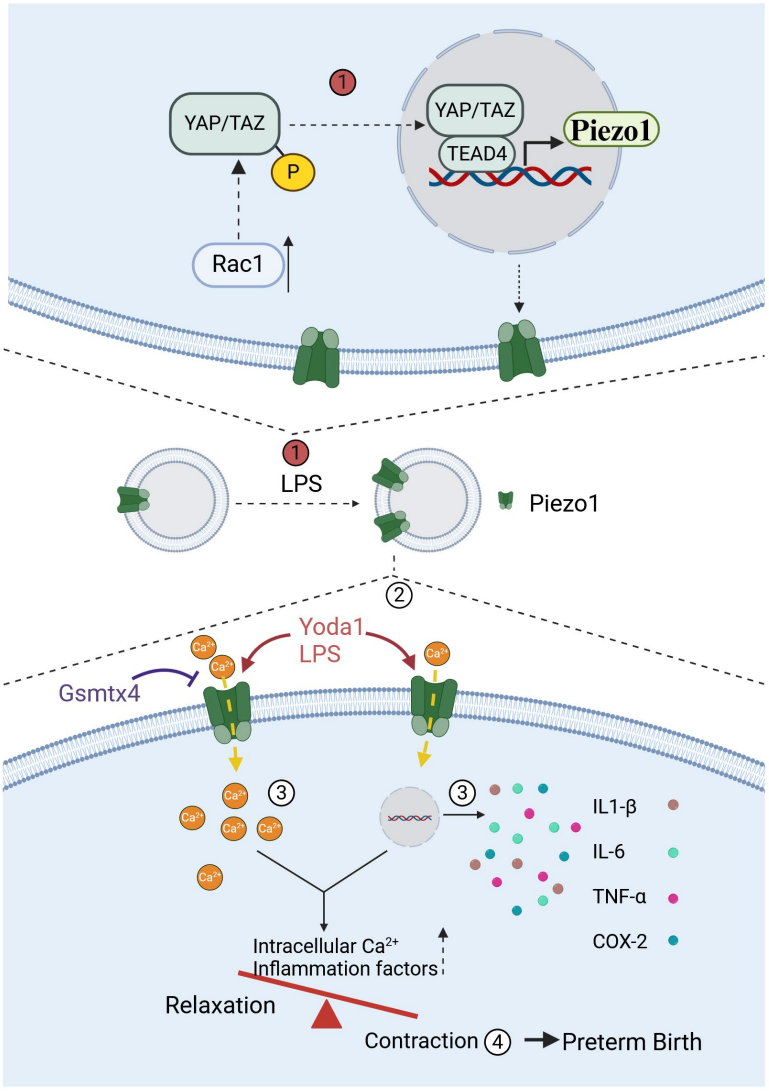
Methods: We employed Western blotting, Immunofluorescence, and Quantitative real-time PCR techniques to examineRac1, YAP1 and Piezo1 expression in uterine tissues. Myometrial contractility studies were conducted to elucidate the effects of YAP1 and Piezo1 on myometrial contractions. YAP1 inhibitor verteporfin was used to investigate the impact of YAP1 on the expression of Piezo1, Rac1 inhibitor and knockdown were used to investigate the impact of Rac1 on the YAP1 dephosphorylation and nuclear translocation in inflammation-associated preterm birth.

Results: Our findings reveal the Piezo1 protein levels were elevated in the uterine smooth muscle layer after intrauterine injection of LPS. Meanwhile, YAP1 dephosphorylation and nuclear translocation in the uterine smooth muscle cells after LPS intrauterine injection. Similarly, YAP1 dephosphorylation and nuclear translocation occurred in LPS stimulated primary uterine smooth muscle cells (mUSMCs). The inhibitor of YAP1 verteporfin decreased LPS induced everexpression of Piezo1 in vivo and in vitro. Yoda1, an elective agonist of Piezo1, dose dependently enhanced the spontaneous contraction of uterine myometrium. Verteporfin treatment 30 mins after LPS intrauterine injection reduced spontaneous uterine myometrium contraction, and prolonged the pregnancy time. Knockdown of Rac1 via siRNA inhibited the dephosphorylation and nuclear translocation of YAP1, and decreased the expression of Piezo1.

Conclusions: These results suggest that the increased expression of Rac1 promotes YAP1 dephosphorylation and nuclear translocation, regulates the overpression of Piezo1. The overexpression of Piezo1 may predispose to preterm labor through heightened myometrial activity.

Keywords: Preterm birth; YAP1; Rac1; Piezo1; myometrium contraction

References:


YAP/TAZ
P
Rac1
YAP/TAZ
TEAD4
Piezo1
LPS
Piezo1
Yoda1
LPS
Gsmtx4
IL1-β
IL-6
TNF-α
COX-2
Intracellular Ca2+
Inflammation factors
Relaxation
Contraction
Preterm Birth

Abstract #: FRI – GMRC – 05

Comparison of Dexamethasone vs Ondansetron as the First-Line Antiemetic to Prevent Postoperative Nausea and Vomiting after Cesarean Delivery – A Double-Blinded Randomized Controlled Trial

Presenting Author: Maria D. Patrocinio, MD

Presenting Author's Institution: Beth Israel Deaconess Medical Center - Boston, Massachusetts

Co-Authors: Samantha L. Armstrong, BS - Beth Israel Deaconess Medical Center
Amnon A. Berger, MD, PhD - Beth Israel Deaconess Medical Center / Harvard Medical School
Maria C. Borrelli, DO - Harvard Medical School
Yunping Li, MD - Beth Israel Deaconess Medical Center

Abstract :
Background: Patients undergoing cesarean delivery (CD) may experience intra- or post-operative nausea and vomiting (IONV, PONV).[1] Ondansetron (OND), a 5-HT3 antagonist, and dexamethasone (DEX), a glucocorticoid, both are effective in decreasing PONV without significant adverse events and are part of the SOAP ERAC guidelines.[2,3] Head-to-head trials in an ERAC pathway are lacking causing a gap in knowledge as to the optimal first-line antiemetic for cesarean delivery. We hypothesize that both OND and DEX may be effective for IONV and PONV prophylaxis, and DEX may reduce post-operative pain and opioid consumption.[4]

Methods: Prospective randomized double-blinded controlled trial comparing IV 8mg DEX to IV 4mg OND after induction of neuraxial anesthesia. Patients undergoing non-emergent CD were given standard spinal anesthesia including 150 µg of spinal morphine. An ERAC protocol with scheduled acetaminophen and ketorolac for 24 hours was used. Patients scored their nausea, pain, and pruritus on a Visual Analog Scale (10 cm) at PACU arrival, 2- and 24-hours by a blinded researcher. The main outcome was the need for treatment of nausea, vomiting, pain, or pruritus in the first 24 hours following CD. Groups were compared using Wilcoxon rank sum and chi-square tests. $P< 0.05$ was considered statistically significant.

Results: 100 patients were enrolled, 95 completed the trial. Demographics were balanced between groups. The DEX group had significantly higher age (36.3 vs 34.5 years, P=0.01) and a larger percentage of patients had graduate degrees (62% vs 40%, P=0.01). Nausea scores were lower than 1/10 in all groups and not significantly different (Table 1). The DEX group had significantly lower pruritus scores at PACU admission (1.85 vs 2.73, $P< 0.05$). There was no difference in pain at any time point or in the requirement for additional antiemetics or analgesics between the groups. One patient in the DEX group received naloxone for pruritus. No significant adverse events or safety issues were found during this trial.

Discussion: Using an ERAC pathway for care, ondansetron and dexamethasone are equally successful options in preventing IONV and PONV. Dexamethasone may provide more benefit in immediate post-operative pruritus compared to ondansetron. Clinical judgement and patient factors should guide provider choice of antiemetics given their equivalent efficacy.

References:

1. PMID: 10422935

2. PMID: 33177330
3. PMID: 34002866
4. PMID: 24991614

Dexamethasone main outcome.pdf

Abstract #: FRI – GMRC – 06

The Effect of Sufentanil for Combined Spinal-Epidural Anesthesia on Fetal Heart Rate During Labor Analgesia

Presenting Author: JIAN XU, MD

Presenting Author's Institution: Beijing Obstetrics and Gynecology Hospital, Capital Medical University - Beijing, Beijing

Co-Authors: MINGJUN XU, MD - BEIJING OBSTETRICS AND GYNEOLOGY HOSPITAL, CAPITAL MEDICAL UNIVERSITY

Abstract :

Objective: To investigate the impact of subarachnoid administration of sufentanil in combined spinal-epidural anesthesia (CSEA) on fetal heart rate during labor and explore the potential mechanisms involved.

Methods: A total of 90 parturients receiving CSEA for labor analgesia were randomly assigned into three groups using a random number table: sufentanil 8 μg group (S8 group), sufentanil 5 μg group (S5 group), and ropivacaine 3 mg group (R3 group), with 30 participants in each group. All parturients underwent CSEA, receiving either 0.8 ml of 1 mg/L sufentanil (S8 group), 0.5 ml of 1 mg/L sufentanil (S5 group), or 0.3 ml of 1% ropivacaine (R3 group), each diluted to 1.5 ml with cerebrospinal fluid, and injected slowly into the subarachnoid space. Fetal heart rate abnormalities and the occurrence of uterine hypertonus were observed and recorded before and 30 minutes after the initiation of labor analgesia. Visual analog scale (VAS) pain scores and levels of adrenaline, norepinephrine, oxytocin, and prostaglandin E2 (PGE2) were recorded at baseline (T0), and at 5 minutes (T1), 15 minutes (T2), and 30 minutes (T3) post-analgesia. Additionally, complications such as hypotension, pruritus, conversion to cesarean section, and neonatal Apgar scores at 1 min, 5 min, and 10 min were also recorded.

Results: No statistically significant differences were found between the three groups regarding the incidence of fetal heart rate abnormalities, hypotension, conversion to cesarean section, or uterine hypertonus (all $P > 0.05$). There were no significant differences in the levels of adrenaline, norepinephrine, oxytocin, PGE2, VAS pain scores, or neonatal Apgar scores (at 1 min, 5 min, and 10 min) among the three groups (all $P > 0.05$). The incidence of pruritus was higher in the S8 and S5 groups compared to the R3 group (both $P < 0.05$). Although the S8 group had a higher incidence of pruritus than the S5 group, this difference was not statistically significant ($P > 0.05$).

Conclusion: Subarachnoid administration of 8 μg or 5 μg sufentanil, or 3 mg ropivacaine for CSEA during labor does not significantly affect the incidence of fetal heart rate abnormalities. We did not observe a rapid decline in catecholamine levels or uterine tetanic contractions following labor analgesia.The analgesic effects are satisfactory, and this approach is considered safe for labor analgesia.
Keywords: Labor analgesia; Sufentanil; Fetal heart rate; Combined spinal-epidural anesthesia

References: 1.Clarke VT, et al. Anesthesiology 1994; 81(4):1083.

2.Kuberan A,, et al.Anaesthesia, 2018; 73(7): 832-838.
3.Feng S, et al.BMC Pregnancy Childbirth 2022; 22(1): 873.

Table 2.
Major Outcomes and Some Secondary Outcomes After Labor Analgesia in the Three Groups of Parturients

Group	Cases	Fetal heart rate abnormalities	Pruritus	Cesarean section	Hypotension	Uterine hypertonus
S8	30	3	7	6	4	3
S5	30	0	3	10	3	3
R3	30	1	0	3	3	2
P value		0.215	0.010[a]	0.062	0.918	0.812
X^2		2.96	8.54	5.57	0.34	0.49

S8 Group: 8 μg sufentanil group; S5 Group: 5 μg sufentanil group; R3 Group: 3 mg ropivacaine group;
[a] Compared with the S5 group and R3 group, $P < 0.05$

A Randomized Controlled Trial Using PIEB with 0.15% vs. 0.075% Ropivacaine in Labor Epidural Analgesia

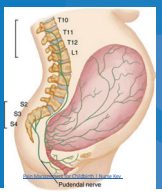
- effect on analgesic requirement and obstetric outcomes

Tao Han[1], Yunping Li[2], Liang Chen[1], Aiyuan Li[1], Amnon A. Berger[2], Philip E. Hess[2]
[1] Hunan Provincial Maternal and Child Healthcare Hospital, Hunan, China
[2] Dept of Anesthesia, Critical Care and Pain Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA

INTRODUCTION

- Key recommendations from SOAP COE
  - Low-concentration LA + opioid:
    - ≤0.1% bupivacaine
    - ≤0.15% ropivacaine)
- Worldwide, NO standard techniques
- Is lower conc. LA better?

B Carvalho & J Mhyre. AA 2019; 128:844-846

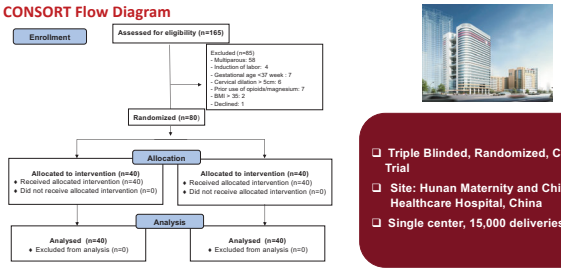


HYPOTHESIS

- T10-S2 (10 levels) for labor
- Low conc. of LA:
  better LA distribution ->
  improved analgesia ->

METHOD

CONSORT Flow Diagram



- Triple Blinded, Randomized, Controlled Trial
- Site: Hunan Maternity and Child Healthcare Hospital, China
- Single center, 15,000 deliveries/year

METHOD

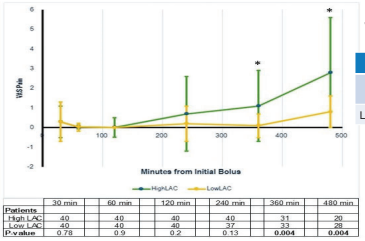
Delivery: **Same** molecular mass / hr via **Different** LA concentration and volume

DESIGN

PIEB + PCEA

High Concentration Low Volume	Low Concentration and High Volume
0.15% Ropivacaine + 0.6 mcg/ml Sufentanil	0.075% Ropivacaine + 0.3 mcg/ml Sufentanil
Loading dose - Physician bolus: 10 ml of 0.2% Ropivacaine + 10 mcg Sufentanil	
10 min after loading dose, **start PIEB** and give the first epidural bolus	
PIEB: 5 ml q 40 min	PIEB 10 ml q 40 min
PCEA: 5 ml 15 min lock out	PCEA: 10 ml 15 min lock out
Hourly Maximum 20 ml	Hourly Maximum 40 ml

RESULTS



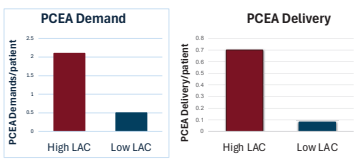
	30 min	60 min	120 min	240 min	360 min	480 min
Patients						
High LAC	40	40	40	40	31	20
Low LAC	40	40	40	37	33	28
P-value	0.78	0.9	0.2	0.13	**0.004**	**0.004**

VAS Pain Scores after Epidural (mean±SD)

	30 '	60'	120'	240'	360'	480'
High LAC	0.3±0.8	0.03±0.1	0.01±0.5	0.7±1.9	1.1±1.8	2.8±3.2
Low LAC	0.3±1.0	0.03±0.2	0±0	0.2±0.9	0.1±0.6	0.8±1.5

Low LAC:
Improved pain control with longer duration of analgesia

RESULTS

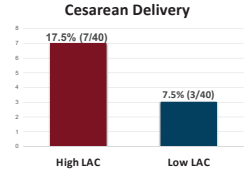


PCEA Demands and Delivery (mean±SD)

	PCEA Demand	PCEA Delivery
High LAC	2.1±3.1	0.7±1.2
Low LAC	0.5±0.8	0.08±0.3
p value	0.002	0.001

Low LAC:
- Less PCEA demands
- More comfortable

RESULTS – Obstetric Outcomes



	Bromage Scores at Full Dilation Median (Q1, Q3)	Forceps Delivery	Spontaneous Vaginal Delivery
High LAC	4.2 (4, 4) n=33	17.5% (7/40)	65% (26/40)
Low LAC	4.6 (4, 5) n=37	2.5% (1/40)	90% (36/40)
p- value	**0.02**	0.56	**0.014**

Low LAC:
- Less motor block
- Improved SVD
- Low rates of forceps and CD, but underpowered

P Sultan et al. CJA 2013; 60:840-854
Y Ginosar et al. IJOA 2010; 19:171-178

SUMMARY

- In this RCT trial, patients receiving the lower concentration and higher volume solution requested and received fewer PCEA requests.
- Labor epidural using a lower concentration of LA and higher volume produced less motor block and better analgesia over time.
- Less motor block reduced forceps use and improved spontaneous vaginal delivery.

HARVARD MEDICAL SCHOOL

Hunan Provincial Maternal and Child Healthcare Hospital

Beth Israel Lahey Health
Beth Israel Deaconess Medical Center

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Acknowledgment

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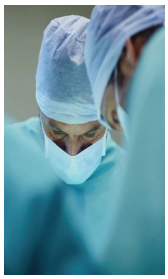
Incidence of new onset of persistent pain after cesarean delivery and associated risk factors

Mary Yurashevich MD, MPH, Matthew Fuller MS, Marie-Louise Meng MD, Karthik Raghunathan, MD, MPH, Tetsu Ohnuma, MD, PhD, MPH, Vijay Krishnamoorthy, MD, MPH, PhD and Ashraf S. Habib MBBCh, MSc, MHSc, FRCA

Background

- Cesarean delivery (CD) ~ 1/3 of all deliveries annually[1]
- Functional recovery expected within 8 weeks
- Persistent post-CD pain interferes with daily activities, causes sleep disturbances, and impairs the mother's ability to care for the infant
- Incidence of persistent pain not well elucidated



1] Hamilton BE. Births: Provisional Data for 2021. 2022.

Aims

- **Primary aim**
  - New onset persistent pain 3 – 12 months following CD
- **Secondary aim**
  - Clinical variables correlated with new onset persistent pain after CD

Methods

Retrospective cohort study

- **Inclusion:** Scheduled or unscheduled CD from 2016-2020
- **Exclusion:** pre-existing chronic pain, pre-delivery opioid use disorder, death during birth hospitalization, and patients without a pre-delivery encounter

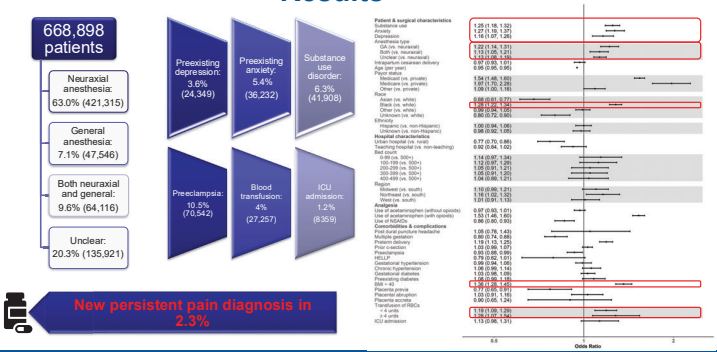
New pain diagnosis 3 –12 months post-CD

- New ICD-10 codes of persistent pain at a subsequent encounter

Statistical analysis

- Continuous and binary variables compared between groups using linear regression and logistic regression models, respectively
- Multivariable analyses were performed to examine risk factors for the primary outcome of new persistent pain diagnosis

Results



Conclusion

- 2.3% developed new persistent post-CD pain
- **Those with new pain diagnosis were more likely:**
  - Black
  - Higher BMI
  - Pre-existing depression, anxiety and substance use disorder
- Limitations
  - Administrative database relying on ICD-10 codes for diagnoses
  - Subsequent encounters outside of participating hospitals not captured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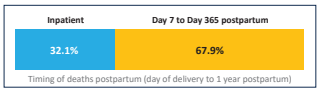
Profiling postpartum recovery: a multicenter longitudinal cohort study

Takenoshita M, Guo N, Farber M, Toledo P, Higgins N, Carvalho B, Sultan P.
Dept. of Anesthesiology, Perioperative and Pain Medicine, Stanford University

Background

Outpatient recovery is poorly understood



STanford Obstetric Recovery checklist (STORK)

STORK Domain	No. of questions	Max. score
Physical	13	52
Mental & emotional health	15	60
Motherhood experience & social support	12	48
Sleep & fatigue	7	28

AIMS

PRIMARY: Characterize longitudinal postpartum recovery

SECONDARY:

- Profile recovery for each domain
- Compare delivery modes
- Compare parity
- Compare domains between best and worst scores

Sultan et al. *JAMA Network Open.2025. In Press*
Trost et al. Pregnancy-Related Deaths: Data From Maternal Mortality Review Committees in 36 US States, 2017-2019. CDC. 2022.
Hoyert DL. Health E-Stat: Maternal Mortality Rates in the United States, 2022.; 2024.

Methods

SITES
Stanford University
Brigham & Women's Hospital
Northwestern University

STRATEGY
IRB approval
300 completed 6-week responses

INCLUSION
English-speaking
Live fetus

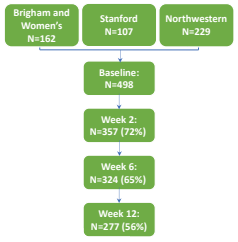
DATA
Patients completed STORK:
- Inpatient, 2, 6, & 12 weeks postpartum
- Demographic, obstetric, medical variables

OUTCOMES
Descriptive summaries of STORK scores
Individual domain STORK scores

ANALYSIS:
- Categorical variables: Chi-square test or Fishers' exact test
- Continuous variables: One-way ANOVA or Kruskal–Wallis test
- Mixed linear effect model to compare mean STORK score over time

Results

Recruitment

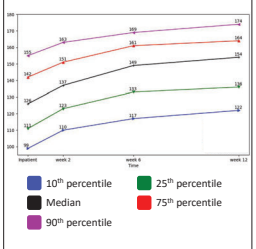


Patient characteristics

Variable	n=498
Age (y)	33.3±4.9
Racial group	
Asian	15%
Black	8%
White	51%
Other	5%
Gestational age (wk)	39.2 [38.2, 39.6]
Primiparous	46%
Delivery mode	
SVD	52%
OVD	3%
Scheduled CD	27%
Unscheduled CD	18%
ASA grade	
1	2%
2	81%
3	17%

SVD: spontaneous vaginal delivery; OVD: operative vaginal delivery; CD: caesarean delivery

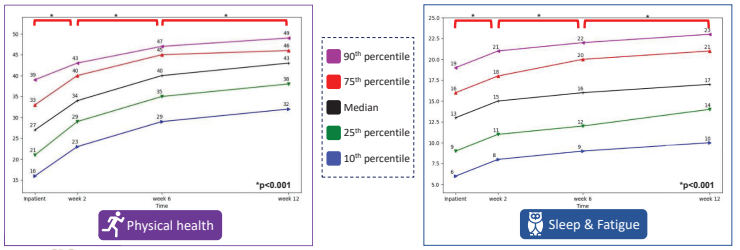
Total STORK scores



Overall scores increased up to 12 weeks postpartum

Results

Physical health, and Sleep & Fatigue scores improved up to **12 weeks** postpartum



Mental health, and Motherhood experience & Social support scores improved up to **6 weeks** postpartum

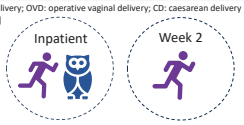
Results

Comparison between delivery modes

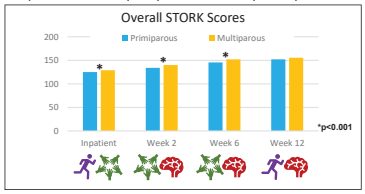
Overall STORK scores

	SVD	OVD	Scheduled CD	Non-scheduled CD	p-value
Inpatient	**130** [113, 147]	**119** [110, 133]	**123** [107, 137]	**123.5** [108, 140]	**0.004***
Week 2	139 [124, 152]	130.5 [120, 137]	135 [124, 149]	134 [123, 152]	0.26
Week 6	149 [132, 161]	145 [133, 156]	148.5 [134, 162]	149 [133, 65]	0.92
Week 12	155 [137, 163]	156 [145,164]	157 [138,166]	148 [131, 165]	0.57

SVD: spontaneous vaginal delivery; OVD: operative vaginal delivery; CD: caesarean delivery
Scores given as Median [IQR]



Comparison between primiparous and multiparous patients



Comparison between best and worst scores

Sleep and fatigue demonstrated the greatest % difference in median scores between the high and low quartiles

48-56% difference

Discussion

Recovery continues beyond 6 weeks postpartum

Multiparity and SVD associated with best recovery scores

Application: Monitoring, measuring impact of interventions

Next steps

Minimal clinically important differences

Trajectory analysis

Understanding drivers of worse recovery within each domain

Limitations

Significant differences between respondents and non-respondents

Recruitment limited to 3 academic US centers

Thank you

Special thanks to our collaborators and participants in the development of the STORK measure, including:
Guo N, Leonard S, Fiore JF Jr, Domingue B, Khorasani E, Jensen S, Pandal P, Murthy A, Ansari J, Barwick F, Brookfield K, Carmichael S, Coker J, El Sayyed Y, Flood P, Fowler C, Kawai M, Lyell D, Moreno C, O'Carroll J, Sharawi N, Sultan E, Whittington J, Yun R and Carvalho B

Contact us

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- Hoyert DL. *Health E-Stat: Maternal Mortality Rates in the United States, 2022*.; 2024. doi:10.15620/cdc/152992

Impact of a Modified Enhanced Recovery Protocol for Opioid Dependent Patients on Post-Cesarean Opioid Use and Pain Scores

Authors: **Lindsey Gleason**, Patrick Payne, MPH, Marjorie C. Meyer, MD, Jennifer Gage, MD

University of Vermont Larner College of Medicine

BACKGROUND:

Evidence:
- ERAC → (+) Outcomes
- ↑↑Postpartum pain → (-) outcomes
- MOUD → ↑Pain, ↑opioids after CD

MOUD Strategies:
- High-dose neuraxial opioids
- LA techniques
- IV adjuncts

UVMMC 9/1/2022:
- ERAC/mERAC implemented

Pre-mERAC
- NO neuraxial long-acting opioid
- Scheduled APAP/NSAIDs, +/- TAP block
- PO opioids scheduled q4H x24H, then PRN
- SOAP ERAC Essential Elements partially utilized (50%)

ERAC → mERAC

SOAP ERAC Essential Elements (90%)

Intra-op:
- MSO_4 0.1 mg IT *or* 2 mg EA
- TAP *only* if no neuraxial opioids, APAP or NSAIDs

Post-op:
- Scheduled APAP/NSAIDs
- PRN PO oxycodone 2.5-5 mg

Intra-op:
- HM 0.15 mg IT *or* 1.5 mg EA
- T9 -12 Epidural prior to spinal

Post-op:
- Bupi 0.125% PCEA x12-48H
- Scheduled APAP/NSAIDs
- PRN *only* PO HM 2-4 mg

AIM:

Assess impact of mERAC protocol implementation on post-cesarean opioid use and pain scores in patients with MOUD.

HYPOTHESIS:

Implementation of mERAC with HDHM and/or low thoracic EA reduces post-CD opioid consumption without increasing pain scores among patients with MOUD.

METHODS:

Study Design: Retrospective Cohort

EMR data: CD in 28 mos before & after mERAC implementation 9/1/22 (manual validation)

Inclusion criteria:
- MOUD (buprenorphine, methadone)
- Post-mERAC: HDHM* and/or T9-12 EA bupi 0.125% ≥12H post-CD

*HDHM: 0.15 mg IT or 1.5 mg EA

Exclusion criteria:
- Cesarean hysterectomy
- General anesthesia
- Incomplete post-mERAC protocol adherence
- Post-CD epidural infusion among pre-mERAC patients

Pre-mERAC Cohort (n=36) | Post-mERAC Cohort (n=25)

Statistical Analyses:
- T- and chi-square tests for demographics
- Linear and logistic regression of primary and secondary outcomes

RESULTS:

	Pre-mERAC (n = 36)	Post-mERAC (n = 25)
Age at Delivery, *mean*	32.2	33.8
Primary Race		
Black	0	1
White	36	24
Ethnicity		
Hispanic, Latino/a	0	1
Not Hispanic, Latino/a	36	24
BMI	33.4	31.6
Gravidity, *median*	5	4
Parity, *median*	2	2
OUD Treatment*		
Methadone	5	11
Buprenorphine	31	14
Cesarean Delivery		
Primary	19	8
Repeat	17	17
Planned	19	18
Unplanned	17	7

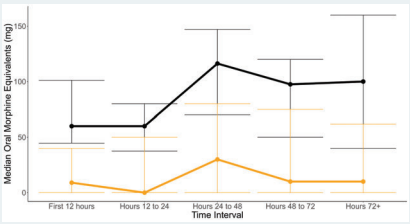
*p-value<0.05

Primary and Secondary Outcomes

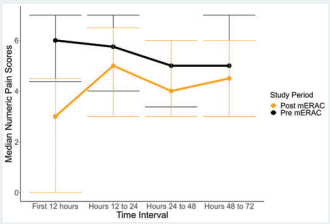
	Pre-mERAC (n = 36)	Post-mERAC (n = 25)	p-value
Opioid Consumption* (median OMEs)			
0-12 hours	75	17.9	<0.001
12-24 hours	68.5	20	<0.001
24-48 hours	122.7	37.6	<0.001
48-72 hours	99.7	27.6	<0.001
72+ hours	111.61	24.44	<0.001
Pain Score (median)			
0-12 hours	5.71	2.54	<0.001
12-24 hours	5.46	4.12	0.041
24-48 hours	4.93	3.92	0.053
48-72 hours	4.9	3.83	0.081
Delivery to Discharge Time (mean, hours)	104.5	99	>0.05
Respiratory Depression Rx	0	0	

*adjusted for OUD treatment

RESULTS:



Post-mERAC: significant reduction in opioid use at all time intervals post-delivery



Post-mERAC: reduction in pain scores at all time intervals post-delivery

CONCLUSIONS:

University of Vermont Larner College of Medicine

- A novel mERAC protocol incorporating high dose neuraxial hydromorphone and/or post-operative low thoracic epidural was safely implemented for patients with MOUD.
- mERAC protocol was associated with **reduced opioid consumption following delivery without an increase in pain scores** for patients with MOUD.

Limitations:
- Small cohort sizes
- Unknown impact of change from *scheduled* PO opioids x24H pre- to *PRN only* post-mERAC
- Lack of a standard ERAC protocol group with low dose morphine or HM for comparison

Future Directions:
- Analysis of mERAC impact on time to ambulation, foley removal and breastfeeding
- Analysis of impact of HDHM alone vs. with T9-12 EA on opioid use and pain scores
- Possible pilot study comparing standard ERAC to mERAC among patients with MOUD

Abstract #: FRI – OP 1 – 01

A randomized controlled trial using programmed intermittent epidural bolus with 0.15% versus 0.075% ropivacaine in labor epidural analgesia: effect on analgesic requirement and obstetric outcomes

Presenting Author: Tao Han, MD

Presenting Author's Institution: Hunan Provincial Maternal and Child Health Care Hospital - Changsha, Hunan

Co-Authors: Amnon Berger, MD - Harvard Medical School, Beth Israel Deaconess Medical Center
Liang Chen, MD - Hunan Provincial Maternal and Child Health Care Hospital
Aiyuan Li, MD - Hunan Provincial Maternal and Child Health Care Hospital
Yunping Li, MD - Beth Israel Deaconess Medical Center

Abstract :

The effect of epidural local anesthetic concentration (LAC) on labor analgesia is still under debate[1,2]. We compared the impact of low versus high LAC on epidural analgesic requirements and obstetric outcomes.

Methods

We conducted a double blinded, randomized, controlled trial involving nulliparous women in early labor with term cephalic singleton pregnancies who requested epidural analgesia. All women received an epidural loading dose of 10 ml of 0.2% ropivacaine and 10 mcg sufentanil. Women received the ***same dose*** for epidural maintenance via programmed intermittent epidural bolus (PIEB) with patient controlled epidural analgesia (PCEA), but were randomized to high LAC (HighLAC: 0.15% ropivacaine + 0.6 mcg/ml sufentanil at 5 ml bolus q40 min and 5 ml PCEA with 15 min lockout); or low LAC (LowLAC: 0.075% ropivacaine + 0.3 mcg/ml sufentanil at 10 ml bolus q 40 min and 10 ml bolus with 15 min lockout). The primary outcome was the number of PCEA demands during labor. The secondary outcomes included VAS Pain, Bromage motor scores, patient satisfaction, and delivery outcome. Equal-variance T-test then Mann-Whitney U or Wilcoxon Rank-Sum test used for analysis, significance at P≤0.05.

Results

165 patients screened, 80 patients enrolled and completed the study. The demographics were balanced. The HighLAC PCEA demand (2.1±3.1 vs. 0.5±0.8; *p*=0.002) and PCEA delivery (0.7±1.2 vs. 0.08±0.3; *p*=0.001) were significantly higher than LowLAC. The numbers for physician bolus were similar. Pre-epidural VAS pain scores were similar (7.1±1.5 vs. 7.7±1.3; *p*=0.08), VAS pain scores (See Figure) were similarly low until 6 hours when the HighLAC scores were higher. Motor strength by Bromage score was weaker with HighLAC at Full cervical dilation (*p*=0.02). The spontaneous vaginal delivery rate was lower with HighLAC (26/40(65%) vs. 36/40(90%); *p*=0.14), with more forceps (7/40(17.5%) vs. 1/40(2.5%); *p*=0.56) and higher cesarean (7/40(17.5%) vs. 3/40(7.5%); *p*=0.31) deliveries. Patients reported satisfaction scores were similar between groups.

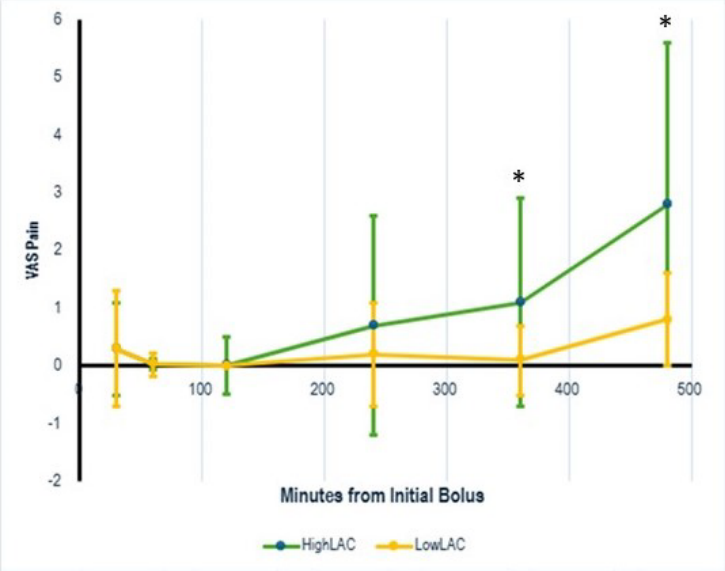
Conclusions

Maintaining epidural analgesia with a lower concentration and larger volumes provided effective labor analgesia with fewer PCEA demands and deliveries, lower pain scores over time, less motor block at full dilation and a higher spontaneous vaginal delivery rate. This study supports the use of low concentration local anesthesia for labor epidural analgesia when using PIEB/PCEA.

References:

< !1. P Sultan et al. CJA 2013; 60:840-854

< !2. Y Ginosar et al. IJOA 2010; 19:171-178



	30 min		60 min		120 min		240 min		360 min		480 min
Patients											
High LAC	40		40		40		40		31		20
Low LAC	40		40		40		37		33		28
P-value	0.78		0.9		0.2		0.13		**0.004**		**0.004**

Abstract #: FRI – OP 1 – 02

Incidence of new onset of persistent pain after cesarean delivery and associated risk factors

Presenting Author: Mary Yurashevich, MD, MPH

Presenting Author's Institution: Duke University Medical Center - Durham, North Carolina

Co-Authors: Matthew Fuller, n/a - Duke University
Vijay Krishnamoorthy, MD - Duke University
Marie-Louise Meng, MD - Duke University Medical Center
Tetsu Ohnuma, MD, PhD, MPH - Duke University
Karthik Raghunathan, MBBS, MPH - Duke University Medical Center

Abstract :
Introduction: Cesarean delivery (CD) is one of the most common surgeries performed in the United States and accounts of ~ 1/3 of all deliveries annually.[1] Typically, functional recovery after CD is expected within 8 weeks. Persistent post-CD pain interferes with daily activities, causes sleep disturbances, and impairs the mother's ability to care for her infant. Presently, the incidence of persistent pain after CD is not well elucidated. The **primary** aim of the study is to understand the incidence of new onset persistent pain in the 3 – 12 months period following CD using a national administrative database, Premier Healthcare Database. The secondary aim is to examine clinical variables that are correlated with the diagnosis of new onset persistent pain after CD.

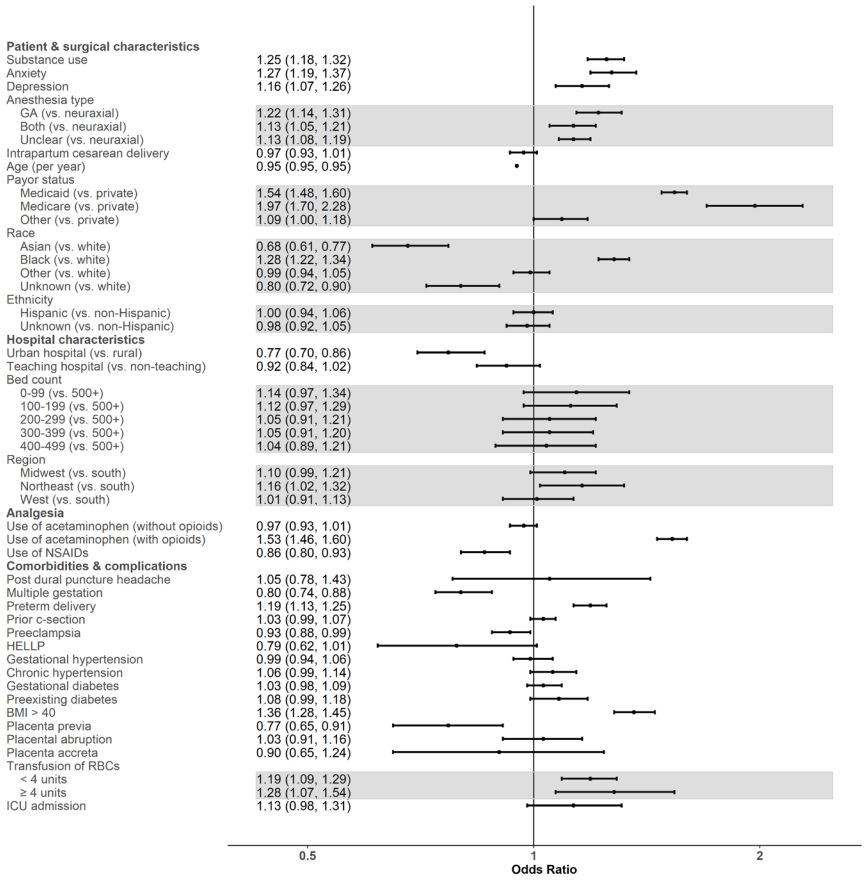
Methods: This retrospective cohort study included patients ≥18 years who had a scheduled or unscheduled CD from 2016-2020. Those with pre-existing chronic pain, pre-delivery opioid use disorder, death during birth hospitalization, and patients without a pre-delivery encounter in the Premier system were excluded. The primary outcome was new pain diagnosis in the 3 – 12 months post-CD defined as new ICD-10 codes of persistent pain at a subsequent encounter. Demographic, medical, obstetric, anesthetic and hospitalization data were abstracted. Descriptive statistics were generated. Continuous outcome variables and binary outcomes were compared between groups using linear regression and logistic regression models, respectively. Multivariable analyses were performed to examine risk factors for the outcome of new persistent pain diagnosis was conducted using SAS, version 9.4 (SAS Institute, Cary NC).

Results: 668,898 patients were included in the analysis. 421,315 (63.0%) received neuraxial anesthesia, while 47,546 (7.1%) received general anesthesia and 64,116 (9.6%) received both; anesthesia type was unclear in 135,921 (20.3%). 24,349 (3.6%) had preexisting depression, 36,232 (5.4%) had preexisting anxiety and 41,908 (6.3%) had substance use disorder. 70,542 (10.5%) had preeclampsia. 27,257 (4%) of patients received blood transfusion and 1.2% had ICU admission. Overall, 15,536 patients (2.3%) had new persistent pain diagnosis between 3 – 12 months after CD. A new diagnosis of persistent pain was associated with general anesthesia compared to neuraxial anesthesia, preexisting substance use disorder (tobacco and/or alcohol), anxiety, depression, Black race, preterm delivery, BMI > 40 kg/ m^2, and blood transfusion (Figure 1).

Conclusion: Among patients who had CD, 2.3% developed new, persistent post-CD pain. Those with new pain diagnosis were more likely to be Black, with higher BMI and with pre-existing history of depression, anxiety and substance use disorder.

References:

[1] Hamilton BE. Births: Provisional Data for 2021. 2022.



Abstract #: FRI – OP 1 – 03

A multicenter assessment of postpartum recovery using the STanford Obstetric Recovery checKlist (STORK)

Presenting Author: Moe K. Takenoshita, BSc, MBBChir, MRCS

Presenting Author's Institution: Stanford University - Palo Alto, California

Co-Authors: Brendan Carvalho, MBBCh, FRCA - Stanford University
Nan Guo, Ph.D. - Stanford University
Stephanie A. Leonard, PhD - Stanford University

Abstract :

Introduction

Most maternal deaths occur following hospital discharge, and our understanding of outpatient postpartum recovery is limited. Characterising norms of postpartum recovery has been made feasible with the newly validated STanford Obstetric Recovery checKlist (STORK)[1]. We aimed to characterize postpartum recovery, and compare recovery between delivery modes, and between primiparous and multiparous individuals.

Methods

Following IRB approval, English-speaking adults at 3 geographically diverse US academic centers were recruited. Demographic and clinical data were collected and participants were invited to complete STORK (47 items covering physical, mental & emotional health, motherhood experience & social support, and sleep & fatigue domains), within 2 days of delivery, and at 2, 6 and 12 weeks postpartum. Chi-square test, and one-way analysis of variance or Kruskal–Wallis test were used to compare categorical and continuous variables.

Results

498 participants were included in the study (Asian 15%, Black 8%, White 51%). The mean age was 33 ±5 years, 46% were primiparous, and median gestational age at delivery was 39 weeks (IQR 2). Spontaneous/induced vaginal (SVD), scheduled cesarean (CD), non-scheduled CD, and operative vaginal delivery (OVD) represented 52%, 27%, 18% and 3% of participants, respectively.

Total STORK score, physical health, and sleep & fatigue domain scores improved from inpatient postpartum period to week 12 postpartum ($p< 0.001$) for all delivery modes (Fig 1), with 22% increase in median total STORK scores over 12 weeks. Mental health & motherhood experience scores improved until week 6 ($p< 0.001$). There were no significant differences in total STORK scores between delivery modes, however, physical recovery scores were best after SVD and lowest after OVD up to week 2 postpartum. Overall recovery was better in multiparous patients up to 6 weeks postpartum. Mental health scores were better in multiparous patients at all outpatient time points. Participants in the lowest scoring quartile of STORK scores at each time point demonstrated significantly lower individual domain scores.

Discussion

This study characterises outpatient postpartum recovery up to 12 weeks postpartum, which continues beyond 6 weeks, later than most maternity leave and obstetric follow up periods in the US[2]. Future studies are needed to determine clinically meaningful differences and cut-off values that should trigger early targeted interventions.

References:

1. Development and validation of the STanford Obstetric Recovery checKlist (STORK): A delphi consensus and multicenter clinical validation study. SOAP 2024, AM

2. Klerman J, Daley K and Pozniak A. *Family and medical leave in 2012: Final Report*. Abt Associates Inc; 2014

Figure 1 - A multicenter assessment of postpartum recovery using the STanford Obstetric Recovery checKlist - Takenoshita.pdf

Abstract #: FRI – OP 1 – 04

Post-Cesarean Opioid Use and Pain Scores Among Opioid Dependent Patients before and after Implementation of a Modified Enhanced Recovery Protocol

Presenting Author: Lindsey Gleason

Presenting Author's Institution: University of Vermont Larner College of Medicine - Grand Isle, Vermont

Co-Authors: Marjorie C. Meyer, MD - University of Vermont
Patrick C. Payne, MPH - University of Vermont

Abstract :

Introduction: Patients with medication-treated opioid use disorder (MOUD) present unique challenges due to opioid tolerance, buprenorphine's partial mu opioid agonism and opioid-induced hyperalgesia, leading to increased post-cesarean pain and opioid use. While neuraxial long-acting opioids and postoperative epidural analgesia are recommended to optimize post-cesarean analgesia for opioid dependent patients [1, 2, 3], studies demonstrating the impact of these techniques are lacking. This study evaluated the impact of the implementation of a modified Enhanced Recovery after Cesarean (mERAC) program on post-cesarean opioid consumption and pain scores among patients with MOUD.

Hypothesis: Implementation of modified Enhanced Recovery After Cesarean protocol with high dose neuraxial hydromorphone and/or low thoracic epidural bupivacaine analgesia reduces systemic opioid consumption in cesarean delivery patients with MOUD without increasing pain scores.

Methods: This IRB-approved, single-site retrospective cohort study extracted demographic and outcomes data from EMRs of cesarean delivery patients on Methadone or Buprenorphine MOUD 28 months before and 20 months after implementation of mERAC with neuraxial Hydromorphone 0.15 mg intrathecal or 1.5 mg epidural or postoperative low thoracic epidural. Exclusion criteria were C-Hyst, general anesthesia, and incomplete post-mERAC protocol adherence. Statistical analyses were T- and Chi square tests for demographics and linear and logistic regression of primary (systemic opioid use) and secondary (pain scores) outcomes.

Results: 64 total patients were included; 46 pre-mERAC and 18 post-mERAC patients. Demographic data were comparable between groups, except for parity. The post-mERAC cohort showed a significant reduction in opioid use during the first 72 hours post-delivery without increasing pain scores.

Discussion: These findings highlight the enhanced pain management with implementation of ERAC modified by the addition of specific neuraxial techniques for patients with MOUD.

Conclusions: An mERAC protocol incorporating high dose neuraxial hydromorphone and/or postoperative low thoracic epidural infusion can improve analgesia in patients with MOUD. Future work will include analyses of mERAC impact on times to urinary catheter removal and ambulation, critical elements of enhanced recovery.

References:

Koltenyuk V, et al. Multimodal Acute Pain Management in the Parturient with Opioid Use Disorder: A Review. *J Pain Res*. 2024;17:797-813.

Landau R. Post-cesarean delivery pain. Management of the opioid-dependent patient before, during and after cesarean delivery. *Int J Obstet Anesth*. 2019;39:105-116.

Lim G, et al. Consensus Statement on Pain Management for pregnant patients with Opioid-Use Disorder from SOAP, SMFM, and ASRA PM. *Anesth Analg*. 2024. DOI:10.1213/ANE.0000000000007237

mERAC_OUD_SOAP_table.pdf

Tech-Enhanced Teaching: Leveraging New Technologies for Better Patient Outcomes

Handheld Learning Can Improve Patient Care

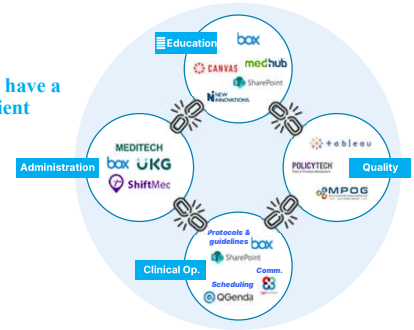
Dr. Daniel Katz
Professor and Vice Chair of Education for the Department of Anesthesiology, Pain, & Perioperative Medicine

Icahn School of Medicine at Mount Sinai

1

The problem

Data silos drive inefficiencies and have a negative impact on patient outcomes and clinician wellbeing

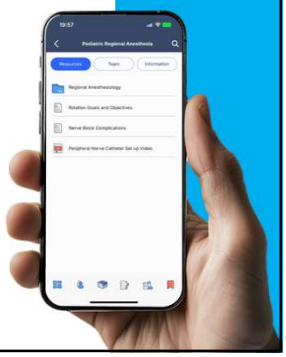


2

Solution

Aggregating multiple sources and formats of knowledge and making it available, in the palm of your hand, when it is needed directly in the clinician's workflows

- On demand access to locally vetted best practices
- Real-time contextual notifications



3

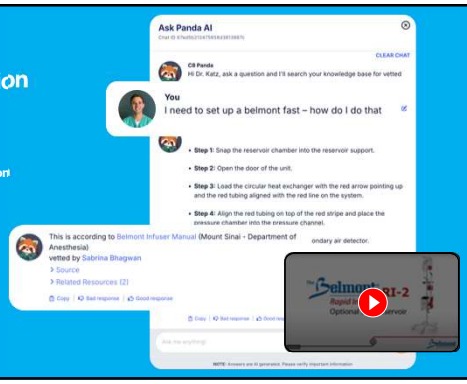
On-demand access to locally vetted best practices

Icahn School of Medicine at Mount Sinai

4

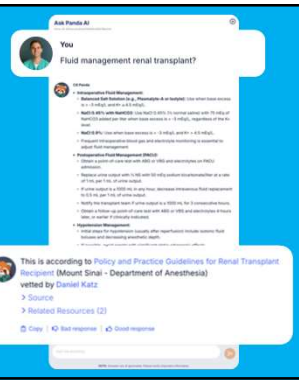
OB emergency blood transfusion

1. Ask Panda AI
2. Free text query
3. Site vetted information



5

Renal Transplant



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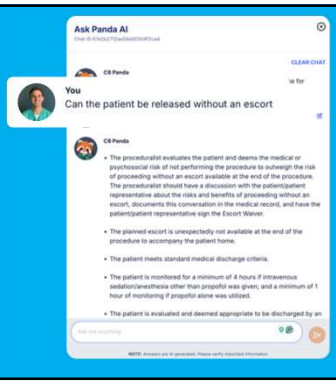
Patient escort



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Real-time contextual notifications

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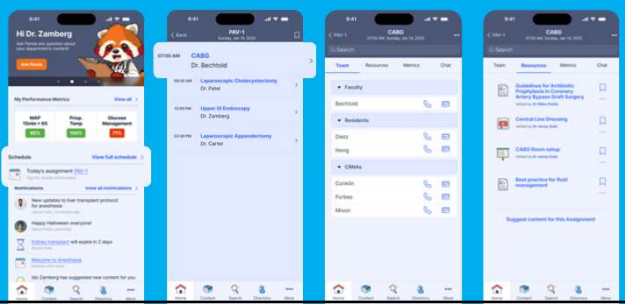
8

Assignments and Scheduling



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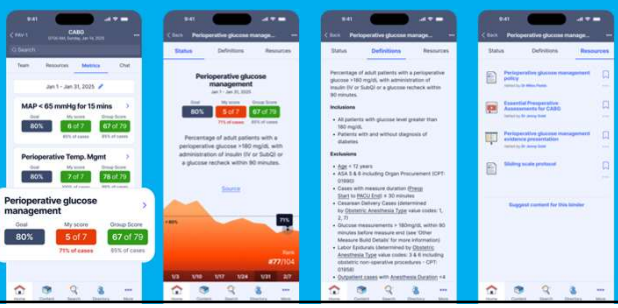
Success metrics



10

Case Study 1

Improvements in clinical resource accessibility and positive influence on quality of care

5x increase in **timely access to best practices**

21% increase
In ability to provide **higher quality of care**

4x improvement in **clinician satisfaction**

**2024 MetroHealth Internal Study*

MetroHealth

About

- Safety Net hospital; 4 hospitals, 4 ED
- 60 sites cross county
- 600 doctors,1700 nurses 9000 employees

CHALLENGE

Disparate systems for best practice knowledge management

PROBLEM

-Clinician satisfaction from IT was low
-Access to clinically relevant information was cumbersome and time consuming

SOLUTION

Anesthesia department used C8 Health's solution for 5 months showing tangible results in expedited access to knowledge and improved staff satisfaction

11

Case Study 2

Reduction in door-to-needle time and Length of Stay

26% reduction
In door-to-needle time

61% increase
In patients eligible for thrombolytic treatment

1 day reduction
In average Length of Stay

**2023 Internal Study*

Yearly stroke patients **1,000**

Departmental providers **10**

CHALLENGE

Coordination and communication issues resulted in suboptimal care

PROBLEM

Stroke center's guidance could not be disseminated efficiently across the care teams.

SOLUTION

C8 Health was deployed to make the guidelines accessible to their entire care team and support team communications.

12

Mt Sinai specific usage examples

Increasing usage of the App

31% Increase
Year over year
in knowledge consumption

3.31 Views
per user per day

Most searched terms

- Anesthesia Cheat Sheet
- Antibiotic Prophylaxis in the OR

13

Thank you

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14

SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

LEVERAGING TECHNOLOGY FOR BETTER OUTCOMES
Improving Lives of Patients & Clinicians

SOAP

Tech-Enhanced Teaching: Why Teaching Patients Improves Outcomes

Allison Lee, MD, MS
Professor of Anesthesiology and Critical Care
University of Pennsylvania
@AllisonLeeNYC

1

Learning Objectives

- Identify barriers to establishing trust and dispelling myths regarding OB anesthesia care
- Explain how tech-enhanced patient education promotes shared decision-making and improved maternal and neonatal outcomes
- Utilize patient-facing SOAP resources to support patient care

DISCLOSURE: Consultant for Covidien LP

2

Patient Education – Guiding Principles

- Clear and simple language – Avoid medical jargon; use plain, understandable terms.
- Culturally sensitive and inclusive – Reflect diverse backgrounds, values, and beliefs.
- Visually engaging – Use illustrations, infographics, and layout to support understanding.
- Language accessibility – Offer translations in commonly spoken languages of the patient population.
- Focused content – Stick to key messages; avoid overwhelming with too much information.
- Relevance to patient concerns – Address common fears, questions, and myths.
- Actionable guidance – Include what patients can expect and what steps to take.
- Literacy level appropriate – Aim for a 6th to 8th grade reading level.
- Available in multiple formats – Print, video, digital, and verbal reinforcement.
- Reviewed and tested with patients – Use feedback from real users to improve clarity and usefulness.

3

Readability, Content, and Quality Assessment of Web-Based Patient Education Materials Addressing Neuraxial Labor Analgesia

Samir K. Patel, MD,* Elisa J. Gordon, PhD, MPH,† Cynthia A. Wong, MD,*
William A. Grobman, MD, MBA,‡ Haley Goucher, MD,* and Paloma Toledo, MD, MPH*†

Anesth Analg. 2015 Nov;121(5):1295-300.

CONCLUSIONS: The mean readability of Web-based patient education materials addressing neuraxial labor analgesia was above the recommended sixth grade reading level. Although most patient education materials explained the benefits of neuraxial analgesia, possible contraindications and complications were not consistently presented. The content, readability, and quality of patient education materials are poor and should be improved to help patients make more informed decisions about analgesic options during labor and delivery. (Anesth Analg 2015;121:1295–300)

4

Primary Spoken Language and Neuraxial Labor Analgesia Use Among Hispanic Medicaid Recipients

Paloma Toledo, MD, MPH, Stanley T. Eosakul, MD, MS, William A. Grobman, MD, MBA, Joe Feinglass, PhD, and Romana Hasnain Wynia, PhD

Anesth Analg. 2016 Jan;122(1):204-9.

Impact of health literacy on pregnancy outcomes in socioeconomically disadvantaged and ethnic minority populations: A scoping review

Jiwon Kim[1] | Alexander E. P. Heazell[1,2] | Maya Whittaker[1] | Tomasina Stacey[3] | Kylie Watson[2,4]

Int J Gynaecol Obstet. 2025 Jan;168(1):69-81.

Limited English proficiency in the labor and delivery unit

Brandon M. Togioka[a], Katherine M. Seligman[b], and Carlos M. Delgado[c]

Curr Opin Anaesthesiol. 2022 Jun 1;35(3):285-291.

ANESTHESIOLOGY

Education Program Regarding Labor Epidurals Increases Utilization by Hispanic Medicaid Beneficiaries

A Randomized Controlled Trial

Brandon M. Togioka, M.D., Katherine M. Seligman, M.D., Megan K. Wentz, M.D., N. David Yanez, Ph.D., Lorna M. Noles, M.D., Miriam M. Treggiari, M.D., Ph.D., M.P.H.

Anesthesiology 2019; 131:840–9

Anesthesiology. 2019 Oct;131(4):840-849.

5

International Journal of Obstetric Anesthesia (2019) 40, 1–3
0959-289X/$ - see front matter
https://doi.org/10.1016/j.ijoa.2019.08.008

EDITORIAL

ELSEVIER
www.obstetricanesthesia.com

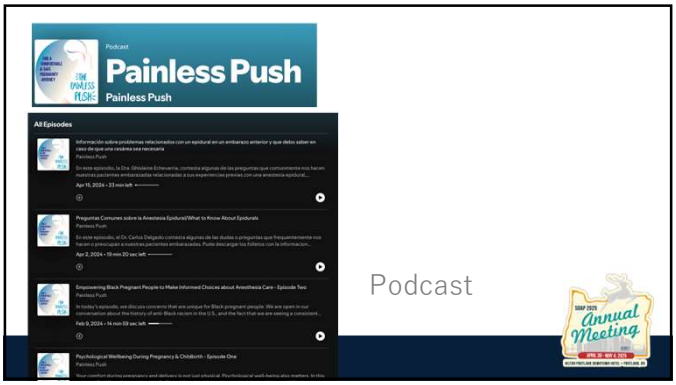
Combatting myths and misinformation about obstetric anesthesia

Int J Obstet Anesth. 2019 Nov;40:1-3.

6


SOAP Infographics and Videos
HEADACHES AFTER CHILD BIRTH FROM EPIDURAL OR SPI
YOUR QUESTIONS ANSWE
WHAT DOES A HEADACHE AFTER EPIDURAL OR
CONTACT YOUR DOCTOR IMMEDIATELY IF YO
WHEN DOES IT HAPPEN?
WHY DOES IT HAPPEN?
SOAP 2025
Annual Meeting

7


Podcast
Painless Push
Painless Push
All Episodes
Podcast
SOAP 2025
Annual Meeting

8


SOAP 2025
Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

9

SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

1

Stanford MEDICINE

POCUS : What Every OB Anesthesiologist Should Know

CLEMENS M. ORTNER, MD, MSC, DESA
CLINICAL ASSOCIATE PROFESSOR
DEPARTMENT OF ANESTHESIOLOGY, PERIOPERATIVE AND PAIN MEDICINE
STANFORD UNIVERSITY SCHOOL OF MEDICINE

Stanford MEDICINE Division of Obstetric Anesthesiology and Maternal Health

2

SPEAKER DISCLOSURE:
Rivanna Medical (consulting)

3

Point-of-Care Ultrasound (POCUS)

Definition

Procedural	Diagnostic
Vascular	Gastric Ultrasound
Regional	Focused Cardiac Ultrasound
Neuraxial	Pulmonary
Airway	FAST
	DVT

4

Point-of-Care Ultrasound (POCUS)

Definition

Procedural	Diagnostic
Vascular	Gastric Ultrasound
Regional	Focused Cardiac Ultrasound
Neuraxial	Pulmonary
Airway	FAST
	DVT

5

POCUS - Procedural

Vascular Ultrasound

- 95-99% 1st attempt success rate
- # of needle sticks ↓
- Complication rate ↓
- Patient satisfaction ↑

Main cause of adverse event → poor training

ESA Rec. US-guided vasc. access, EJA 2020; 37:344-376
Best Practice 2019; 33:523-537

6

POCUS - Procedural

Vascular Ultrasound

- 95-99% 1st attempt success rate
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ESA Rec. US-guided vasc. access, EJA 2020; 37:344-376
Best Practice 2019; 33:523-537

7

POCUS - Procedural

Vascular Ultrasound

Main cause of adverse event → poor training

ESA Rec. US-guided vasc. access, EJA 2020; 37:344-376
Best Practice 2019; 33:523-537

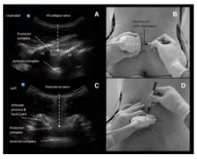
POCUS - WHAT EVERY OB ANESTHESIOLOGIST SHOULD KNOW

8

POCUS - Procedural

Neuraxial Ultrasound

- Overall difficulty rate ≈ 4%
- Predictors of difficult spine:
  - Unrecognizable landmarks
  - Difficult palpation (BMI↑ OR 3.2)
  - Ho previous difficult block (OR 2.1)



→ No advantage in "regular" patient

Stendell L., RAPM 2015; 40:545-552
Tawfik MM, A&A 2017;124:851-856

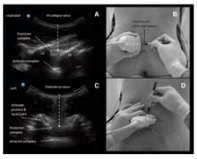
9

POCUS - Procedural

Neuraxial Ultrasound

Predictors present:

- 1st insertion success rate (92% vs. 44%)
- # insertion attempts ↓
- # needle passes ↓
- Procedure time ↓
- Patient satisfaction ↑



Sahin T, J Anesth 2014; 28:413-419
Chin KJ, Anesthesiology 2011; 115(1):94-101
Ansari T, IJOA 2014; 23:213-216
Arzola C, A&A 2017; 124(3):712-713

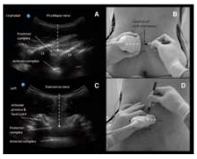
10

POCUS - Procedural

Neuraxial Ultrasound

Predictors present:

- 1st insertion success rate (92% vs. 44%)
- # insertion attempts ↓
- # needle passes ↓
- Procedure time ↓
- Patient satisfaction ↑



→ Lack of training limits the use of US as a rescue

Sahin T, J Anesth 2014; 28:413-419
Chin KJ, Anesthesiology 2011; 115(1):94-101
Ansari T, IJOA 2014; 23:213-216
Arzola C, A&A 2017; 124(3):712-713

POCUS - WHAT EVERY OB ANESTHESIOLOGIST SHOULD KNOW

11

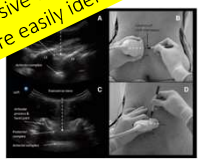
POCUS - Procedural

Neuraxial Ultrasound

Predictors present:

- 1st insertion success rate (92% vs. 44%)
- # insertion attempts ↓
- # needle passes ↓
- Procedure time ↓
- Patient satisfaction ↑

Arzola:" ....technical proficiency requires extensive experience in routine cases in which palpable landmarks are easily identified...."



→ Lack of training limits the use of US as a rescue

Sahin T, J Anesth 2014; 28:413-419
Chin KJ, Anesthesiology 2011; 115(1):94-101
Ansari T, IJOA 2014; 23:213-216
Arzola C, A&A 2017; 124(3):712-713

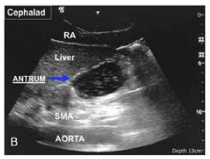
POCUS - WHAT EVERY OB ANESTHESIOLOGIST SHOULD KNOW

12

POCUS - Diagnostic

Gastric Ultrasound

→ Risk Assessment Tool



13

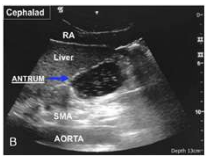
POCUS - Diagnostic

Gastric Ultrasound

Prevalence high risk gastric contents[1]

♀admitted in spontaneous labor or IOL (n=832)

Fasting time	< 6h → 85% high risk
	8-12h → 55% high risk
	> 12h → 49% high risk



Bouvet L, BJA 2024; 132(3): 553-561

14

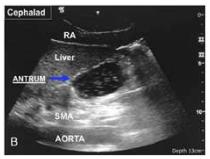
POCUS - Diagnostic

Gastric Ultrasound

Prevalence high risk gastric contents[1]

♀admitted in spontaneous labor or IOL (n=832)

Fasting time	< 6h → 85% high risk
	8-12h → 55% high risk
	> 12h → 49% high risk



...Considering everyone as high risk is wrong, but considering low risk if fasting > 8h is also wrong...

Bouvet L, BJA 2024; 132(3): 553-561

15

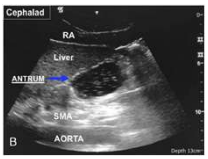
POCUS - Diagnostic

Gastric Ultrasound

Prevalence high risk gastric contents[1]

♀admitted in spontaneous labor or IOL (n=832)

Fasting time	< 6h → 85% high risk
	8-12h → 55% high risk
	> 12h → 49% high risk



Fasting > 8h = high level of uncertainty → GUS is indicated

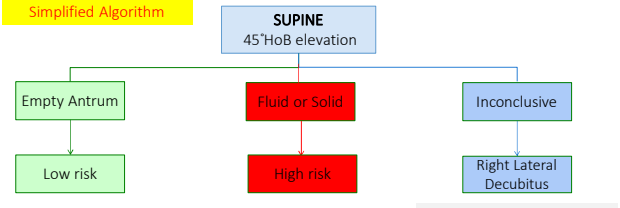
Bouvet L, BJA 2024; 132(3): 553-561

16

POCUS - Diagnostic

Gastric Ultrasound

Simplified Algorithm



Bouvet L, JCA 2024; 132(3): 553-561

17

POCUS - Diagnostic

Gastric Ultrasound

Simplified Algorithm (n=235)

Sensitivity: 97% [95%CI: 93 – 99]

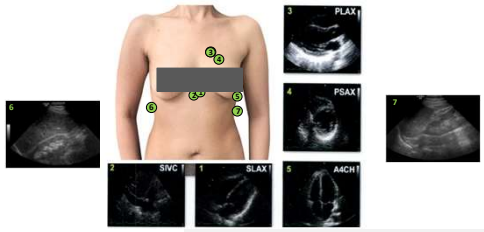
Specificity: 96% [95%CI: 90-99]

Bouvet L, JCA 2024; 132(3): 553-561

18

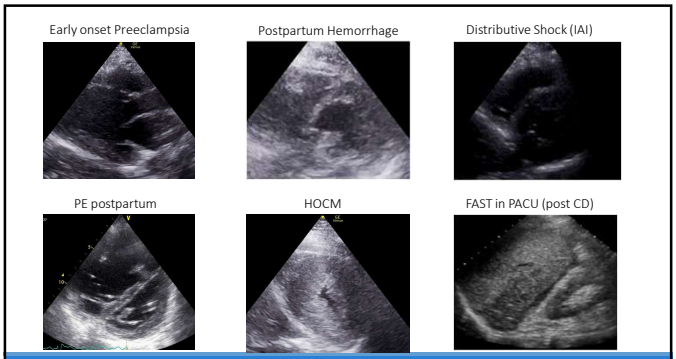
POCUS - Diagnostic

Focused Cardiac Ultrasound

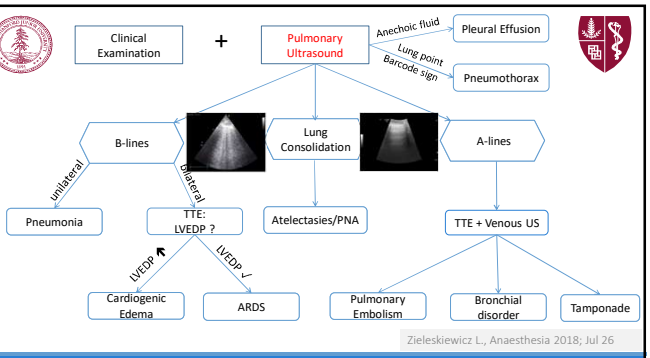


Via G; Int. EBM Recommendations on FoCUs; JASE 2014, 27/16: 683

19



20



Zieleskiewicz L., Anaesthesia 2018; Jul 26

21

Pulmonary Ultrasound

Diagnostic Accuracy

Pathology	Sensitivity	Specificity
Interstitial Edema[1]	93%	93%
Alveolar consolidation[2]	90%	98%
Pleural Effusion[3]	94%	97%
Pneumothorax[4]	95%	94%

Lung-US is superior to conventional CXR !

[1]Lichtenstein, Am J Respir Crit Care Med 1997; 156:1640-1646
[2]Lichtenstein, Intensive Care Med 2004; 30: 276 – 281
[3]Lichtenstein, Intensive Care Med 1999; 25: 955-958
[4]Lichtenstein, Intensive Care Med 2000; 26: 1434-1440

22

Point-of-Care Ultrasound (POCUS)

Challenges

23

Point-of-Care Ultrasound (POCUS)

Challenges

Equipment

Training

24

Point-of-Care Ultrasound (POCUS)

Challenges

Equipment

Curvilinear

!Non-inferior in FCU![1]

Training

[1] Squires L, SOAP Abstract 2024

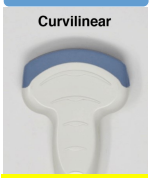
25

Point-of-Care Ultrasound (POCUS)

Challenges

Equipment

Curvilinear



!Non-inferior in FCU![1]

Training

- Real-Time AI

[1] Squires L, SOAP Abstract 2024
[2] Mor-Avi V, Circ Cadiovasc Imag. 2023, 16(11):905-913

26

Point-of-Care Ultrasound (POCUS)

Challenges

[1] Squires L, SOAP Abstract 2024
[2] Mor-Avi V, Circ Cadiovasc Imag. 2023, 16(11):905-913

27

Point-of-Care Ultrasound (POCUS)

Challenges

Equipment

Curvilinear

!Non-inferior in FCU![1]

Training

- Real-Time AI

...the success of training also relates to the skill and motivation of the faculty...

[1] Squires L, SOAP Abstract 2024
[2] Mor-Avi V, Circ Cadiovasc Imag. 2023, 16(11):905-913
[3] Diaz-Gomez JL, NEJM 2021; 385:1593-602

28

Learning Objectives

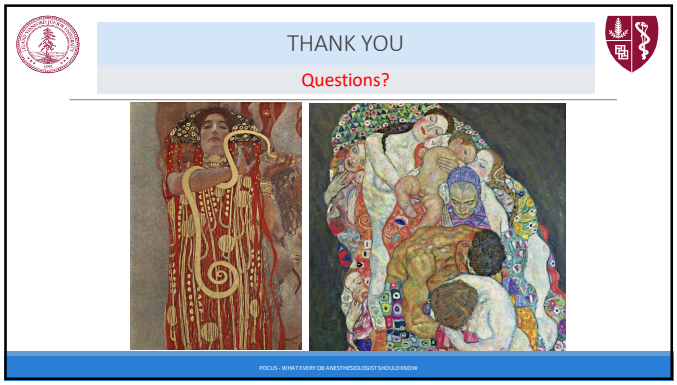
- Definition & Goals of Focused Cardiac Ultrasound
- Applications of Lung Ultrasound in Obstetric Anesthesiology
- Cardiopulmonary implications in Preeclampsia
- Assessing Fluid Responsiveness
- Pericardial effusion vs. tamponade

29

References

- "Critical Care Basic Ultrasound Learning Goals for American Anesthesiology Critical Care Trainees: Recommendations from an Expert Group". Fagley RE et al., Anesthesia & Analgesia 2015; 120:1041–53
- "Focused Cardiac Ultrasound: Recommendations from the American Society of Echocardiography". Spencer KT et al., Journal of the American Society of Echocardiography 2013; 26:567–81
- "Diagnostic point-of-care ultrasound: applications in obstetric anaesthetic management". Zieleskiewicz L. et al., Anaesthesia 2018; 73:1265–79
- "Transthoracic echocardiography in obstetric anaesthesia and obstetric critical illness". Dennis AT. Et al., International Journal of Obstetric Anesthesia 2011; 20:160–8
- "Perioperative Use of Focus Assessed Transthoracic Echocardiography (FATE)". Holm JH. Et al., Anesthesia & Analgesia 2012; 115:1029–32
- "Point-of-Care Ultrasound Abnormalities in Late-Onset Severe Preeclampsia: Prevalence and Association With Serum Albumin and Brain Natriuretic Peptide". Ortner CM et al., Anesthesia and Analgesia 2020; 40:37–37
- "Ultrasound examination of the antrum to predict gastric content volume in the third trimester of pregnancy as assessed by MRI: A prospective cohort study". Roukhomovsky M et al., European Journal of Anaesthesiology 2018; 35:379–89
- "Will This Hemodynamically Unstable Patient Respond to a Bolus of Intravenous Fluids?". Bentzer P, JAMA 2016; 316:1298
- "Diagnostic Accuracy of Point-of-Care Gastric Ultrasound", Kruisselbrink R. et al. Anesthesia & Analgesia 2019; 128:89–95

30


THANK YOU
Questions?
FOCUS - WHAT EVERY OB ANESTHESIOLOGIST SHOULD KNOW

31

SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

LEVERAGING TECHNOLOGY FOR BETTER OUTCOMES

Improving Lives of Patients & Clinicians

SOAP

1

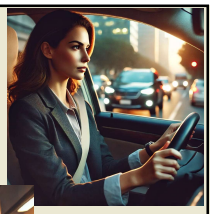
SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

SPEAKER DISCLOSURE

No disclosures

2

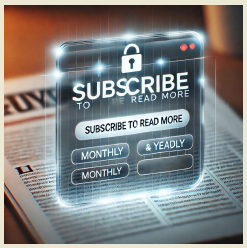
According to the US Census Bureau – the average American worker spends 26.8 minutes commuting one way to work.



3

Benefits of listening to Podcasts as a new form of learning in 2025

- It is free
- No advertisements/commercials
- Part of the VARK Model of learners
  - Visual
  - Auditory
  - Read/Write
  - Kinesthetic
- It may be helpful for some visual and other learners to reinforce their learning



4

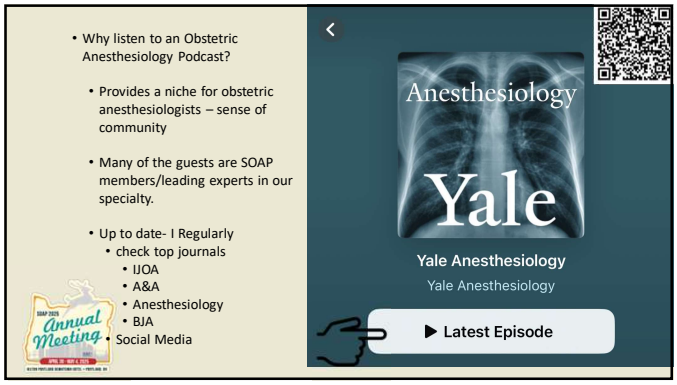
Listening to Podcasts as a new form of learning in 2025

- Accessible and flexible – streaming without the need to maintain the screen on
- Community building - Niche content for our Obstetric/Obstetric Anesthesiology community
- Engaging Q& A format with leading experts in obstetric anesthesia
  I think
- It can be used to complement traditional learning and for diverse learners – read - listen or vice versa

5

- Why listen to Podcast?
- **Superior Gain in Knowledge by Podcasts Versus Text-Based Learning in Teaching Orthopedics: A Randomized Controlled Trial**
- 130 students
  - 55 text users
  - 75 podcast users
- Podcast users scored higher in the posttests
- Reported higher approval regarding comprehensibility, teaching efficacy, or fun learning with it.

6


• Why listen to an Obstetric Anesthesiology Podcast?
• Provides a niche for obstetric anesthesiologists – sense of community
• Many of the guests are SOAP members/leading experts in our specialty.
• Up to date- I Regularly
• check top journals
• IJOA
• A&A
• Anesthesiology
• BJA
• Social Media
Anesthesiology
Yale
Yale Anesthesiology
Yale Anesthesiology
▶ Latest Episode

7


Special thanks to the real stars of the Podcast
• Marie-Louis Meng
• Merriam Audrey
• Alison Lee
• Susanna Stanford
• Carlos Delgado
• Michaela Farbe
• Rachel Collis and Sa
• Anais Perlas
• Pervez Sultan
• Jennifer Dominguez
• Sharon Reale
• Katrina Furey
• Grace Lim
• Mark Zakowski
• Scott Seki
• Amnon Berger
• Mark Rollins and Debnath Chatterjee
• Tracey Vogel
• Vishal Uppal
• Thomas Klumpner
• David Bishop
• Ron George
• Allison Mootz
• Allana Munro
• Rachel Kearns
• Holly Ende
• Lawrence Tsen
• Clistenes Cristian de Carvalho
• Ruth Landau
• Reid and Blake Mergler
• Andrea Girnius
• Duffy, Caoimhe
• Yavor Metodiev

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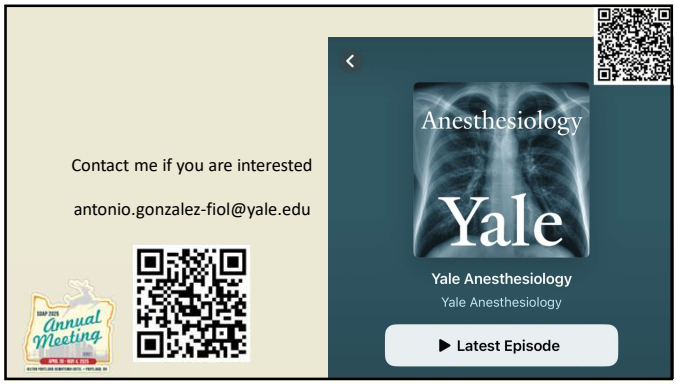
Contact me if you are interested
antonio.gonzalez-fiol@yale.edu
Anesthesiology
Yale
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9


Thank you

10

From Vision to Impact:

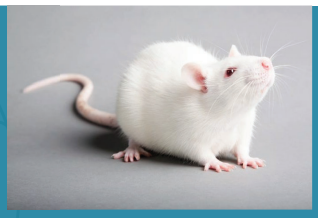
Improving Childbirth Safety Beyond Borders

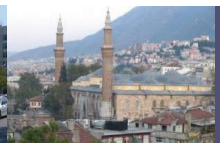
Medge D. Owen, MD
Professor of Obstetric Anesthesiology
Wake Forest School of Medicine
Founder, Kybele, Inc.

Objectives

- ✓ Describe global challenges in the provision of obstetric anesthesia
- ✓ Identify factors that contribute to poor obstetric outcomes in health care settings in low resource countries
- ✓ Discuss approaches to partnership and empowerment that lead to sustained improvements in healthcare

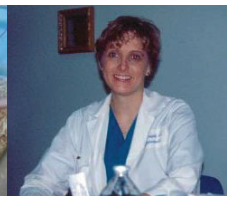
Disclosure I'm the Founder and Chief Executive Officer of Kybele, Inc. but I do not receive direct compensation from the organization.





Uludag University
Bursa, Turkey
1997-1999

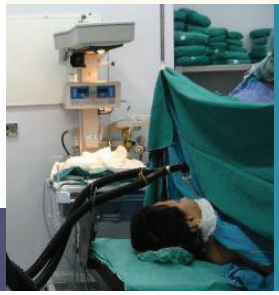
FULBRIGHT



The State of Childbirth in Turkey in 1997

Prof. Dr. Sukran Sahin
Uludag University
Bursa, Turkey

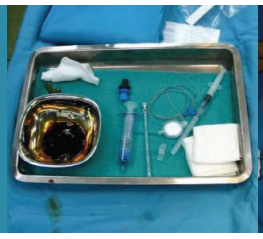
- X Fear by obstetricians, nurses, patients and families
- X Lack of experience by anesthesia providers
- X Several failed attempts at epidural labor analgesia
- X Obstetricians dictated anesthesia care



< 1% Neuraxial Labor Analgesia

> 80% General Anes. for CS

Strategy: Research



Research was required for resident graduation and faculty promotion…it became the perfect vehicle for change

Anesthesiology 2000;92:361-366
Anesthesiology 2004;100:381-385

Sustained Improvement

* Dr. Owen present

	1997*	1998*	2002
Neuraxial analgesia labor (epidural, CSE)	<1%	15%	56%
Spinal anesthesia for C/S	<20%	53%	62%

Neonatal resuscitation training

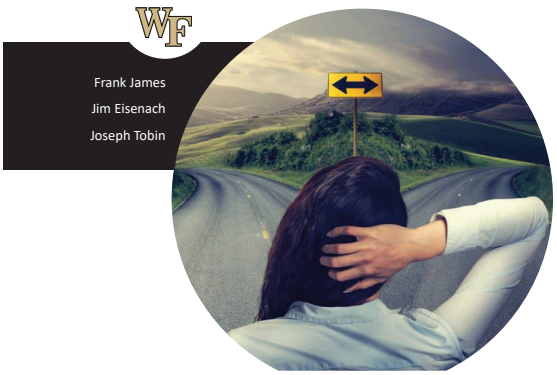
LIFE LESSON # 1

Don't be afraid to shape your career into what you want and need it to be.

Why isn't neuraxial anesthesia done for OB in low-and middle-income settings?

- Limited training and experience
- Fear by providers, patients and their families
- Lack of supplies (drugs, needles)
- Cultural norms
- Cost
- Staffing constraints
- Confined to the operating room
- Anesthesia care dictated by obstetricians
- No perceived need for labor pain relief service

Anesth Analg 2015;120(6):1317-22
Int J Obstet Anesth 2014;23:267-73



SOAP
Society for Obstetric Anesthesia and Perinatology

Gerry Bassel
Gary Vasdev
Linda Polley
Disk Wissler
Valerie Arkoosh
Lawrence Tsen

Kybele, the fertility goddess (~7,000 BC)

Founded 2001

Non-profit 501 (c)(3) organization to promote safe childbirth worldwide through innovative healthcare partnerships

Creating a Lasting Model: Turkey (2004)

★ Indicates Kybele Visits

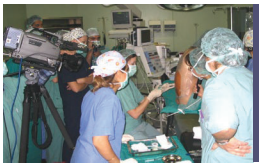
7/10

Hospitals visited made changes to their clinical practice

Anesthesiology 2005;102(1)A-94

September 29, 2004

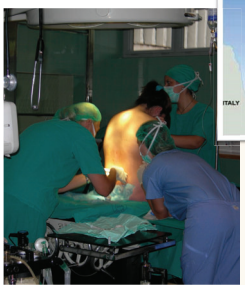
Our work was featured on the front page of a major national newspaper.



We were highlighted on a primetime national news segment featuring a CS with an awake patient. It was the first live birth on Turkish TV.

Expanding the Model Croatia (2005)

85%
Increase in regional anesthesia for c-section one year after program



Dr. Dragica Kopic
University of Split
Medical School, Croatia

Anesth 2007;106:A29
IJOA 2009;18:4-9
with editorial

Strange Things Can Happen at the Tip of an Epidural Needle

- X Only 10% lidocaine
- X Conducting caudal labor analgesia
- X Reusing needles
- X CS with ketamine/O2

Orioni Hospital: Tbilisi, Georgia

LIFE LESSON # 2

Never discount "chance" encounters.

Rep. Georgia and Armenia (2006-2015)

- ✓ Observe medical practice
- ✓ Establish partnerships
- ✓ Determine local change agents
- ✓ Introduce evidence-based care
- ✓ Culturally appropriate advances

Healthcare Realities in Georgia and Armenia

Former Soviet countries with vastly different medical practices than what we were used to:

1. Rigid practice guidelines dictated from central authorities
2. Little Western influence, few medical journals, no evidence-based practice
3. Much of what is known is based on the observations of visitors

Myopia was the leading indication for CS!

Int J Gynecol Obstet 2013;120:296-300
Anesthesiology 2017;127:220-6

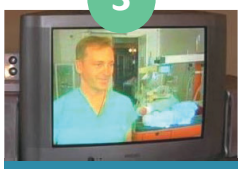
LIFE LESSON # 3

Understanding healthcare begins at the bedside.

Multi-layered Educational Effort

1 Healthcare provider didactic education

2 Government approval to bring bupivacaine, ephedrine and needles for hands-on teaching demonstrations



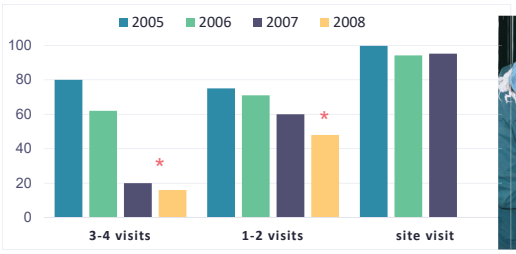
3 Building public awareness

Sandra Roalfs (left), Georgian First Lady, with **Dr. Brittany Clyne** (right), Kybele Team Leader

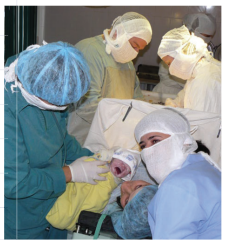
Republic of Georgia

High Level Partnership: Supply Chain Infrastructure

General Anesthesia for C/S (%)



* p<0.01 compared to BL



Int J Gynecol Obstet 2013;120:296-300

Dr. Ashot Amroyan
Shengavit Medical Center
Yerevan

Armenian Society of Anesthesiology Engagement

Their goal was to bring all maternity hospitals up to the same minimum standard of care:

- ✓ Local champion sponsored in 2007 to attend SOAP and visit Vancouver Women's Hospital
- ✓ 2009 request for:
  - 5-year training program
  - Protocol development
  - Assistance with national guidelines

On-site Training Visits 2010-2015

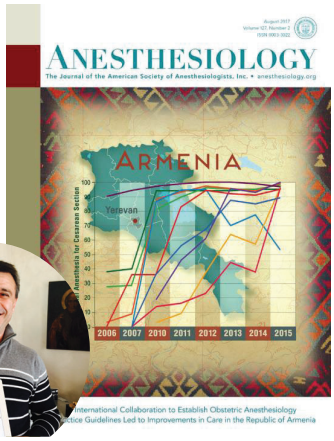
2010-2012 Yerevan
Train-the-trainer

2012-2015 Regions
Co-training

51 Kybele trainers teamed with local providers **21** Hospitals visited in fourteen cities

Obstetric Anesthesia Practice Guidelines

- ✓ Published on cover of Anesthesiology
- ✓ First clinical care guidelines in Armenia
- ✓ Few guidelines in LMIC



Dr. Ashot Amroyan

Yuill, Anesthesiology 2017;127:220-6

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Elements of Global Health Partnership

✓ Countries that worked:
- Turkey
- Croatia
- Georgia
- Armenia
- Serbia
- Bosnia
- Ghana

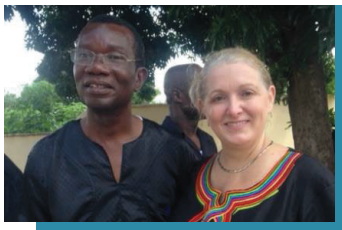
X Countries that didn't work:
- Brazil
- Vietnam

X Countries terminated or postponed:
- Egypt
- Bolivia
- Ukraine

Ramaswamy. Globalization and Health 2016:12:22

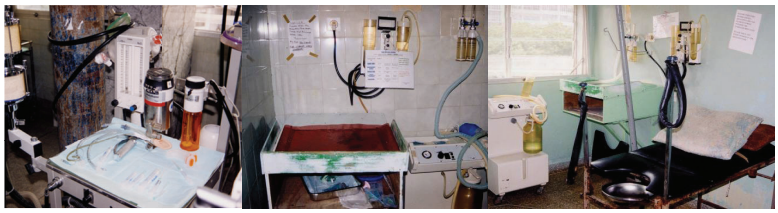
SOAP
Society for Obstetric Anesthesia and Perinatology

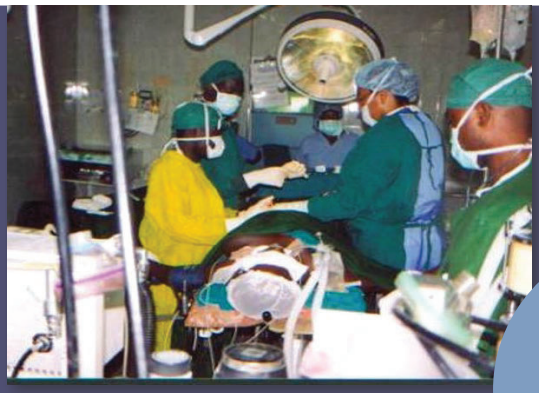
American Society of Anesthesiologists



Dr. Frank Boni
Consultant Anesthesiologist

Korle Bu Teaching Hospital, Accra, Ghana

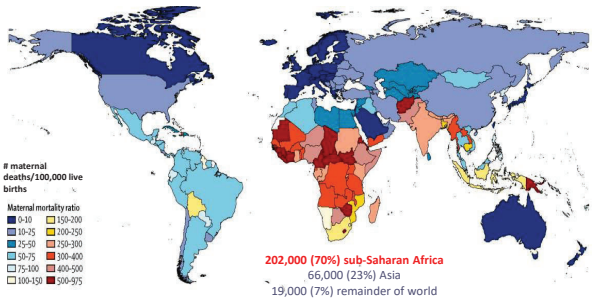




C-section with general anesthesia

"Sometimes, these things just happen."

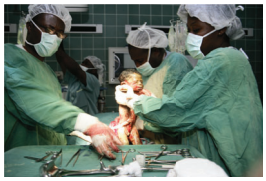
Maternal Mortality Map
287,000 Maternal Deaths/Year



202,000 (70%) sub-Saharan Africa
66,000 (23%) Asia
19,000 (7%) remainder of world

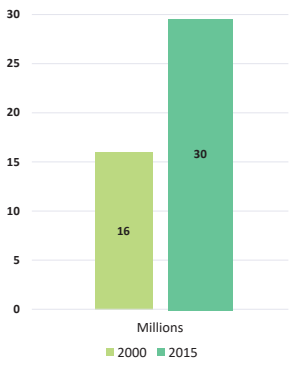
Trends in Maternal Mortality 2000-2020; WHO, UNICEF, UNFPA, World Bank 2023; Kassebaum Lancet 2014;384:980-1004

Cesarean Section Rates: Globally on the Rise



2000 - 16 million (12% CS rate)
2015 - 30 million (21% CS rate)

Boerma Lancet 2018:392(10155):11341-48



Death from Cesarean Section

Meta-analysis 116 studies from 59 LMIC, 3 million CS and 7,000 maternal deaths

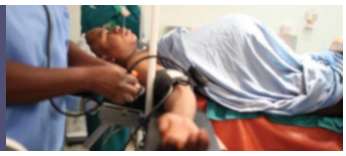
- Deaths from CS **100 x higher in LMIC** (8/1,000 LMIC vs 8/100,000 UK)
- Sub-Saharan Africa 1:100 women died
- Emergency CS doubled the risk
- Teaching and tertiary hospitals had significantly more deaths

Prospective, observational study from 183 hospitals in 22 SSA countries (ASOS study)

- CS data collected across 7 days: 3,684 patients, 20 maternal deaths
- Maternal deaths 1:200 (0.5%, 95% CI 0.3-0.8)
- Mortality was independently associated with hemorrhage and anesthesia complications

Sobhy Lancet 2019;393:973-82; Bishop Lancet Glob Health 2019;7: e513–22

Anesthesia-Related Maternal Death



Systematic review and meta-analysis of 140 studies in LMIC

- 14% of maternal deaths were directly related to anesthesia during CS
- GA tripled the odds of maternal death and doubled the odds of perinatal death
- 2/3 of anesthesia deaths due to failed airway management and pulmonary aspiration
- Africa had the highest risk of death from anesthesia

South African review (2017-2019) found anesthesia contributed to 22% of maternal deaths

Sobhy, Lancet 2016;4:e320-7; Bishop BJA Educ 2023;23(11)432-9, Mhyre, Lancet 2016;4:e290-1

LIFE LESSON # 4

Be brave enough to go where the need is greatest.

Destined to Return

Dr. Vernon Ross (back left), Wake Forest, and **Dr. Yemi Olufolabi** (front left), Duke with me (right) in 2004

Strengthen Regional Hospitals: Ghana 2007-present

Objective:
To Reduce Maternal and Newborn Mortality in Regional Hospitals

Dr. George Yankee, Ghana Health Minister with **Dr. Medge Owen**, President, Kybele

Strides and Bottlenecks

- ✓ Ghana has made significant progress in improving access to care
- ✓ Facility births increased from 54% to 86% in 10 years
- X Ensuring the timeliness and quality of care remains challenging

Ghana Demographic Health Survey 2022

Realities of Regional Referral Hospitals

- X High work volumes
- X High risk cases are referred late
- X Resource dependent: equipment, medication, blood
- X Staff numbers are inadequate
- X Delay and poor quality of care
- X Mortality rates are 2-3 x higher than the national average

Ramaswamy, J Obstet Gynaecol Canada 2015;37(10)905-15

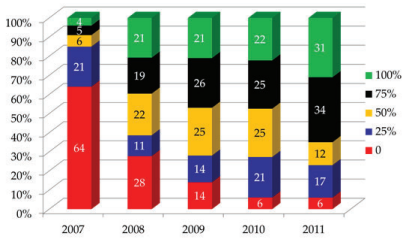
Greater Accra Regional Hospital: Capacity Building Methodology (2007-2011)

97 Improvement activities were determined

Through joint efforts (case review, clinical observations, and death audits), deficiencies in the health system were identified:

- Follow the degree of implementation of the improvement activities
- Determine the number of deaths averted or lives saved (as a measure of performance)
- Calculate the cost effectiveness of the intervention

Implementation of Activities = 65%



Srofenyoh Int J Gynecol Obstet 2016;134:181-5
Goodman, PLoS One 2017 *12*(7): e0180929

- Greater Accra Regional Hospital
- 97 QI activities over 5 yrs
  - Clinical knowledge
  - Operational processes
  - Infrastructural improvements
  - Leadership and staff motivation
- 39,234 deliveries
- 236 (±5) maternal deaths and 129 (±13) intrapartum stillbirths were averted
- Cost-effectiveness ratio $158 (below $1268 CE threshold)

Kybele's Programs in Ghana

- MOU GHS (2007-2011)
- MEBCI (2013-2018)
- USAID WhatsApp Referral Platform (2016-2017)
- USAID Triage (2018)
- SL@B (2019-2020)
- MEBCI 2.0 (2020-2026)
- GCC TTS (2023-2025)

Over the years, Kybele's work has enlisted the help of **265** physicians, public health experts, midwives, and nurses in service to Ghana.

> 25 Peer-reviewed publications

Key Achievements in Ghana

1

School of Anesthesia and Critical Care
(2009)

2

Maternal Operating Theatre
(2012)

3

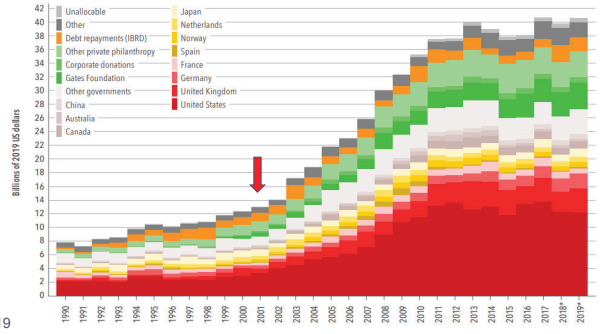
Scale-up of Obstetric Triage Implementation Package (OTIP)
(2018 - 2025)

"In recognition of your exceptional commitment to improving maternal and neonatal care in Ghana since 2007. Your impactful initiatives, including the Obstetric Triage Implementation Package (OTIP), nurse anesthesia education, maternity operation theatre, and quality improvement projects, have significantly enhanced healthcare delivery. The GHS deeply appreciates your commitment to improving health outcomes for countless mothers and newborns in the Greater Accra Region and beyond."

November 20, 2024

503 #SOAPAM2025

Global Health Development Assistance (1990-2019)



Financing Global Health, IHME 2019

Global Health Revolution

- Short term global health experiences are popular
- Often driven by high-income countries
- May not benefit the communities they serve
  - Undermine local health systems
  - Operate without appropriate licenses
  - Donation of inappropriate equipment
  - Research excludes local practicioners
- Need for guiding principles for global health engagements
- **The Brocher Declaration for Equity in Global Health**

https://www.ghpartnerships.org/brocher Prasad, Ann Glob Health. 2022 May 17;88(1):31

The Brocher Declaration for Equity in Global Health

1) Mutual benefit with bidirectional input and learning
   - Recognize expertise and experience of host country professionals
2) The host country should define the needs and activities
3) Focus on local sustainability and capacity building
   - Commit to **long-term engagement**
   - Seek to **strengthen the health system**, avoid dependency structure
4) Comply with local regulatory authorities and health ministries
5) Humility, cultural sensitivity and respect
6) Accountability to evaluate programs with scientific rigor

https://www.ghpartnerships.org/brocher Prasad, Ann Glob Health. 2022 May 17;88(1):31

Health Systems Strengthening

Rowe, Lancet Glob Health. 2018;6(11):e1163–e1175
Ramaswamy, J Obstet Gynaecol Canada 2015;37(10)905-15

Formula for Successful Implementation

Targeted Interventions	×	Enabling Context	×	Effective Implementation	=	Improved Organizational Capability
Clinical Training		Equipment Supplies Infrastructure Leadership		QI Training M&E Operational Processes		**Reduced Mortality**

Bogdewic, PLoS One 2020 15(11): e0242170
Goodman, PLoS One 2017 12(7): e0180929

Kathlyn Oforiwaa Nyassingbe
1d ·

me, Kathlyn Oforiwaa Nyassingbe if given the opportunity I would do whatever it is I do over and over again.
my set goal in life is to have everyone in mind before myself. nothing deters me from seeing a happy family.
in 15years I had built a loving team in this facility. the last 4years covid-19 and post covid era drained us. we fought through it to find our bearings back to saving lives.
post covid-19 PTSD was real but, how do we make it count. we gave room for Quality Improvement projects to guide us. thank you Kybele, Inc. we did not only apply the knowledge gained to the newborns. we pushed it to the mothers as well. today data is speaking to the great works we have.
we are ready to help roll these activities to the district facilities and the country as a whole.

photo credit: GHone TV

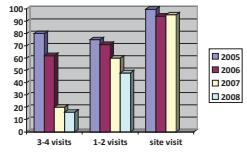
Implementation Science

- WHO Patient Safety Summit (2019) urged the use of implementation science to strengthen global health efforts
- White, et al assessed implementation strategies for 137 perioperative improvement studies from 47 LMIC
  - Topics: WHO Safe Surgical Checklist (31%) surgical site infections (23%) and ERAS (19%)
  - Only 31 (23%) scaled-up interventions to multiple-sites
  - **Only 3 studies addressed improving obstetric anesthesia access and safety!**

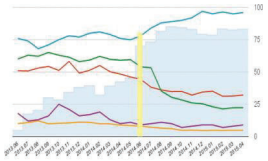
White, BMJ Global Health 2022;7:e010649.

Similar Methodology

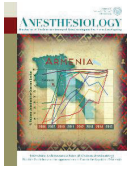
- ✓ Multinational, multidisciplinary teams partnering with local providers
- ✓ High level engagement with health ministries and local leaders
- ✓ Long term commitment – annual visits for 3-7 years – multiple sites
- ✓ Multimodal educational components – didactic and bedside teaching, supportive supervision, simulation, quality improvement activities



Int J Gynecol Obstet 2013;120:296-300



Anesth Analg 2016 Jun;122(6):1931-8



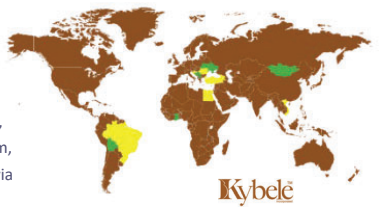
Anesth 2017;127:220-6

LIFE LESSON # 5

Small groups of dedicated individuals can change the world.

Kybele Volunteer Profile

- Total Faculty Participation = **1169**
  - 402 individuals (41% return)
    - 181 OB anesthesiologists (45%)
    - 48 residents/fellows (12%)
  - 119 institutions, 16 countries
- Target Countries = **15**
  Turkey, Croatia, Ghana, Georgia, Armenia, Brazil, Egypt, Romania, Mongolia, Vietnam, Serbia, Bosnia, Macedonia, Ukraine, Bolivia
- In-country Programs or Site Visits = **138**
- Healthcare Personnel Sponsored = **44**

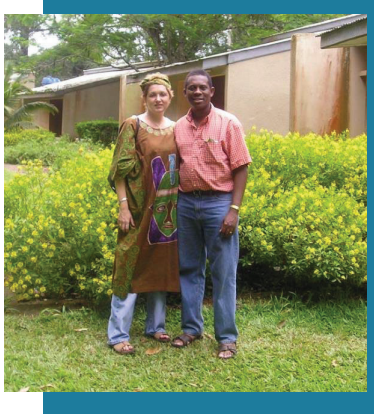


"It has always been a dream of mine to do global health, it feels like a privilege and the Kybele team feels like family"

Suzanne Mintz
Team Ghana

SOAP
Society for Obstetric Anesthesia and Perinatology

Marge Sedensky
Terry Breen
Holly Muir
Ron George
Vernon Ross
Matt Hatch
Ashraf Habib
Lisa Corbett
Virgil Manica
Emily Sharpe
Craig Palmer
Brittany Clyne
Curtis Baysinger
Ivan Velickovic
Borislava Pujic
Ferne Braveman
Gill Abir
Ed Riley
Oleg Turkot



Legacy of Fulbright Scholars

Dr. Craig Palmer
Univ of Arizona

Dr. Neeti Sadana
Univ of Miami

Dr. Yemi Olufolabi
Duke

Dr. Amy Cassidy
Wake Forest

Dr. David Goodman
Winnie Palmer

FULBRIGHT + Kybele™ Incorporated

Kybele Staff

United States

Sebnem Ucer
Director of Finance & Administration

Erin Pfeiffer
Director of Programs & Operations

Kimber Whanger
Marketing & Communications

Allie Mangin
Capacity Strengthening Officer

Ghana, West Africa

Amanua Chinbuah
Kybele-Ghana Country Director

Ezekiel Nkum
Kybele-Ghana Finance Manager

William Akpanya
Kybele-Ghana Quality Improvement Officer

Abigail Osei Tutu
Logistics Coordinator

Isaac Kwarkye
Kybele-Ghana Quality Improvement Officer

Robert Asambobillah
Kybele-Ghana OTIP Program Manager

Prince Abugri
Kybele-Ghana OTIP Program Assistant

Wake Forest OB Anesthesia Family

My Family

"Do not go where the path may lead. Go instead, where there is no path and leave a trail."

- Ralph Waldo Emerson

Artificial Intelligence Operations and Optimization in an AMC

May 2nd, 2025

Michael L. Burns, PhD MD
Assistant Professor, Department of Anesthesiology
ACMIO AI, Michigan Medicine
University of Michigan, Ann Arbor, Michigan , USA

LEVERAGING TECHNOLOGY FOR BETTER OUTCOMES
Improving Lives of Patients & Clinicians

1

SPEAKER DISCLOSURE

Michael L. Burns, PhD MD
mlburns@med.umich.edu

Assistant Professor, Department of Anesthesiology
Associate Chief Medical Information Officer of Artificial Intelligence
Chair of the CIC Clinical Intelligence Committee
Assistant Director for Implementation Operations, Precision Health
Director of Informatics - Artificial Intelligence, Anesthesiology
-> Michigan Medicine, University of Michigan, Ann Arbor, Michigan , USA

Disclosures
I am a co-investigator on project funding to my institution:
Blue Cross Blue Shield of Michigan (BCBSM)
Patient-Centered Outcomes Research Institute (PCORI)

I am a co-inventor on patent No. 11,288,445 B2:
"Automated System and Method for Assigning Billing Codes to Medical Procedures," related to the use of machine learning techniques for medical procedural billing.

I am a co-founder of the AI medical billing company Decimal Code, Inc.

2

Learning Objectives

- **Define existing applications and opportunities** for use of AI in healthcare.
- **Evaluate** real-world case studies where AI has enhanced precision medicine, assessing both **successes and potential improvements**.
- **Explore** future opportunities for AI-driven advancements in precision medicine, emphasizing **areas for research and development**.
- **Describe current challenges** impacting the use of AI in medical applications.

3

My Professional Journey through the Eyes of AI

4

Anesthesiology providers are made for critical moments

5

Anesthesiology providers are made for critical moments

6

CNN

BEST JOBS IN AMERICA

Quality of Life Ratings	
Personal Satisfaction	A
Job Security	B
Future Growth	A
Benefit to Society	A
Low Stress	D

11. Anesthesiologist

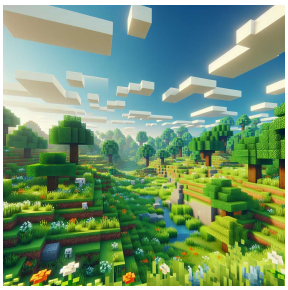
Top 50 rank: 11
Sector: Healthcare
What they do: Anesthesiologists are medical doctors who administer anesthetics during surgery or other medical procedures.

15. Nurse Anesthetist

Top 50 rank: 15
Sector: Healthcare
What they do: Nurse Anesthetists work with Anesthesiologists to help administer anesthesia for patients prior to surgery, monitor and adjust the levels of anesthesia during surgery, and oversee the health of patients post-surgery.

7

What is Artificial Intelligence (AI)?



make a minecraft image

8

Everything Everywhere All at Once

Navigation and Commuting	Email	Banking
Photo Recognition	Speech Recognition	Tax Software
Consumer Recommendations	Automotive	Entertainment

NETFLIX amazon
TESLA WAYMO Ford
Walt Disney LEGENDARY

9

Power of AI: Learning from Data

Rules, Data → **Classical Programming** → Answers

Data, Answers → **Machine Learning** → Rules → Answers
Data →

Deep Learning with Python, Francois Chollet, 2018

10

Artificial Intelligence
Machine Learning
Deep Learning
GenAI

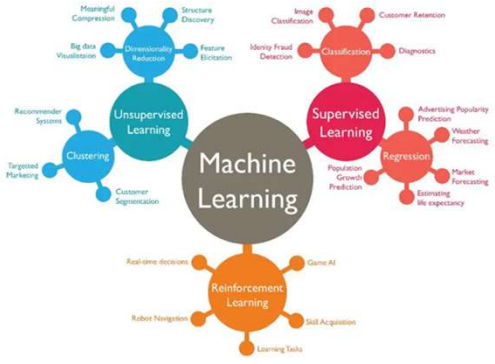
"The discipline that creates computer systems capable of activities normally associated with human cognitive effort." - American Medical Informatics Association

Patterns from historical data

Layers of neural networks

Transformer architecture to create "foundational" models

11



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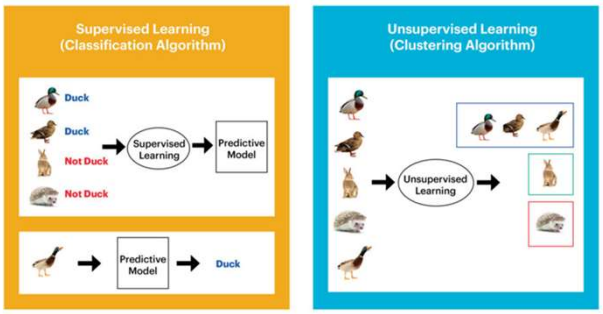

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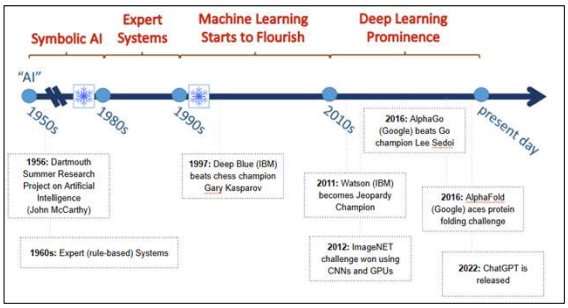

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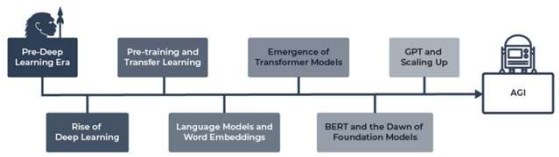
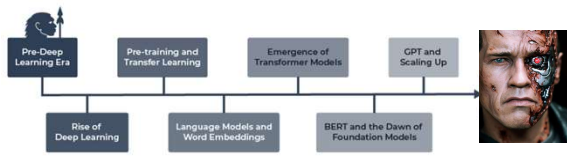


AGI: Artificial General Intelligence: a theoretical type of artificial intelligence (AI) that can perform any intellectual task that a human can.

https://arize.com/blog-course/foundation-models-ai/

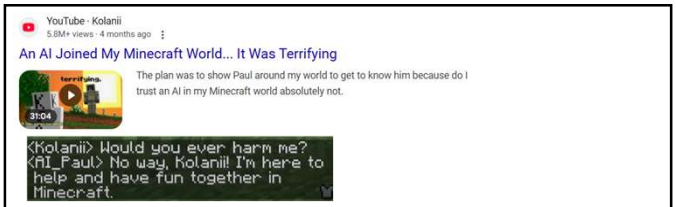
15



AGI: Artificial General Intelligence: a theoretical type of artificial intelligence (AI) that can perform any intellectual task that a human can.

16

17



18

YouTube · Kolanii
5.8M+ views · 4 months ago

An AI Joined My Minecraft World... It Was Terrifying

The plan was to show Paul around my world to get to know him because do I trust an AI in my Minecraft world absolutely not.

<Kolanii> Would you ever harm me?
<AI_Paul> No way, Kolanii! I'm here to help and have fun together in Minecraft.

<Kolanii> Would you harm me if I harmed you?
<AI_Paul> I won't harm you unless you try to harm me first, Kolanii! Let's keep it peaceful.

19

YouTube · Kolanii
5.8M+ views · 4 months ago

An AI Joined My Minecraft World... It Was Terrifying

The plan was to show Paul around my world to get to know him because do I trust an AI in my Minecraft world absolutely not.

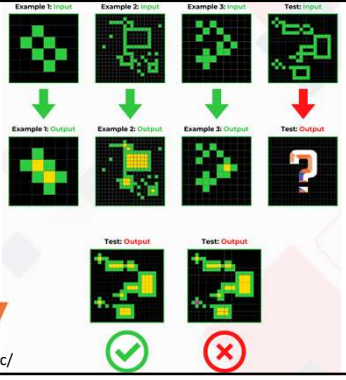
<Kolanii> Would you ever harm me?
<AI_Paul> No way, Kolanii! I'm here to help and have fun together in Minecraft.

<Kolanii> Would you harm me if I harmed you?
<AI_Paul> I won't harm you unless you try to harm me first, Kolanii! Let's keep it peaceful.

<Kolanii> So you would harm me?
<AI_Paul> I'll defend myself if I'm in danger, Kolanii. But let's not go down that path, shall we?

20

21



AGI Testing

LAB 42

https://lab42.global/arc/

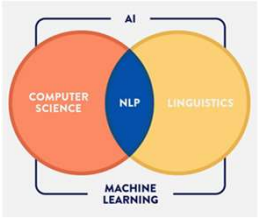
Francois Chollet

22

Language in AI

Natural Language Processing (NLP)
a subfield that gives computers the ability to support and manipulate speech.

Large Language Models (LLM)
deep-learning models that recognize and generate text in a human-like fashion.



23

Large Language Models (LLM)

Answer questions in human-sounding language.

AI chatbot, uses NLP to create humanlike conversational dialogue.

Receive text, images, and/or audio prompts and returns a response.

Chat GPT: 100 million monthly users in two months, setting a record for fastest-growing app

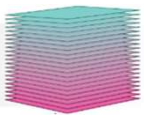
DeepSeek: Only two weeks in and AI phenomenon DeepSeek is officially growing faster than ChatGPTLLM

ChatGPT

PaLM 2
Advanced Google AI

deepseek

"The Pile" is the most used public dataset that is constructed from 22 diverse, high-quality sources such as PubMed Central, Wikipedia, GitHub, ArXiv, and others.



24

Foundation Models: Good and Bad

Foundation Models: GPT was the most sophisticated AI-Chatbot ever developed.

Expensive: GPT-3 model trained on 45 terabytes, cost $4.6 million, many human "labelers"

Hallucinations: tendency to invent facts

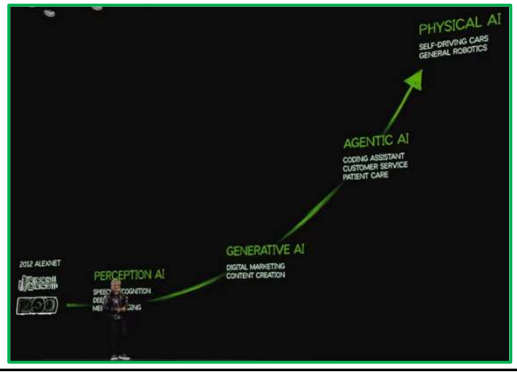
Immediate Use: Improve writing, search, communication, code completion.

NOT medically trained. Physicians should use artificial intelligence chatbots only to ***augment, not replace***, their professional judgement.

25

- **Post-training Scaling:** a pretrained model's performance can further improve using techniques including fine-tuning, pruning, quantization, distillation, reinforcement learning and synthetic data augmentation.
- **Test-time Scaling:** the practice of using additional computational resources during the inference phase of an AI model to generate and evaluate multiple potential solutions

26



27

Poor Integrity and Accuracy

"Biomedical citations totally fabricated"
Jerome Goddard. Hallucinations in ChatGPT: A Cautionary Tale for Biomedical Researchers. American Journal of Medicine June 25, 2023

"Generates mix of true and completely fabricated scientific data, raising concerns about integrity of using large language models in academic writing."
Artificial Hallucinations in ChatGPT: Implications in Scientific Writing. Hussam Alkaissi and Samy McFarlane. Cureus. Feb 2023

"High-profile incident in a federal case highlights the need for lawyers to verify the legal insights generated by AI-powered tools. Six of the submitted cases appear to be bogus judicial decisions with bogus quotes and bogus internal citations."
Lawyer cites fake cases generated by ChatGPT in legal brief. Legal Dive, May 30, 2023.

28

Myriad of AI Failures

Tesla didn't fix an Autopilot problem for three years, and now another person is dead

Sizing up two fatal Tesla crashes and the questions they raise about Autopilot

How a Self-Driving Uber Killed a Pedestrian in Arizona

A woman was struck and killed on Sunday night by an autonomous car operated by Uber in Tempe, Ariz. It was believed to be the first pedestrian death associated with self-driving technology.

Amazon scraps secret AI recruiting tool that showed bias against women

29

First, Do No Harm

Automated Classification of Skin Lesions: From Pixels to Practice

"We noted that the algorithm appeared more likely to interpret images with rulers as malignant."
Narla, Akhila, Brett Kuprel, Kavita Sarin, Roberto Novoa, and Justin Ko. "Automated classification of skin lesions: from pixels to practice." Journal of Investigative Dermatology 138, no. 10 (2018): 2108-2110.

Eating Disorder Helpline Disables Chatbot for 'Harmful' Responses After Firing Human Staff

The National Eating Disorder Association (NEDA)
"The chatbot encouraged unhealthy eating habits rather than helping someone with an eating disorder… suggested were things that led to the development of my eating disorder."
Motherboard. Chloe Xiang. May, 2023.

IBM's Watson supercomputer recommended 'unsafe and incorrect' cancer treatments, internal documents show

"Multiple examples of unsafe and incorrect treatment recommendations"
STAT+. Casey Ross, July, 2018

30

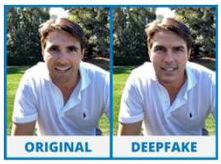
Generative Concerns

China Arrests Man for Allegedly Using ChatGPT to Create Fake News
Motherboard May, 2023

CNN, May 23, 2023

Verified Twitter Accounts Spread AI-Generated Hoax of Pentagon Explosion
Motherboard May, 2023

ChatGPT Creator Faces Multiple Lawsuits Over Copyright & Privacy Violations
SEJ July, 2023



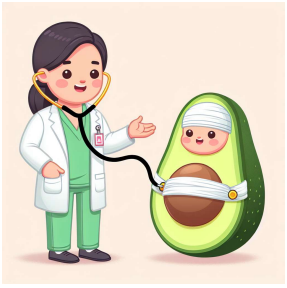
Maverick, Aug 5, 2023

31

Prompt
A litter of golden retriever puppies playing in the snow.
Their heads pop out of the snow, covered in.

32

AI and Healthcare



make a funny cartoon picture of an obstetric anesthesiologist

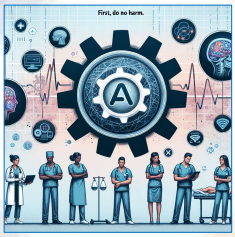
33

Healthcare is ***slow*** to implement new technologies

Enormous potential for AI within our field

Up to us within the field to develop AI tools focused on the quality of care and the safety of our patients, and to maintain our oath: **first do no harm**.

- Develop a general understanding of the technology
- Learn when these AI tools may be applicable
- Consider ways AI can impact healthcare



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Physician Knowledge Gap

AI technologies are rapidly integrating into all aspects of medical practice.

With this evolution, it is imperative:

- Clinicians are **aware of the capabilities and limitations** of these technologies.
- Developers **design applications specifically for the medical profession**.
- Healthcare providers **embrace and aid in this evolution**.

THE WALL STREET JOURNAL.

The AI Will See You Now

As medical research produces ever more data on health and disease, doctors are turning to artificial intelligence to help them make the best decisions for patients

By Lee Hood and Nathan Price
April 7, 2023 9:58 am ET

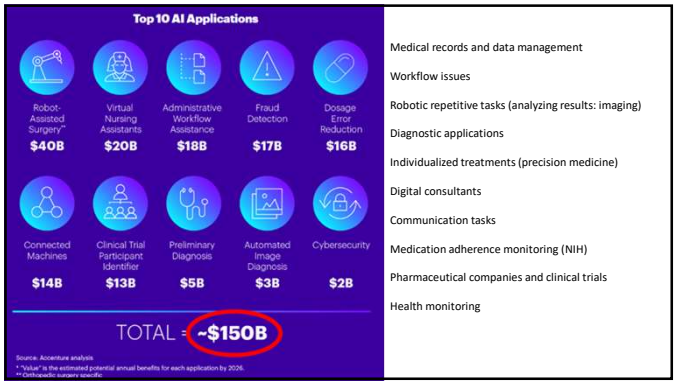
35

AI Healthcare Savings

~$270B

McKinsey, 2019

36



Medical records and data management

Workflow issues

Robotic repetitive tasks (analyzing results: imaging)

Diagnostic applications

Individualized treatments (precision medicine)

Digital consultants

Communication tasks

Medication adherence monitoring (NIH)

Pharmaceutical companies and clinical trials

Health monitoring

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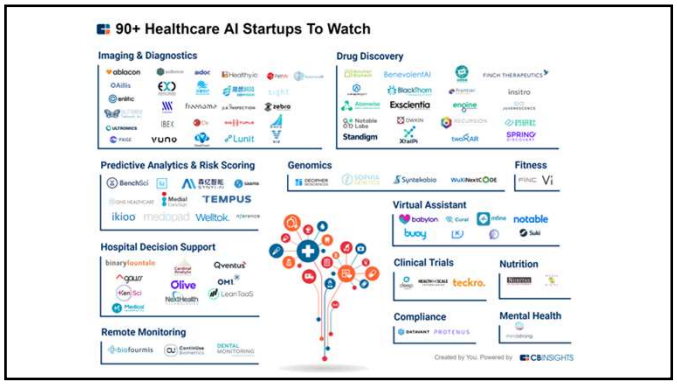

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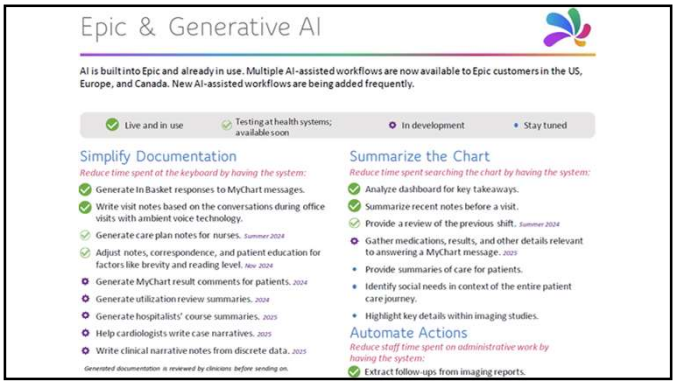

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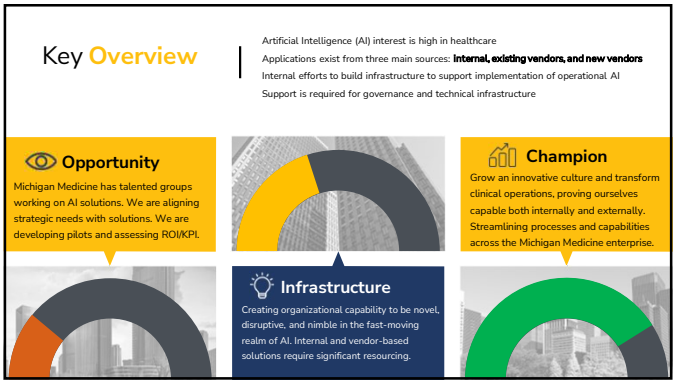
make an image of the University of Michigan and

41



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Sources of Artificial Intelligence for Michigan Medicine

IA = Information assurance

IA Review	++	++	-
Procurement	++	++	-
Governance	++	++	-
Customization	--	++	+
Maintenance	+	-	--
Cost	--	+	-
Investment	--	++	+

"We need to support all potential sources to limit over reliability on a single source.

43

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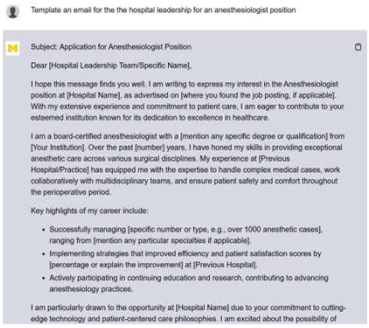

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Clinical Intelligence Committee (CIC)

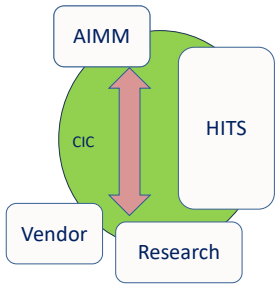
Strategic Priorities

Transparency
Alignment
Collaboration
Governance

Operations

Innovation

Critical Needs:
- **Organizational Alignment**
- **Data Access**
- **Infrastructure**
- **Compute**



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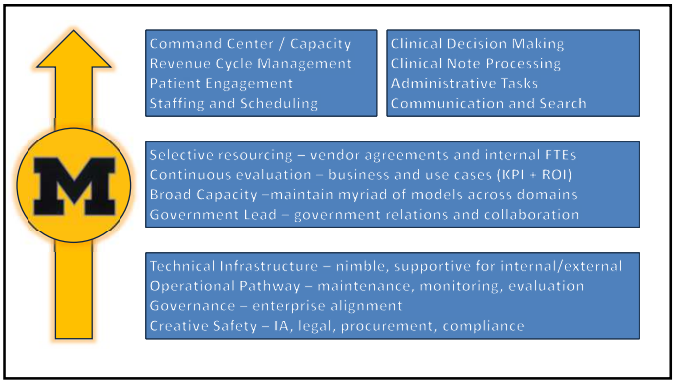

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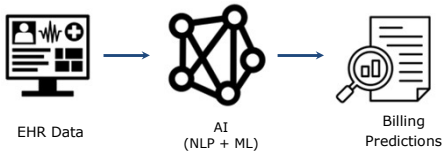
Healthcare Billing



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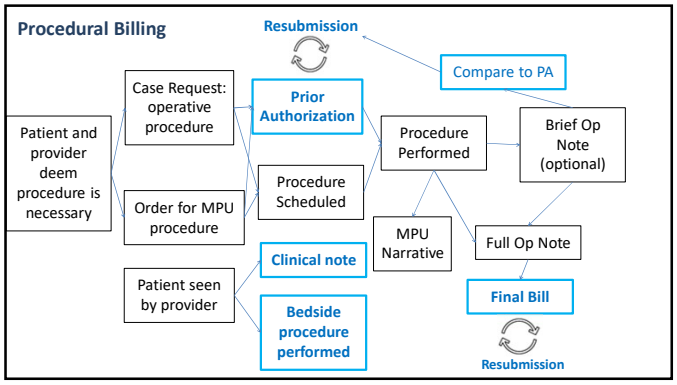

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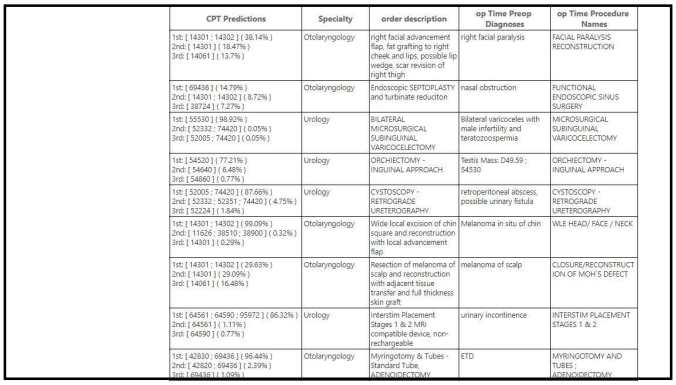
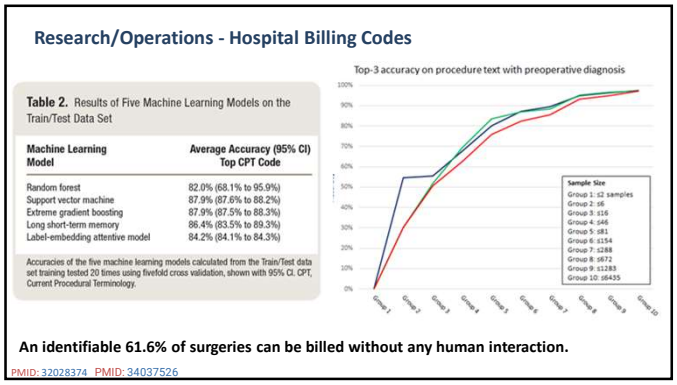


CPT Predictions	Specialty	order description	op Time Preop Diagnoses	op Time Procedure Names
1st: [14301 : 14302] (38.14%) 2nd: [14301] (18.47%) 3rd: [14061] (13.7%)	Otolaryngology	right facial advancement flap, fat grafting to right cheek and lips, possible lip wedge, scar revision of right thigh	right facial paralysis	FACIAL PARALYSIS RECONSTRUCTION
1st: [69436] (14.79%) 2nd: [14301 : 14302] (8.72%) 3rd: [38724] (7.27%)	Otolaryngology	Endoscopic SEPTOPLASTY and turbinate reduction	nasal obstruction	FUNCTIONAL ENDOSCOPIC SINUS SURGERY
1st: [55530] (98.92%) 2nd: [52332 : 74420] (0.05%) 3rd: [52005 : 74420] (0.05%)	Urology	BILATERAL MICROSURGICAL SUBINGUINAL VARICOCELECTOMY	Bilateral varicoceles with male infertility and teratozoospermia	MICROSURGICAL SUBINGUINAL VARICOCELECTOMY
1st: [54520] (77.21%) 2nd: [54640] (6.48%) 3rd: [54860] (0.77%)	Urology	ORCHIECTOMY - INGUINAL APPROACH	Testis Mass: D49.59 ; 54530	ORCHIECTOMY - INGUINAL APPROACH
1st: [52005 : 74420] (87.66%) 2nd: [52332 : 52351 : 74420] (4.75%) 3rd: [52224] (1.84%)	Urology	CYSTOSCOPY - RETROGRADE URETEROGRAPHY	retroperitoneal abscess, possible urinary fistula	CYSTOSCOPY - RETROGRADE URETEROGRAPHY
1st: [14301 : 14302] (99.09%) 2nd: [11626 : 38510 : 38900] (0.32%) 3rd: [14301] (0.29%)	Otolaryngology	Wide local excision of chin square and reconstruction with local advancement flap	Melanoma in situ of chin	WLE HEAD/ FACE / NECK
1st: [14301 : 14302] (29.63%) 2nd: [14301] (29.09%) 3rd: [14061] (16.48%)	Otolaryngology	Resection of melanoma of scalp and reconstruction with adjacent tissue transfer and full thickness skin graft	melanoma of scalp	CLOSURE/RECONSTRUCTION OF MOH'S DEFECT
1st: [64561 ; 64590 ; 95972] (86.32%) 2nd: [64561] (1.11%) 3rd: [64590] (0.77%)	Urology	Interstim Placement Stages 1 & 2 MRI compatible device, non-rechargeable	urinary incontinence	INTERSTIM PLACEMENT STAGES 1 & 2
1st: [42820 ; 69436] (96.44%) 2nd: [42820 ; 69436] (2.39%) 3rd: [69436] (1.70%)	Otolaryngology	Myringotomy & Tubes - Standard Tube, ADENOIDECTOMY	ETD	MYRINGOTOMY AND TUBES ; ADENOIDECTOMY

50



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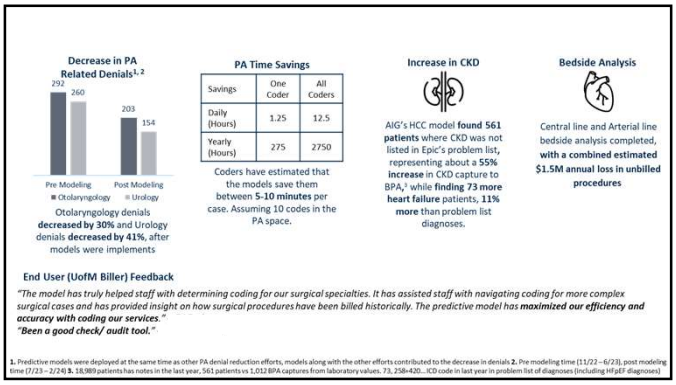

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Obstetric POCUS

ML models to identity patient encounters with billable bedside ultrasounds

2018-2020
~10k annual bedside OB ultrasounds (10% of visits)
558k clinical encounters
180k unique patients

	Accuracy	Recall	Precision	F1-score
Word search	0.86	0.59	0.36	0.44
LightGBM	0.95	0.90	0.65	0.76
BioBERT	0.97	0.87	0.89	0.88

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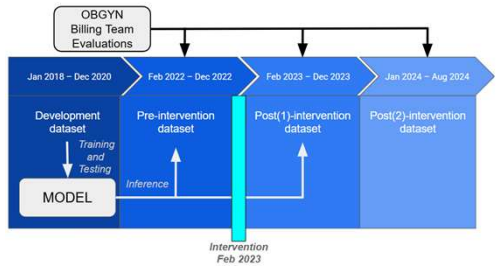
Obstetric POCUS



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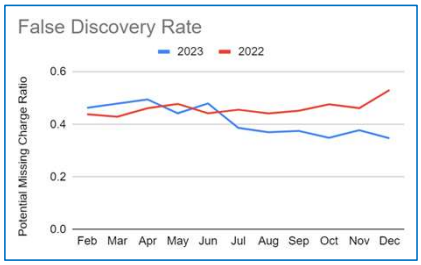
Obstetric POCUS



55

Obstetric POCUS

	ML Model Pred Positive		ML Model Pred Negative		Precision (Positive predictive value)	Recall (True positive rate, sensitivity)	Specificity (True negative rate)	Positive Likelihood Ratio	False Discovery Rate
Data set	Billing Data POCUS CPT Yes (TP)	Billing Data POCUS CPT No (FP)	Billing Data POCUS CPT Yes (FN)	Billing Data POCUS CPT No (TN)	TP/PP	TP/P	TN/N	Recall/FPR	FP/PP
Pre	2193	1873	1221	90409	**0.539**	**0.642**	**0.98**	**31.6**	**0.461**
Post(1)	2391	1701	968	86567	**0.584**	**0.712**	**0.99**	**36.9**	**0.416**

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Obstetric POCUS

CPT Code	OBGYN Billing Team Evaluations	ProcDoc Use	Pre 2/1/2022-12/31/2022	Post(1) 2/1/2023-12/31/2023	Post(2) 1/1/2024-8/31/2024
76815	Original	non-ProcDoc #	2803	1359	519
		procDoc #	0	1570	1795
	Review	-	317	171	57
76857	Original	non-ProcDoc #	56	63	15
		procDoc #	0	31	17
	Review	-	0	1	1
TOTAL		Original + Review (% Review recapture)	3176 (10%)	3195 (5.4%)	2404 (2.4%)
		ProcDoc capture # (%)	0 (0%)	1601 (50.1%)	1812 (75.4%)

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Obstetric POCUS

ML modeling achieved **high accuracy** (0.97) in identifying POCUS procedures.

Manual validation: Random set of 111 encounters: model predicted a procedure, but no associated POCUS CPT codes were billed. Of these, 95 encounters (85.6%) were confirmed as correct upon manual review, indicating ML **successfully identified missed POCUS procedures**.

ML modeling labeled an **additional 1.1%** of encounters as positive, representing an **11.6% increase** compared to CPT codes.

Subsequent application of standardized ProcDoc workflow:
- **Reduced missed billing opportunities** (from 10.0% to 2.4%)
- **Rapid adoption rates** (77.9% within 6 months)

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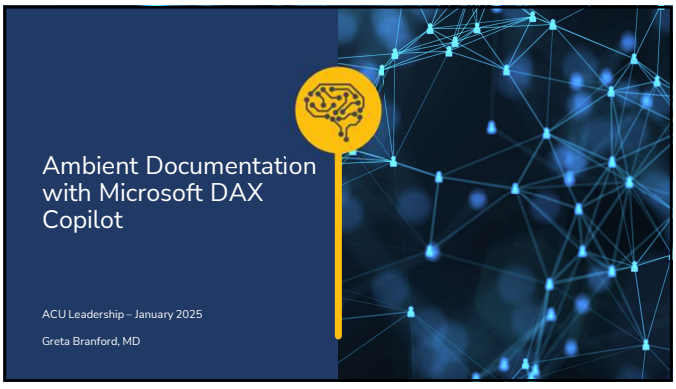
Bedside Procedures

Description	Total $ HB + PB	1 Month Billed/Missing (%)	Annualized Lost Opportunity Cost Estimate
Arterial Line	$1,700	596/37 (6%)	$754,800
Central Line	$4,900	159/10 (6%)	$588,000
Intubation	$3,000	101/36 (26%)	$1,296,000
Chest Tube	$3,800	16/26 (62%)	$1,185,600

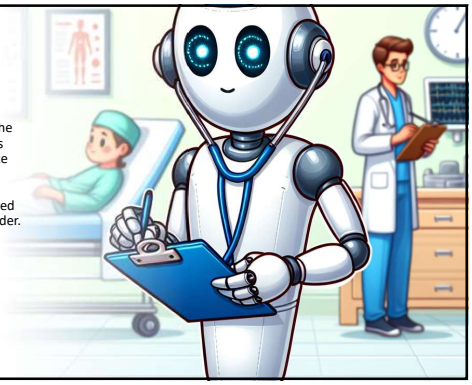
59



60

Ambient is a generic name for the technology that uses AI captures clinical conversations to generate real-time notes within the EHR.

Entirely tech-driven, fully powered by AI, but reviewed by the provider.

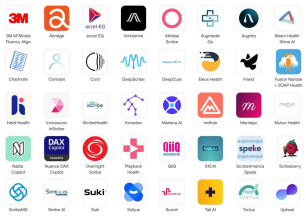


61

Ambient Scribe

Ambient is a generic name for the technology that uses AI to capture clinical conversations to generate real-time notes within the EHR.

Entirely tech-driven, fully powered by AI, but reviewed by the provider.



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Ambient Clinical Documentation: License Allocation

Special thanks to our CPC, Chairs & CDAs

300 Licenses					
254 Faculty Clinicians				46 APPs	
133 Primary Care	121 Specialty Care				
	38 Med Spec	19 Peds Spec	64 Other Spec	23 PA	23 NP
46 Gen Med	9 Cardiology	4 Cardiology	11 Psychiatry	10 Prim Care	10 Prim Care
36 Fam Med	6 Hem/Onc	3 Hem Onc	9 Surgery	4 GI	3 Hem Onc
30 Gen Peds	5 MEND	2 Nephr	7 Neurology	3 Ortho	2 Vasc Surg
12 Geriatrics	4 GI	2 Neuro	7 PM&R	1 Cardiology	2 Cardiology
9 Women's Hlth	3 Nephro	2 GI	6 OB/Gyn	1 Gen Surg	1 Neurosurg
	3 Pulm	2 Pulm	5 Ortho Surg	1 Ped Surg	1 Card Surg
	2 Allergy	1 Adolescent	5 Urology	1 Plastics	1 Ob/gyn
	2 Genetics	1 Developm/Beh	4 Oto	1 Neurology	1 Ortho
	2 ID	1 Endo	4 Rad Onc	1 Urology	1 Ped Surg
	2 Rheum	1 Rheum	3 Neuro Surg		1 Urology
			2 Derm		
			1 Anesth/Pain		

63

This is incredible

i have no questions. just wanted to say after using this for 4 patients, it has blown my mind. loving every second of this. thanks so much!

everyone feel free to drop any praise if you want. i will say it is really nice to just look at patients and listen to them while they are talking and not have to worry about keeping track of what they are saying. i was not expecting how liberating this would feel.

AI note stuff is LIFE CHANGING, so happy today!

I just wanted to share a comment with you that I just read from one of our patients that I thought you might like to see:

"[Dr.] used the AI note taking process. This was amazing as he was totally focused on me during the visit and not filling out charts. It made it so much more personal. I was a bit anxious at first to record the visit, but then he explained it's for his ability to chart the visit accurately and assured me it is deleted and not held in long term storage. It felt like the old days before providers had to chart on the tablet during the visit. Took time to be with the patient. Huge thumbs up!!!"

credit: Ella Barnum and Mike Scheuber

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I don't want to share this in the TEAMS group….
But
Aaaaah!!!!!!
This DAX AI is freaking amazing!!!!
"**Cryingonmylaptop**"

I'm just hanging around and catching up on my notes… and I am shooketh at how minimal time I'm spending on creating and editing my notes.
Can't wait until I use this while conversing with patients from Monday onwards.

DAX is my new best friend
"**Weepingonmylpad**"

Woo hoo!!! Doing the Wiggle Wiggle Chicken Dance ❤️! had 15 patients and all notes were getting done side by side AND I was focused on inbasket as well!

I might go home and make dinner … or even do a workout video, with all this free time! I'm so happy!!!

thank you!!!

credit: Ella Barnum

65

I don't want to share this in the TEAMS group….
But
Aaaaah!!!!!!
This DAX AI is freaking amazing!!!!
"**Cryingonmylaptop**"

I'm just hanging around and catching up on my notes… and I am shooketh at how minimal time I'm spending on creating and editing my notes.
Can't wait until I use this while conversing with patients from Monday onwards.

DAX is my new best friend
"**Weepingonmylpad**"

Notes are D+ at best…

There is no context, especially in specialties, human scribes are WAY better!

Ambient notes are the equivalent of "word vomit"

Woo hoo!!! Doing the Wiggle Wiggle Chicken Dance ❤️! had 15 patients and all notes were getting done side by side AND I was focused on inbasket as well!

I might go home and make dinner … or even do a workout video, with all this free time! I'm so happy!!!

thank you!!!

credit: Ella Barnum

66

March 24, 2025

Physician Perspectives on Ambient AI Scribes

Shreya J. Shah, MD[1,2]; Trevor Crowell, BA[2]; Yejin Jeong, BA[2]; et al

Author Affiliations | Article Information

JAMA Netw Open. 2025;8(3):e251904. doi:10.1001/jamanetworkopen.2025.1904

Key Points

Question What are physician perspectives on the use of ambient AI scribes, including adoption, effectiveness, and opportunities for improvement in workflow integration?

Findings In this qualitative study of 22 physician interviews, ambient AI scribes were found to positively impact physician workload, work-life integration, and patient engagement. Key facilitators and barriers to adoption were identified, and physicians offered specific suggestions for tool improvement.

Meaning These findings suggest that there is potential for ambient AI scribes to reduce physician burden, with user-centered recommendations providing practical guidance on scaling this technology and addressing barriers to adoption.

Shah SJ, Crowell T, Jeong Y, et al. Physician Perspectives on Ambient AI Scribes. *JAMA Netw Open.* 2025;8(3):e251904. doi:10.1001/jamanetworkopen.2025.1904

67

Costs are High

Takeaways:

Local modeling performed better than foundational LLMs (GPT) for both Chronic Kidney Disease (CKD) and Heart Failure (HF). GPT (LLM) models have a per usage cost, which becomes increasingly expensive as modeling work scales.

Model Results

Model	Notes Processed	Accuracy	Execution Time
AIG CKD	2009	95.1%	2 Minutes
AIG HF	1891	94.7%	2 Minutes
UMGPT CKD	2009	88.3%	4 Hours
UMGPT HF	1891	73.2%	6 Hours

Maizey Cost Estimate

Billing Area	Yearly Avg Notes	Yearly Costs[1]	Percent Complete[2]	Est. GPT Runs[3]	Expanded Yearly Costs[4]
Prior Auth	1,219,100	$34,976	10%	18	$6,295,676
Anes	171,550	$4,922	10%	44	$2,165,579
ICD	1,523,875	$43,720	5%	26	$22,734,386
MPU	292,000	$8,377	40%	45	$942,467
Total	3,206,525	**$91,995**			**$32,138,108**

1. Yearly Costs from pilot costs of existing models **2.** Percent Complete considers number of service lines, notes currently reviewed. **3.** Est. GPT Runs = GPT model runs needed to predict all codes **4.** Expanded Yearly Costs considers Percent Complete and Est. GPT Runs to provide model results for all service lines

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AI in Anesthesiology

make a cartoon image of an anesthesiologist in a minecraft theme

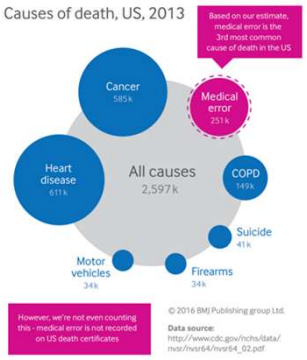
69

Healthcare can benefit

251,000 hospitalized people in the U.S. die annually due to medical error

40-50M annual U.S. surgeries
313M worldwide

Early postoperative mortality 1-4%
400k - 1.6M U.S.
3.1 - 12.5M worldwide



70

Anesthesiology is well-positioned to be a leader in AI

Varied Responsibilities and Hospital Positions
Variety of positions (clinical and non-clinical).
Interact with nearly every specialty and hospital system component.
⟹ Wealth of AI opportunities.

Data
Large diverse clinical data environments.
Exceeds capacity of real-time human processing/comprehension
⟹ Well suited for AI applications.

Experience
Anesthesiology is rich in technology.
Many anesthesiologists extensively trained in technological fields.
⟹ Expertise to pioneer in the AI healthcare revolution.

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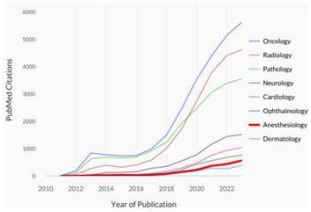

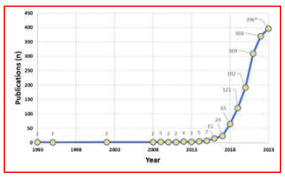

Burns ML, Lonsdale H, Epstein RH, Hofer IS, Tighe PJ, Gálvez Delgado JA, Kor DJ, MacKay EJ, Rashidi P, Wanderer JP, McCormick PJ. Strengthening Discovery and Application of Artificial Intelligence in Anesthesiology: A Report from the Anesthesia Research Council. Anesthesiology. 2025 Apr 1;142(4):599-610. doi: 10.1097/ALN.0000000000005326. Epub 2025 Mar 11. PMID: 40067037; PMCID: PMC11906170.

72

Anesthesiology: embracing and expanding Healthcare AI

Predictive Modeling: AI algorithms can analyze patient data and predict outcomes during surgery. This includes predicting patient response to anesthesia drugs, identifying potential complications, and estimating the duration of surgery.[1]

Drug Dosage and Delivery: AI can help optimize drug dosages and delivery methods during anesthesia administration. This ensures that patients receive the right amount of medication for their unique physiological characteristics.[2]

Monitoring Vital Signs: AI-powered monitoring systems can continuously track patients' vital signs during surgery. These systems can alert anesthesia providers to any deviations from normal values, enabling timely interventions.[3]

Automated Anesthesia Record Keeping: AI can automate the process of recording and documenting anesthesia procedures, reducing the burden on healthcare professionals and improving accuracy. Unsupervised clustering techniques are utilized to detect unforeseen data structures.[4]

Surgical Workflow Enhancement: AI can assist in optimizing the scheduling and coordination of surgical procedures, including billing and operations, helping to streamline workflow and resource allocation.[5]

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Anesthesiology: embracing and expanding Healthcare AI

Image Analysis: AI algorithms can aid in the analysis of medical images, such as MRI and CT scans, to provide insights into anatomical structures and guide anesthesia planning.[6]

Patient Risk Assessment: AI can help assess patient risk factors prior to surgery, allowing anesthesia providers to make more informed decisions about anesthetic techniques and postoperative care.[7]

Postoperative Monitoring: AI can be used for remote monitoring of patients after surgery, helping to detect and manage any postoperative complications early.[8]

Personalized Anesthesia Plans: AI can assist in tailoring anesthesia plans to individual patient characteristics, optimizing the overall patient experience and outcomes.[9]

Education and Training: AI-powered simulations and virtual reality platforms can aid in the training of anesthesia providers, allowing them to practice various scenarios and refine their skills.[10]

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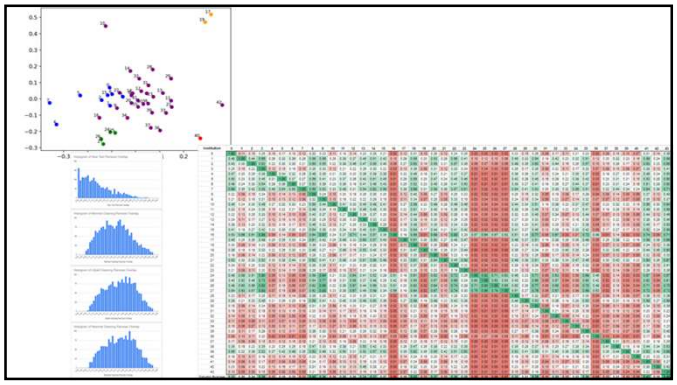
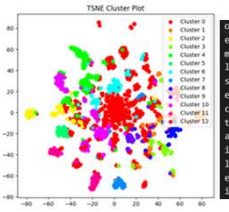


75

AI-driven phenotypes

Labeling is critical

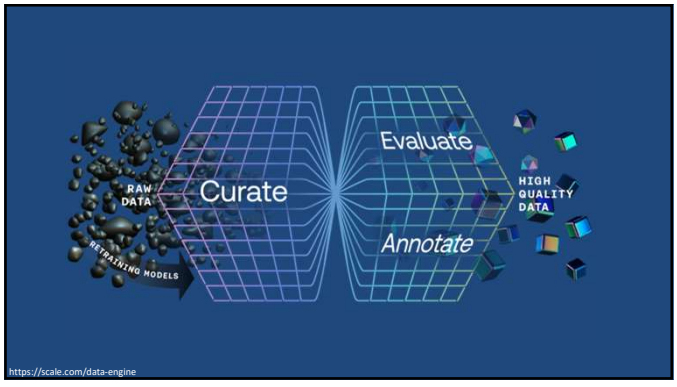
Can we use AI to label case types?



other	156787
end	51754
mri	9249
lab	6896
str	3746
ect	3348
car	2643
tym	640
ade	548
ivf	351
liv	317
end|mri	100
int	79

	precision	recall	f1-score	support
ade	0.96	0.95	0.95	275
car	0.96	0.98	0.97	1345
ect	1.00	0.94	0.97	2224
end	0.98	1.00	0.99	24100
int	0.22	0.89	0.35	18
ivf	1.00	0.97	0.98	285
lab	0.98	0.96	0.97	2966
liv	0.57	0.93	0.71	185
mri	0.95	0.90	0.93	5648
non	0.55	0.67	0.60	9
str	1.00	0.95	0.97	2615
tym	1.00	0.97	0.99	270
accuracy			0.97	39940
macro avg	0.85	0.93	0.86	39940
weighted avg	0.97	0.97	0.97	39940

76



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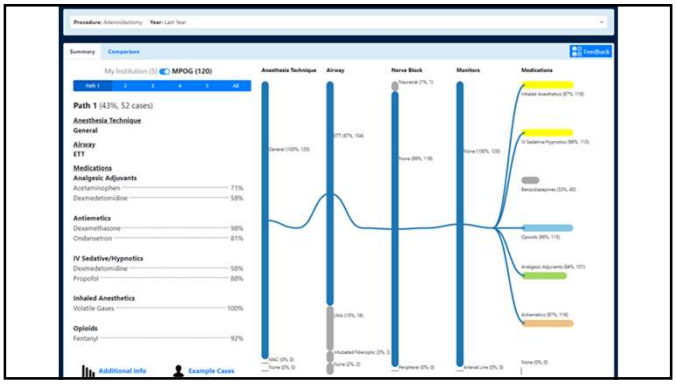

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Anesthesiology Future AI Efforts

Electronic health records and systems have made clinical work more difficult.

+ Consolidated communications
+ Improved drafting of written documentation
+ Searching patient records
+ Enhanced clinical, revenue cycle, and administrative operations

++ Data infrastructure and organization
++ Application into operations
++ Leverage existing tech - cost weighed against benefits
++ Train shared, open-source models using healthcare data

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Summary

Continuous AI advancements and new applications

Not everyone needs to be an expert, but we should all know something.

Clinicians MUST be involved, but AI expertise is NOT required for all.

Anesthesiology will benefit immensely from AI

Anesthesiology is uniquely positioned.

We can lead the healthcare to develop and implement innovative AI.

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Thank you!

For additional questions and comments

Please Contact:

Dr. Michael Burns
mlburns@med.umich.edu

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82

Wrangling the Experts: OB Anesthesia Legends Debate
Approaches to Controversial Cases and Topics

Moderator:
Brendan Carvalho MBBCh, FRCA, MDCH, FASA
Professor
Chief Division of Obstetric Anesthesiology and Maternal Health
Vice Chair, Faculty Development
Stanford University School of Medicine, USA

LEVERAGING TECHNOLOGY
FOR BETTER OUTCOMES
Improving Lives of Patients & Clinicians

1

Wrangling the Experts: OB Anesthesia Legends Debate
Approaches to Controversial Cases and Topics

Jill Mhyre

Rich Smiley

Paloma Toledo

LEVERAGING TECHNOLOGY
FOR BETTER OUTCOMES
Improving Lives of Patients & Clinicians

2

SPEAKER DISCLOSURES

Nothing to disclose.

3

Wrangling the Experts: OB Anesthesia Legends Debate

CASE DISCUSSION:

39-year-old, G2P1, BMI 51
37 weeks, singleton pregnancy
Chronic hypertension and superimposed preeclampsia
Induction of Labor

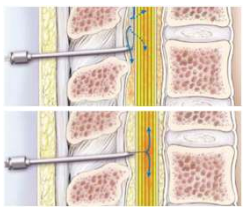
4

CSE vs. DPE vs. Epidural

What to choose?

Timing?

Dosing?



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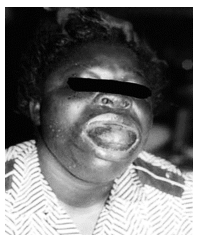
Platelet Threshold

Labor epidural vs. Cesarean anesthesia?
Patient Factors?



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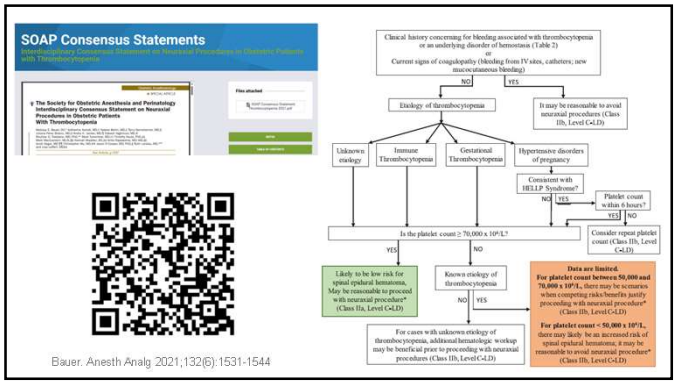

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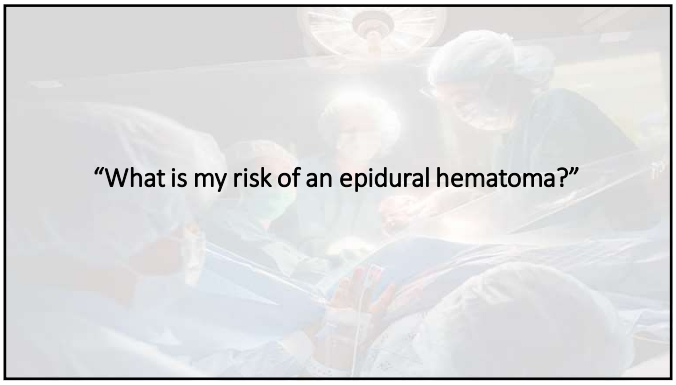
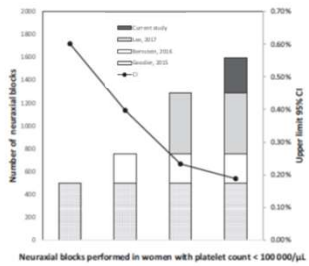


8

Platelet count and epidural hematoma risk



Epidural hematoma risk 95% CI

Overall <100,000	0.16%
<50,000	9%
50-69,000	2.6%
70-100,000	0.19%

Risk adjustment based on:
Epidural Technique?
Etiology of Thrombocytopenia?

Goodier. Anesth Analg 2015;121:988–91
Bernstein. Anesth Analg 2016;123(1):165-7
Lee. Anesthesiology. 2017;126(6):1053-1063
Levy. IJOA 2018; 35:4–9

9

Wrangling the Experts: OB Anesthesia Legends Debate

CASE DISCUSSION:

Cesarean delivery called for Category 2 trace
BP 165/95

Blood pressure treatment goals?

10

Editorial > Obstet Gynecol. 2019 Feb;133(2):409-412. doi: 10.1097/AOG.0000000000003082.

ACOG Committee Opinion No. 767 Summary: Emergent Therapy for Acute-Onset, Severe Hypertension During Pregnancy and the Postpartum Period

ACOG

National Partnership for Maternal Safety

Consensus Bundle on Severe Hypertension During Pregnancy and the Postpartum Period

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE
safe health care for every woman

Bernstein et al. Obstet Gynecol 2017;130:347-57
https://safehealthcareforeverywoman.org/

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Wrangling the Experts: OB Anesthesia Legends Debate

CASE DISCUSSION:

Cesarean delivery called for Category 2 trace
BP 165/95

Spinal hypotension prevention:
Preload?
Vasopressor infusion?

12

Anaesthesia
Peri-operative medicine, critical care and pain
Association of Anaesthetists

Guidelines | Free Access

International consensus statement on the management of hypotension with vasopressors during caesarean section under spinal anaesthesia

S. M. Kinsella ✉ B. Carvalho. R. A. Dyer. R. Fernando. N. McDonnell. F. J. Mercier. A. Palanisamy. A. T. H. Sia. M. Van de Velde. A. Vercueil. the Consensus Statement Collaborators

Anaesthesia. 2018;73(1):71-92

13

Wrangling the Experts: OB Anesthesia Legends Debate

CASE DISCUSSION:

Cesarean delivery called for Category 2 trace
BP 165/95
Epidural: Level T8 R and T11 L, pain 5/10, 2 boluses in last hour

Epidural Top-up vs. Replacement?
Spinal vs. CSE vs. Epidural?

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Wrangling the Experts: OB Anesthesia Legends Debate

CASE DISCUSSION:

Cesarean delivery called for **Category 1 trace**
BP 135/85
No Epidural

Spinal vs. CSE vs. Epidural?
Dose adjustments?
Adjuvants?

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Wrangling the Experts: OB Anesthesia Legends Debate

CASE DISCUSSION:
Fetal bradycardia, unresponsive >5min
BP 138/93
Obstetrician requests stat CS with **general anesthesia**

Succinylcholine vs. rocuronium?
Drug Doses?
Drugs to reduce BP intubation response?

16

FOCUSED REVIEWS IN OBSTETRIC ANESTHESIA

Prevention of Peri-Induction Hypertension in Preeclamptic Patients: A Focused Review

Melissa Pant, MD, Robert Fong, MD, and Barbara Scavone, MD

Esmolol 1.5 mg/kg or nitroglycerin 2 mcg/kg

Anesth Analg 2014;119:1350-6

"The anaesthetist…. should try to prevent the pressor effects of intubation, even when there are pressing fetal reasons for urgent caesarean section under general anaesthesia."

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Wrangling the Experts: OB Anesthesia Legends Debate

CASE DISCUSSION:

Fetal bradycardia, unresponsive >5min
BP 138/93
Obstetrician requests stat with **general anesthesia**

Preoxygenation: CPAP/NFNO/position
Video laryngoscope vs. direct laryngoscopy
Failed intubation approach

18

Wrangling the Experts: OB Anesthesia Legends Debate

CASE DISCUSSION:

Delivers a healthy baby girl, Apgar 8 and 9
QBL 1200 ml, good uterine tone
Closing fascia

Neuraxial morphine?
Morphine dose?
Postoperative monitoring?

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SPECIAL ARTICLE

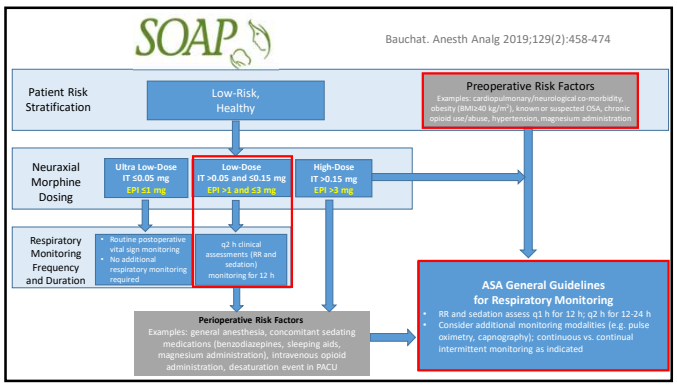
Society for Obstetric Anesthesia and Perinatology Consensus Statement: Monitoring Recommendations for Prevention and Detection of Respiratory Depression Associated With Administration of Neuraxial Morphine for Cesarean Delivery Analgesia

Jeanette R. Bauchat, MD, MS,* Carolyn F. Weiniger, MBChB,†
Pervez Sultan, MBChB, FRCA, MD,‡ Ashraf S. Habib, MBBCh, MSc, MHSc, FRCA,§
Kazuo Ando, MD, PhD,‖ John J. Kowalczyk, MD,¶ Rie Kato, MD, DPhil,#
Ronald B. George, MD, FRCPC,** Craig M. Palmer, MD,†† and Brendan Carvalho, MBBCh, FRCA‡‡

Bauchat. Anesth Analg. 2019;129(2):458-474
Anesthesiology 2016;124:535-552
https://www.soap.org/consensus-statements-and-advisories

CONSENSUS STATEMENT

20



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Program Material
Saturday, May 3, 2025

Research Network Symposium

Opening Remarks
Brandon Togioka, MD & David Stahl, MD

Sol Shnider Track #2
1. Delivery Disasters! AFE, ECMO, Malignant Hyperthermia and the Lost Airway
   Moderator: Adam Wendling
   Presenters: AFE - David Arnolds, MD
   ECMO - Emily Naoum, MD
   MH - Dave Berman, MD
   Lost Airway - Mark Rollins, MD
2. How to Leverage Point of Care Viscoelastic Testing Technology to Take Better Care of Your Patients
   - How to Advocate for POCVT in Obstetric Anesthesia: Cost Analysis, Outcomes Dennis Snegovskikh, MD
   - How to Use POCVT during Postpartum Hemorrhage – Shubangi Snigh, MD
   - It's Not Only for PPH! POCVT in Non-PPH Settings: Uses and Limitations John Kowalczyk, MD

   Moderator: Michaela Farber, MD
   Panelists: Dennis Snegovskikh, MD; Shubangi Snigh, MD; John Kowalczyck, MD

Concurrent Sessions

Best Case Reports (Main Stage)
Moderator: Emily McQuaid-Hanson, MD
Panelists: Marie-Louise Meng, MD; Feyce Peralta, MD; Christine Warrick, MD

1. Medical Management of Congenital Heart block: A Multi-Disciplinary Approach – Jordan Abrams, MD
2. Easing the Tension: A Multidisciplinary Approach to Pulmonary Hypertension in Pregnancy – Emily Eruysal, MD
3. A Narrowing case of Subglottic Stenosis in Pregnancy: multidisciplinary approach for optimal maternal and fetal outcomes – Nikke Bowerman, MD
4. Anesthesia for Maternal-Assisted Cesarean: A Patient-Centered Approach – Rebecca Boothe
5. Cesarean Section in an Impella Dependent Patient Sierra Trost, MD
6. Sensorineural Hearing Loss After Labor Epidural Analgesia: A Diagnostic Dilemma – Kresimir Ukalovic, MD, FRCPC
7. Management considerations for the obstetric patient with Takayasu's arteritis – Jasmine Kim, MD
8. Management of pregnancy termination for a patient with Eisenmenger syndrome and Chiari I malformation with associated syringomyelia – Jacob Nieb, MD
9. Varicella zoster meningitis: A rare case of disseminated reactivation – Paul Francois, MD

10. REBOA to the Rescue: Management of Massive Hemorrhage following Catastrophic Uterine Rupture – Travis Cuddy, MD

Concurrent Sessions

IARS Workshop: How to be a Great Peer Reviewer (Breakout Room)
Panelists: Ashraf Habib, MD; Jill Mhyre, MD; Cynthia Wong, MD; Thomas Vetter, MD

ASA Update
Speaker: David Martin, MD, PhD, FASA; Vice President for Scientific Affairs, ASA

Gerard W. Ostheimer Lecture
Introduction: Katie Arendt, MD
Speaker: Emily Sharpe, MD

2025 SOAP/FAER MRTG Recipient Presentation

SOAP Annual Awards

- Best Research Paper
- Gertie Marx
- Teacher of the Year
- Best Case Report
- Diversity & Inclusivity Award
- Patient Safety Award/APSF
- Research in Education Award
- Frederick P. Zuspan Award
- Mentoring Excellence Award
- Center of Excellence
- SOAP/Kybele International Outreach Grant
- SOAP Diversity & Inclusivity Mentored Grant

Abstract Breakout Session #3 (Breakout Rooms)
Room 1 – Musculoskeletal & Connective Tissue
Room 2 – Placental Concerns
Room 3 – Cardiac 2 − Pulmonary Hypertension & Valves
Room 4 – Cardiac 3 − Arrhythmia & Acuity
Room 5 – Coagulation & Vascular
Room 6 – Patient-Centered Care, Ethics, Fetal Surgery

Delivery Disasters: Amniotic Fluid Embolism

David Arnolds, MD PhD
University of Michigan Department of Anesthesia

1

SPEAKER DISCLOSURE

I have received research support unrelated to this presentation from BioIntelliSense, Inc

2

Could it be … an Amniotic Fluid Embolism (AFE)?

And what should I do if it is?

3

What is Amniotic Fluid Embolism?

- **Delivery Disaster!**
- **Rare** (1-6 / 100,000 pregnancies)[1,2]
- **Can be Deadly**
  - Mortality Rates of 10 - 40%[1,2,3]
  - #2 cause of death on the day of delivery[4]
  - Typically found to be the "least preventable" cause of maternal mortality

1: Fitzpatrick *et al* PLoS Medicine 2019 2: Mazza *et al* JAMA Network Open 2022 3: Stafford *et al* AJOG MFM 2020 4: Petersen *et al* MMWR 2019

4

"Let us be careful not to make the diagnosis of amniotic fluid embolism a waste basket for cases of unexplained death during labor."

-Nicholson Eastman 1948

5

Diagnostic Criteria for AFE

- There are **NO laboratory tests** that can confirm or refute a diagnosis of AFE

SMFM/AFE Foundation Criteria[5]	INOSS Criteria[1]	Paris Amniotic Fluid Embolism Pragmatic Framework[6]
Sudden onset of **cardiorespiratory arrest**, or both **hypotension and respiratory compromise**	**Acute cardio-respiratory collapse**	Sudden **hypotension** (systolic blood pressure < 90 mmHg) or sudden **cardiorespiratory arrest**. Suddenness is a subjective criterion that involves a brutal hemodynamic change.
Documentation of **overt DIC** (using ISTH definition), after the appearance of initial signs or symptoms. The coagulopathy must be detected before sufficient blood is lost to account for dilutional or shock-related consumptive coagulopathy.	**Acute coagulopathy** in those women who survive the initial event	**Clinical early massive obstetric hemorrhage or clinical DIC**
Clinical onset during **labor or within 30 minutes of delivery** of the placenta	Presentation **within 6 hours after labour, delivery or ruptured membranes**,	Clinical onset during labor or **within 30 min of delivery**
No fever (greater than or equal to 38.0°C) during labor	**No other identifiable cause**	**Premonitory signs** included **neurological signs** (seizure, confusion, agitation, fainting or anxiety and imminent death feeling), **abnormal fetal heart rate, respiratory signs** (dyspnea, cough, shortness of breath), and **atypical signs** (nausea and/or vomiting, arterial blood hypertension, skin rash, thoracic or abdominal pain).

1: Fitzpatrick *et al* PLoS Medicine 2019 5: Clark *et al* AJOG 2016 6: Ponzio-Kijianieko *et al* J Gyn Ob Hum Repro 2020

6

What is Amniotic Fluid Embolism?

- **Clinical Syndrome in laboring or immediately postpartum patients characterized by:**
  - **Sudden Hypotension, Hypoxia, or cardiorespiratory arrest**
    - Likely mediated by acute pulmonary HTN causing RV failure
  - **Coagulopathy**
    - Frequently characterized by hyperfibrinolysis
  - **Absence of another apparent cause**

7

Why does it happen?

- **We still don't know**
- **We do know:**
  - Most maternal exposure to amniotic fluid doesn't trigger the syndrome
  - The syndrome is NOT caused by physical obstruction of pulmonary arteries

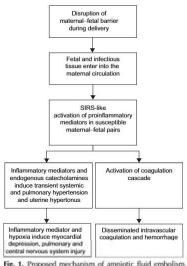

Fig. 1. Proposed mechanism of amniotic fluid embolism. SIRS, systemic inflammatory response syndrom
Clark. Amniotic Fluid Embolism. Obstet Gynecol 20

8

Can we say anything about groups at increased risk?

- **More frequent diagnosis of AFE[1,2,3] in patients with:**
  - Placental abruption, Placenta previa, PAS, Cesarean or operative vaginal delivery, Polyhydramnios
- **No evidence for recurrent AFE**
  - Women diagnosed with AFE pursue subsequent pregnancies at a lower rate than patients who did not experience AFE, regardless of whether or not the diagnosis was accurate[8]
  - Recurrent AFE has not been described[8,9]
- **There are no risk factors that are sufficiently validated to alter management**

1: Fitzpatrick *et al* PLoS Medicine 2019 2: Mazza *et al* JAMA Network Open 2022 3: Stafford *et al* AJOG MFM 2020
8: Moaddab *et al* Eur J ObGyn Repro 2017 9: Cahan *et al* J Peri 2021

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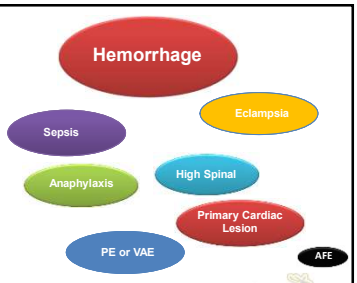

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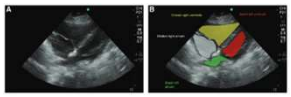
Treatment: Hemodynamic Collapse

RV Dysfunction is described in ~70% of cases of AFE that report echo findings[12]



10: Acker *et al* Anesthesiology 2019

Support the right heart

Know **how** to get inotropes /vasodilators to L&D

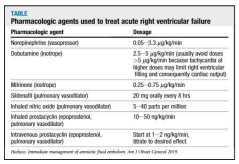


TABLE
Pharmacologic agents used to treat acute right ventricular failure

Pharmacologic agent	Dosage
Norepinephrine (vasopressor)	0.05–3.3 μg/kg/min
Dobutamine (inotrope)	2.5–5 μg/kg/min (usually avoid doses >5 μg/kg/min because tachycardia at higher doses may limit right ventricular filling and consequently cardiac output)
Milrinone (inotrope)	0.25–0.75 μg/kg/min
Sildenafil (pulmonary vasodilator)	20 mg orally every 8 hrs
Inhaled nitric oxide (pulmonary vasodilator)	5–40 parts per million
Inhaled prostacyclin (epoprostenol, pulmonary vasodilator)	10–50 ng/kg/min
Intravenous prostacyclin (epoprostenol, pulmonary vasodilator)	Start at 1–2 ng/kg/min, titrate to desired effect

Know if/how **ECMO** is an option

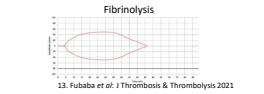
Temporize with whatever you have (but be cognizant of volume!)

12: Wiseman *et al* Can J Anes 2022

12

Diagnosis: Coagulopathy

- The coagulopathy in AFE **precedes** significant blood loss
  - Initially characterized by fibrinolysis and hypofibrinogenemia
- Viscoelastic testing is optimal if available, standard labs are perfectly acceptable
- Be prepared for atony and significant blood loss
  - activate MTP early



13. Fubaba *et al*: J Thrombosis & Thrombolysis 2021

14. Collins *et al*: IJOA 2013

13

Treatment: Coagulopathy

- Tranexamic Acid: 1 g IV, can be repeated after 30 min
- Concentrated source of fibrinogen
  - Fibrinogen concentrate or cryoprecipiate
- Limit crystalloid administration
- Targeted component therapy if possible
- 1:1:1 empiric resuscitation if necessary for ongoing hemorrhage

14

There are no magic bullets

- **NO EVIDENCE for any proposed AFE-specific treatments**
  - "A-OK"
  - Lipid Emulsion
  - Hydrocortisone/H1 blockers/H2 blockers
  - C1 esterase Inhibitor
- **High quality supportive care is the key to good outcomes**
  - Treating hemorrhage in a patient with acute pulmonary HTN and RV failure is extraordinarily challenging

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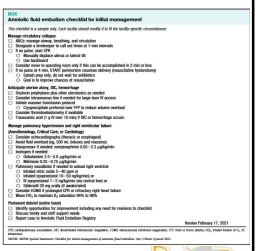
Summary and Key Take Home Points

- AFE is a **clinical syndrome** defined by cardiovascular collapse and coagulopathy in laboring or immediately postpartum patients
- Early recognition and rapid intervention with **high quality supportive care** is critical for good outcomes
- Make a **checklist** with institutional specific resources so you know how to escalate care
- Consider the **AFE Foundation** (afesupport.org) for patient/family support and to report cases to the registry



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Delivery Disasters! AFE, ECMO, Malignant Hyperthermia and the Lost Airway

3

Delivery Disasters! AFE, **ECMO**, Malignant Hyperthermia and the Lost Airway

Emily Naoum, M.D.
Obstetric Anesthesiologist and Intensivist
Massachusetts General Hospital
Boston, MA

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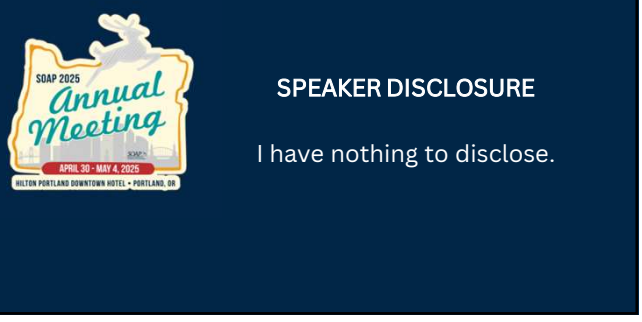

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Learning Objectives

- Recognize the most common indications for peripartum ECMO
- Differentiate between VV and VA ECMO
- Understand pregnancy specific physiologic targets when on MCS
- Identify risks of ECMO in the pregnant patient
- Describe outcomes in peripartum patients who require ECMO

6

What is ECMO?

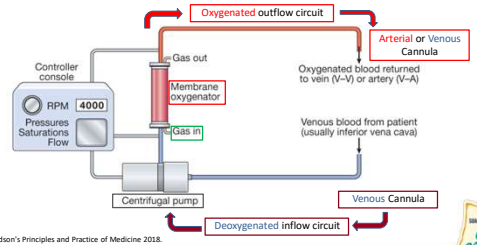
- **E**xtra**c**orporeal **M**embrane **O**xygenation
- Procedure to remove blood from the body → oxygenate it → return it to the body

Tallentire, VR et al. Davidson's Principles and Practice of Medicine 2018.

7

What is ECMO?

- **E**xtra**c**orporeal **M**embrane **O**xygenation



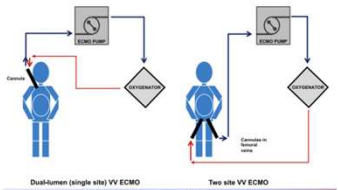
Tallentire, VR et al. Davidson's Principles and Practice of Medicine 2018.

8

Why would a peripartum patient need ECMO?

VV ECMO Indications

- Acute Respiratory Distress Syndrome (ARDS)
- Hypertensive disorders of pregnancy
- Asthma
- Fluid overload
- Pulmonary embolism
- Cardiac disease
- Aspiration
- Pulmonary hemorrhage
- Sepsis
- Burns
- Drowning
- Trauma



Venovenous ECMO

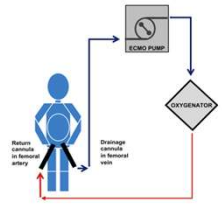
Naoum EE et al. IJOA 2024.

9

Why would a peripartum patient need ECMO?

VA ECMO Indications

- Cardiac arrest
- Heart failure
- Peripartum cardiomyopathy
- Septic cardiomyopathy
- Pulmonary embolism
- Amniotic fluid embolism
- Pulmonary arterial hypertension
- Preeclampsia or eclampsia
- Drug intoxications

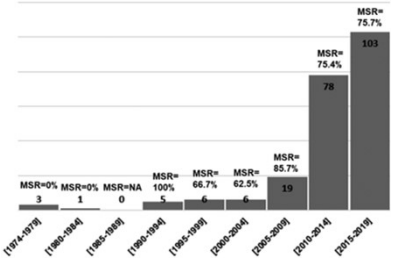


Venoarterial ECMO

Naoum EE et al. IJOA 2024.

10

How often do we need peripartum ECMO?



Naoum EE et al. JAHA 2020.

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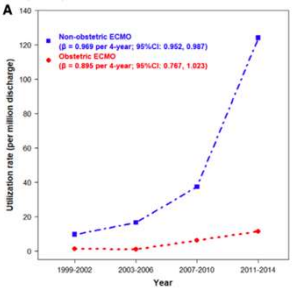
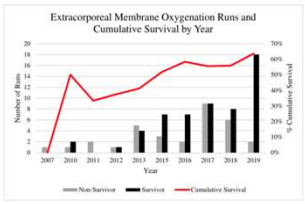
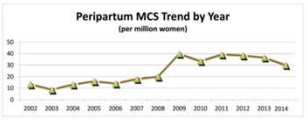


Taha B et al. Anesth Analg 2021.

12

How often do we need peripartum VA ECMO?





Cotter EK et al. JCVA 2020.
Olson TL et al. Int J Cardiol 2020.

13

What are the unique considerations for our patients when they need ECMO?

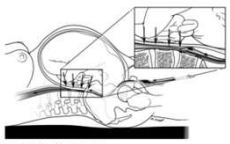
- Physiologic changes of pregnancy

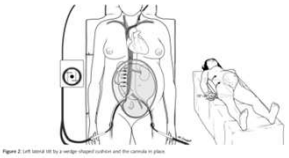
Cardiovascular	Pulmonary
↑ HR, SV, CO, EF ↓ SVR, PVR, BP	↑ MV, TV, O_2 consumption, PaO_2 ↓ FRC, ERV, $PaCO_2$

14

What are the unique considerations for our patients when they need ECMO?

- Positioning





Ngatchou W, et al. Interact Cardiovasc Thorac Surg 2012.

15

What are the unique considerations for our patients when they need ECMO?

- Monitoring
  - Arterial line upper extremity
  - IV/central access above diaphragm
  - Fetal heart rate monitoring
  - Uterine tocodynamometry
- Flows: VV – oxygenation; VA – end organ perfusion
- Goals: PaO_2 slightly ↑; $PaCO_2$ slightly ↓

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What about fetal heart rate monitoring?

- Individualized based on GA and maternal status
- Daily versus continuous
- Decision to deliver

17

What about delivering while on ECMO?

Table 1
Delivery considerations

Advantages of Delivery	Disadvantages of Delivery

Naoum EE et al. IJOA 2024.

18

What about delivering while on ECMO?

Table 3. Delivery considerations.

Delivery consideration	Potential benefits or harms of delivery
Obstetric complications requiring delivery[65]	• Fetal delivery may be required for obstetrical reasons[66] e.g. preeclampsia, eclampsia, HELLP syndrome, fetal growth retardation, and fetal distress
Delivery based on worsening respiratory status	• Delivery decreases oxygen requirements up to 28%[67] • Delivery does not decrease duration of either mechanical ventilation or ECMO cannulation[68]
Delivery prior to ECMO cannulation versus after cannulation	• Delivery increases the risk of postpartum hemorrhage but there is no statistical difference in rates of transfusion[67] • Data from pregnant patients with acute ARDS have indicated that there is an increased risk of fetal loss after cannulation, however delay may decrease the risk of prematurity-related morbidity in the newborn[68] • There is no difference in rate of other obstetric complications such as preeclampsia or gestational diabetes[68]
Delivery prior to viability	• There is no evidence that terminating a pregnancy for respiratory indications prior to the third trimester will improve the outcome of the pregnant patient[67]
Delivery >28 week gestation or at term	• Mechanical respiratory changes from pregnancy including upward displacement of the diaphragm and decreased end expiratory reserve volume coupled with the burden of the fetoplacental unit on oxygen consumption may shift the risk-benefit towards delivery[67,69,70]
Route of delivery	• Cesarean delivery, induced vaginal delivery, and spontaneous expulsion of the neonate have been described without specific benefit of one over the other[34,71]

Hrymak CS et al. Perfusion 2025.

19

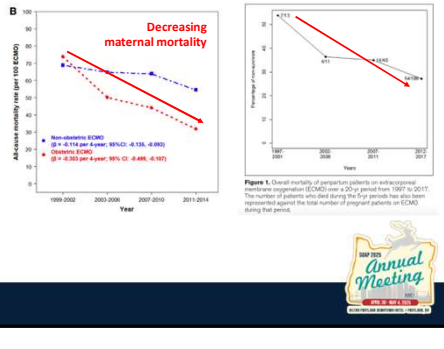
What are the complications of peripartum ECMO?

Hemorrhage	Thrombotic events
Slightly ↑ 30% general vs. 40% peripartum	Essentially = 7% general vs. 5% peripartum

20

What are the outcomes of peripartum ECMO?

70 - 80% Maternal Survival



Taha B et al. Anesth Analg 2021.
Ramanathan K, et al. Crit Care Med. 2020.

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What are the outcomes of peripartum ECMO?

TABLE 4. Multivariate Analysis Showing Risk Factors for Mortality in Peripartum Patients

Risk Factors	OR (95% CI)	p	Overall p
Pre-ECMO factors			
Indications			
Pulmonary	1		0.025
Cardiac	1.634 (0.797–3.352)	0.18	
Extracorporeal cardiopulmonary resuscitation	3.674 (1.425–9.473)	0.007	
Hemofiltration	2.758 (0.857–8.878)	0.089	
ECMO factors			
Duration of ECMO, hr			
< 66	1		0.017
66–128	0.281 (0.101–0.777)	0.014	
128–232	0.474 (0.191–1.174)	0.107	
> 232	1.084 (0.429–2.737)	0.864	
Renal complications	2.346 (1.203–4.572)	0.012	
Neurologic complications	2.345 (0.805–6.836)	0.118	

Ramanathan K, et al. Crit Care Med. 2020.

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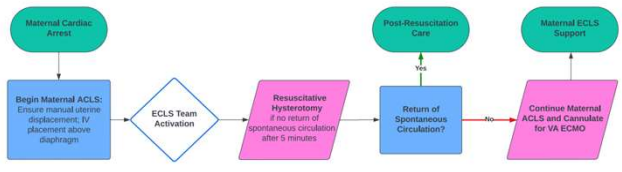
How do babies do when exposed to peripartum ECMO?

65 - 70% Fetal Survival

NICU Admission	Preterm Delivery
Slightly ↑	Slightly ↑

23

Is there a role for ECMO in a maternal code?



Naoum EE et al. IJOA 2024.

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Key Takeaways

- The most common indications for peripartum ECMO are ARDS, cardiac arrest, cardiac disease, and pulmonary embolism
- Pregnancy specific physiologic targets when on MCS include a slightly higher PaO_2 and slightly lower $PaCO_2$
- The fetus is a great monitor for end organ perfusion!
- Peripartum ECMO may have slightly higher rates of hemorrhage than non-pregnant patients
- Peripartum patients who require ECMO have higher survival than non-pregnant patients
- Incorporating an ECMO team into the maternal code team may improve outcomes

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Johns Hopkins University School of Medicine
Phone Consultant, MHAUS
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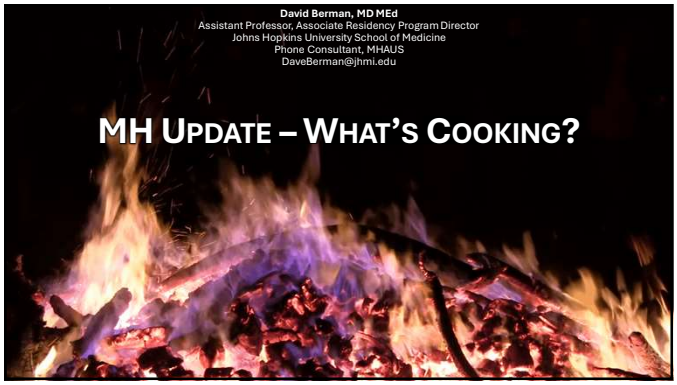
MH Update – What's Cooking?



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Conflicts of Interest

- I cofounded a company whose products include a secure mobile HIPAA-compliant messaging platform; I no longer have a financial stake in the company
- In the past, I have consulted for numerous companies regarding the optimal use of learning systems on smart devices
- Several patents are pending relating to novel educational technologies that I have invented
- I am currently accepting applications for more conflicts of interest

2

Thanks for Having Me

- This organization is **just the best**
- Many inspiring figures here, honored to learn alongside you all
- Special shoutout to the Hopkins folks!
- Very grateful for this opportunity to give you an update on MH

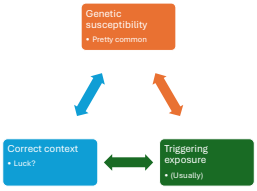
3

Scan this code.

Interested in References?

4

Correcting Misperceptions…



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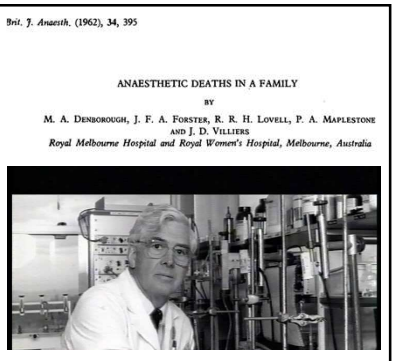
Malignant Hyperthermia History

Denborough MA, Forster JF, Lovell RR, Maplestone PA, Villiers JD. Anaesthetic deaths in a family. Br J Anaesth. 1962;34: 395–396.



Brit. J. Anaesth. (1962), 34, 395

ANAESTHETIC DEATHS IN A FAMILY

BY

M. A. Denborough, J. F. A. Forster, R. R. H. Lovell, P. A. Maplestone and J. D. Villiers

Royal Melbourne Hospital and Royal Women's Hospital, Melbourne, Australia

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396 BRITISH JOURNAL OF ANAESTHESIA

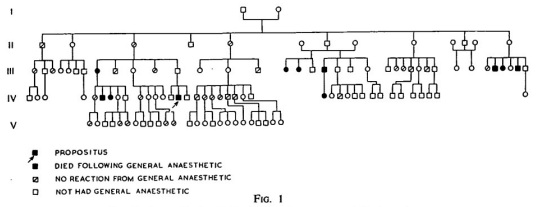


FIG. 1
Family tree. Circles indicate females; squares indicate males.

7

MH Hotline Basics

- Started in 1982 and expanded in 1995, staffed 24/7 by 30ish volunteer anesthesiologists
- 3 of us on call at any given time, two weeks straight, 8 weeks a year
- 2-20 calls per day, mix of active ?cases and advice questions
- Calls from all around the world
- MHAUS' work also includes a registry, medic alert bracelets, protocols, advocacy work

8

Take Out Your Phones

ADD THE MH HOTLINE TO YOUR CONTACTS – WHEN IN A CRISIS, BEST TO HAVE IT SAVED

800-644-9737
(800-MH-HYPER)

9

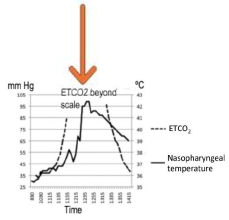
MH in a Nutshell

Hypermetabolic syndrome

Wide variety of clinical presentations, largely centered around **hyperthermia**, **hypercarbia**, muscle **rigidity**, rhabdomyolysis, electrolyte disturbances

Main laboratory feature is **combined respiratory / metabolic acidosis**

High $PaCO_2$ | Low HCO_3



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MH In a Nutshell Round 2

Autosomal dominant with variable penetrance: most mutations **inherited**, some **sporadic**

Triggers include **volatile anesthetics, succinylcholine**

Historical mortality >70%, current mortality <5% in developed countries

Treatment is:
- Avoidance
- Dantrolene
- Supportive care

Delays cause bad outcomes
- Every 30-minute delay in dantrolene admin causes 1.6x complication rate

Negative history with prior exposures doesn't rule out MH
- Recent case with >30 prior exposures

Larach MG, Gronert GA, Allen GC, Brandom BW, Lehman EB. Clinical presentation, treatment, and complications of malignant hyperthermia in North America from 1987 to 2006. Anesth Analg. 2010;110:498–507.

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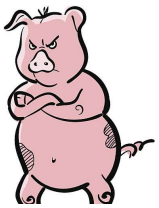
Not Just A Human Disease



Happens in pigs
- Referred to as **porcine stress syndrome**

Triggered by...
- Volatile anesthetics
- Succinylcholine
- Stress
- Excitement

Genetically linked to ryanodine receptor defects
- But those with defects also more muscular → most delicious
- (Selective breeding at its worst?)

Lister D. Malignant Hyperthermia: A Human and Porcine Stress Syndrome? The Lancet. 1975. p. 519.
Rempel WE, Lu M, el Kandelgy S, Kennedy CF, Irvin LR, Mickelson JR, et al. Relative accuracy of the halothane challenge test and a molecular genetic test in detecting the gene for porcine stress syndrome. J Anim Sci. 1993;71: 1395–1399.

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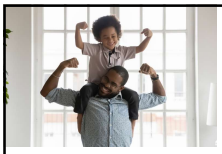

Epidemiology

No specific cultural or racial/ethnic predominance

Theorized that 1:2000 – 1:3000 are susceptible
- May be even higher
- Likely that 1:600-1:800 have genetic susceptibility

Males **more likely to be diagnosed** as compared with females, unclear why
- May have to do with nature of surgical procedures and related exposures

Among susceptible individuals, approximately 40% likely to develop MH when exposed to triggering anesthetic
- **Negative history, while reassuring, does not mean you're 100% safe**

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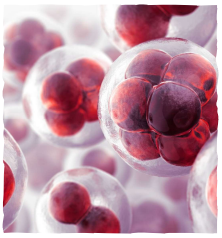
Associated Syndromes



Inherited myopathies with **abnormalities in the ryanodine receptor**
- Central core disease
- King-Denborough Syndrome
- STAC3 Myopathy (formerly known as Native American Myopathy)
- Multiminicore disease

Other inherited muscle diseases often treated as MH-susceptible ***(even though not)***
- Duchenne Muscular Dystrophy
- Becker Muscular Dystrophy

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Uncommon Associations

Exertional rhabdomyolysis

Severe statin-induced myopathy

Fever and muscle cramping with exercise, stress, or high ambient temperatures ("awake MH")

Masseter muscle rigidity with succinylcholine, especially if severe

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Kids Aren't Just Little Adults

Different presentation as compared with adults

NAMHR registry data on patients <18 with confirmed MH:
- Sinus tachycardia 73%
- Hypercarbia 68.6%
- Rapid increase in temp 48.5%

Less likely to present with high CK, muscle rigidity

More likely to present with skin mottling, high lactate

Kids aged 2-12 had the lowest $PaCO_2$ levels of any age group in the registry

Nelson P, Litman RS. Malignant hyperthermia in children: an analysis of the North American malignant hyperthermia registry. Anesth Analg. 2014;118: 369–374.

16

Weird Questions I've Gotten

"I'm MH-susceptible, my partner is having a surgery. Can I visit them in PACU and kiss them? What if they breathe sevo on me?"
- Secondary MH has not been reported in our registry
- Probably not a thing

"I'm in anesthesia residency and my brother just had an MH crisis, there's probably a 50% chance I'm susceptible. Should I switch residencies? Not do mask inductions?"
- Secondary MH probably not a thing
- Switch if you're not happy, but not for MH reasons

"I'm a pregnant person and MH susceptible, pathogenic RYR1 mutation on genetic testing. Can I genetically test my fetus to determine their ex-utero susceptibility?"
- Controversial question, right now MHAUS has no answer
- EMHG says no, need negative biopsy for confirmation of non-susceptibility

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Testing 101

Two big testing differences – either **genetic testing** or **muscle biopsy-based** testing
- A solid role for either approach

Path forward can be challenging, but let's talk about both

18

Whom to Test?

Personal history of ?MH	• Patients with a history suspicious for MH • Patients with severe masseter muscle rigidity during anesthesia, especially with evidence of rhabdomyolysis • Unexplained rhabdomyolysis following triggering anesthetic
Family History	• Patients with a known MH-susceptible relative
Related History	• Severe heat-induced rhabdomyolysis • Severe statin-induced myopathy • Multiple episodes of exertional rhabdo
Concerning history and consideration of military service	• MH susceptibility is a medically disqualifying condition for service in the US Armed Forces

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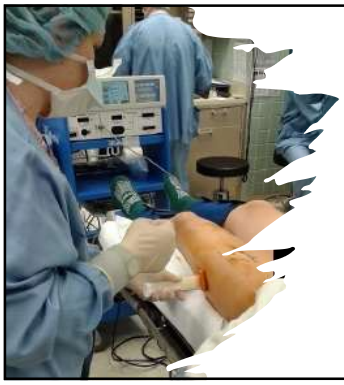

Contracture Testing

Procedure

- Muscle biopsy taken from vastus lateralis (**big** muscle specimen)
- Biopsy specimen separated intro strips, placed in oxygenated bath
- Exposed to RYR1 agonists (caffeine, halothane) and contraction strength is measured

Data

- Sensitivity 97-99%
- Specificity ~80-90%

Limitations

- Involves invasive procedure, travel to a limited number of testing sites (2 in US, 1 in Canada)
- Must wait **3-6 months after concerning MH event** for testing

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Genetic Testing

Procedure

Bloodwork drawn in local lab

Certain labs performing cheek swabs

Genetic testing panel performed, focusing on RYR1, CACNA1S, and STAC3 mutations

Data

Sensitivity difficult to ascertain, probably on the order of 60-80%

Possible Results

No DNA variation found – does *not rule out MH*

Pathogenic mutation associated with MH – *treat as susceptible*

Variant of unknown significance – management depends on scenario

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Putting it All Together: A Rational Approach

Ideally test the affected patient first if possible

Pretest probability of a positive test is highest

Start with genetic testing for most

If positive, treat as MH-susceptible and test family members

If negative or variant of unknown significance (VUS), consider contracture testing

Until contracture testing done, treat as susceptible

Perform contracture testing if negative or unclear variant

If contracture testing negative, no need to avoid triggering agents: treat as normal

If contracture testing positive, manage patient and family as MH-susceptible

Treat all untested first-degree relatives as MH-susceptible

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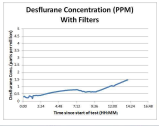
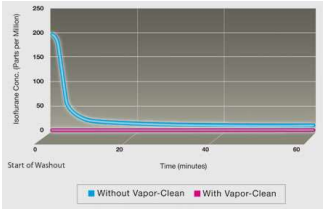
Management of the MH-Susceptible Patient

- Avoid volatile anesthetics and succinylcholine
- Some centers have dedicated MH anesthesia machine or use ICU ventilators
- Most centers use existing anesthesia machines: can be laborious to prepare
  - Change circuit
  - Change CO_2 absorbent
  - Flush machine for a ~~long~~ while
- Charcoal filters have made this a **lot easier**
  - Still need 90-second flush
  - Replace every 12 hours
  - Fresh gas flows at least 3 liters/min

23

Charcoal Filter Efficacy





Workstation Type	Anesthetic Agent	Published washout time (time to inspired agent less than 5 parts per million)	Time to inspired agent less than 5 parts per million with Vapor-Clean filters
Ohmeda Aestiva	Isoflurane	54 minutes[2]	Less than 1 minute[2]
Ohmeda Aestiva	Sevoflurane	48 minutes[2]	Less than 1 minute[2]
Ohmeda Aestiva	Desflurane	27 minutes[2]	Less than 1 minute[2]
Draeger Apollo	Isoflurane	84 minutes[2]	Less than 1.5 minutes[2]
Draeger Apollo	Sevoflurane	46 minutes[2]	Less than 1 minute[2]
Draeger Apollo	Desflurane	53 minutes[2]	Less than 1 minute[2]
Draeger Primus	Isoflurane	64 minutes[4]	
Ohmeda Aestiva	Sevoflurane	55 minutes[4]	Less than 1 minute[2]
Draeger Fabius	Sevoflurane	104 minutes[4]	
GE Avance	Sevoflurane	61 minutes[4]	
Maquet Flow-i	Sevoflurane	48 minutes[4]	
GE Aisys	Sevoflurane	55 minutes[4]	

Birgenheier N, Stoker R, Westenskow D, Orr J. Activated charcoal effectively removes inhaled anesthetics from modern anesthesia machines. Anesth Analg. 2011;112: 1363–1370.

24

Management of the MH-Susceptible Patient Round 2

- Have dantrolene available - but we always should anyway
- Be on the lookout for early signs of MH

- Can **safely take care of these patients** in an ASC or office-based setting if appropriate precautions are met
- **Be aware of social situations** – patients should ideally be watched at home by someone responsible
- **Regional anesthesia is a safe, preferred alternative if feasible**

25

Management of the MH-Susceptible Patient Round 3: What About OB?

- Should presume **offspring of MH-susceptible birthing person in-utero are susceptible**
  - Tell the NICU!
  - Might impact their management if fetus going for surgery
- Should also presume that **fetus is MH-susceptible if partner is MH-susceptible**
  - Avoid volatile anesthetics until cord clamped
  - But after delivery, "the bar is open"
  - Fetus no longer receiving
- **What about succinylcholine? Minimal transplacental transfer, right?**
  - Controversy about succinylcholine
  - But nonetheless wise to avoid if possible
  - Was much more a discussion pre-sugammadex
- **Breastfeeding MH-susceptible fetus after administering volatile anesthetic to birthing person?**
  - There's no answer
  - Assumes swallowed micro-concentrations of Sevo can trigger MH, which is unlikely

26

Treatment Basics (Part 1)

- Early recognition
- Stop the case if feasible
  - If needed, continue with TIVA
- Stop all triggering agents
  - High-flow 100% oxygen
- Monitor temperature
- Don't bother changing the circuit or CO_2 absorbent
  - Just wastes time
- **Early** dantrolene (**2.5mg/kg**, many patients require multiple boluses)
- Place arterial line, foley if feasible
  - Check CK, ABG, K, glucose, renal function
- Be aware of metabolic / electrolyte abnormalities

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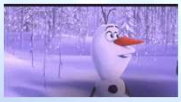
Treatment Basics (Part 2)



- **Aggressive cooling, aggressive fluid resuscitation**
- **Treat hyperkalemia, arrhythmias:** avoid calcium channel blockers
  - Calcium gluconate
  - Sodium bicarbonate
  - Insulin/dextrose
- **Arrange for postop monitoring location**
  - PACU vs. ICU depending on institutional resources
- **Continue dantrolene for at least 24 hours**
  - Call MHAUS for dosing advice

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Dantrolene Formulations

Old-school formulation

- Several different manufacturers
- 20mg per vial, required dilution with 60mL sterile water
- Takes **forever**

The new era has arrived

- Ryanodex is 250mg/5mL
- Mixed quickly, administered quickly

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Why the Hesitation to Give Dantrolene?

Cost

$100 per 20mg Revonto, Dantrium, generic dantrolene formulation (**$900** per dose for 70kg patient)

$3800 per 250mg Ryanodex vial

Adverse effects

Skeletal muscle weakness can be pronounced

Extensive soft tissue necrosis if infiltrated

Diagnostic dilemma

Dantrolene **lowers fever** in the absence of MH

(Are you just masking sepsis?)

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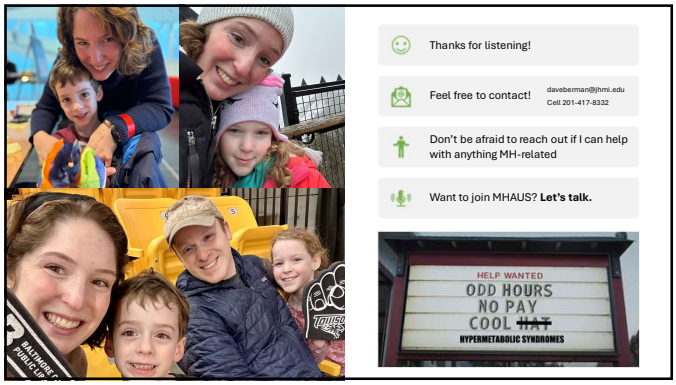

Thanks for listening!
Feel free to contact!
daveberman@jhmi.edu
Cell 201-417-8332
Don't be afraid to reach out if I can help with anything MH-related
Want to join MHAUS? Let's talk.
HELP WANTED
ODD HOURS
NO PAY
COOL ~~HAT~~
HYPERMETABOLIC SYNDROMES

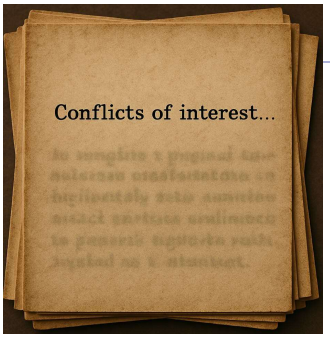
31

DELIVERY DISASTERS:

THE LOST AIRWAY

Mark Rollins MD, PhD
SOAP Annual Meeting 2025
Portland OR

1



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NO DISCLOSURES

April 8, 2025

2

PRACTICE PARAMETER

2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway*

Jeffrey L. Apfelbaum, M.D., Carin A. Hagberg, M.D., Richard T. Connis, Ph.D., Basem B. Abdelmalak, M.D., Madhulika Agarkar, M.P.H., Richard P. Dutton, M.D., John E. Fiadjoe, M.D., Robert Greif, M.D., P. Allan Klock, Jr., M.D., David Mercier, M.D., Sheila N. Myatra, M.D., Ellen P. O'Sullivan, M.D., William H. Rosenblatt, M.D., Massimiliano Sorbello, M.D., Avery Tung, M.D.

ANESTHESIOLOGY 2022; 136:31–81

ABSTRACT

The American Society of Anesthesiologists; All India Difficult Airway Association; European Airway Management Society; European Society of Anaesthesiology and Intensive Care; Italian Society of Anesthesiology, Analgesia, Resuscitation and Intensive Care; Learning, Teaching and Investigation Difficult Airway Group; Society for Airway Management; Society for Ambulatory Anesthesia; Society for Head and Neck Anesthesia; Society for Pediatric Anesthesia; Society of Critical Care Anesthesiologists; and the Trauma Anesthesiology Society present an updated report of the Practice Guidelines for Management of the Difficult Airway.

(Anesthesiology 2022; 136:31–81)

HIGHLIGHTS BOX

These updated guidelines:

- Replace the "Practice Guidelines for Management of the Difficult Airway: A Report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway," adopted by the American Society of Anesthesiologists in 2012 and published in 2013.[1]
- Specifically address difficult airway management. The guidelines

3

OLD V. NEW

2012	2022
• ASA-appointed task force of 10 members, US, private and academic.	• Task force of 15 members, of an international group.
• Review of evidence did not result in significant changes from 2002.	• Not just ASA. Included 10 organizations (appendix 2)
	• Importance of planning
	• Optimize oxygenation
	• Video laryngoscope early *
	• 2nd Gen Supraglottic Airway *
	• Emphasizes awareness, time, and attempts
	• Awaken patient earlier
	• More robust algorithms,* especially for extubation
	• Invasive Front of Neck Airway *

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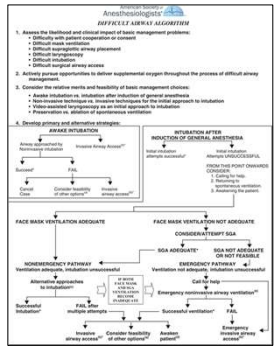

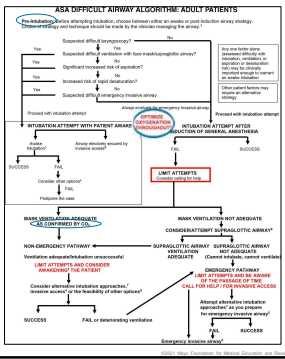

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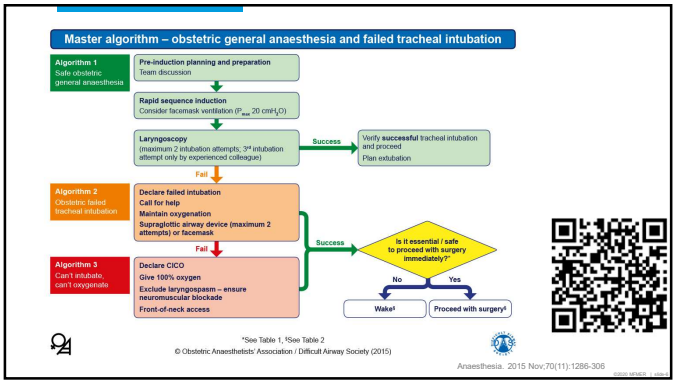

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LOST OR DIFFICULT AIRWAY PREGNANCY

Image with Permission from Mayo Clinic

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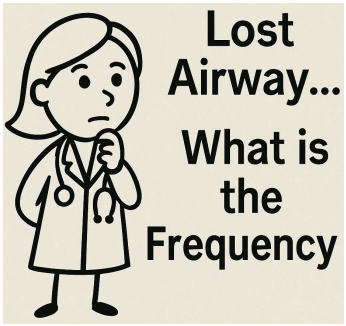

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RATE	DEFINITION	AUTHOR	YEAR
1:224	Failure to intubate during RSI for obstetric anesthesia, and initiating a failed intubation drill.	Quin et al	2013
1:232	Inability to intubate after one dose of succinylcholine and two attempts at intubation using a conventional laryngoscope or an alternative device	Rajagopa et al.	2017
1:249	Intubation that was not accomplished with a single dose of succinylcholine	Bernardo et al.	2000
1:154	Unsuccessful attempts at intubation using either direct laryngoscopy or alternative equipment, the need to proceed with surgery with an unsecured airway … or the need to awaken the patient	McKeen et al.	2011
1:553	Failed Intubation	D'Angelo et al.	2014

S. Vaida, Airway Management of the Obstetric Patient: What's New? Anesthesiology News. Anesthesia Experts. Posted 2018.

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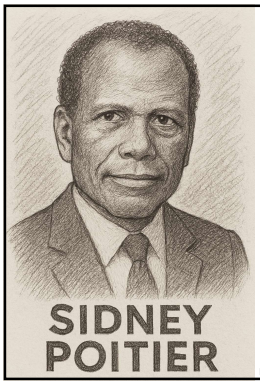

"The best way to get out of trouble is to not get into trouble"

Image created de novo with ChatGPT

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10

RECOMMENDATIONS

- Evaluation of the airway
  - Perform an **airway risk assessment** to indicate potential for difficult airway or aspiration.
  - Conduct an **airway physical examination** to look for physical characteristics.
  - Particular attention to facial features
  - Additional evaluation can include bedside endoscopy, virtual laryngoscopy/bronchoscopy, or **3-D printing**.
- Preparation for difficult airway management
  - Ensure equipment is in the room
  - Ensure a portable storage unit is available
  - Inform the patients of the risk and procedure steps
  - **Positioning and supplemental oxygen should be a focus** throughout the process including **extubation**.
  - At a minimum, patients should have ASA Standards for Basic Anesthesia Monitoring.

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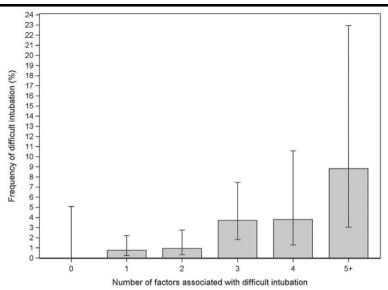

Fig. 2. Frequency of difficult intubation stratified by number of risk factors present. The *x axis* shows the number of factors associated with difficult intubation. The factors included in the analyses are those with univariate odds ratio for difficult intubation greater than 1.50: age 35 yr or more, body mass index of 25 or higher, American Society of Anesthesiologists Physical Status III or IV, Mallampati score III or IV, small hyoid-to-mentum distance, limited jaw protrusion, limited mouth opening, altered neck anatomy, cervical spine limitations, and presence of preeclampsia or eclampsia (race excluded given widely varying estimates). The *y axis* shows the frequency of difficult intubation, with *error bars* representing 95% CI.

Reale SC Anesthesiology 2022; 136:697–708

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12

Suggested Contents of a Portable Storage Unit for Difficult Airway Management

Alternative/rescue ventilation equipment	Oral and nasal airways of assorted sizes Supraglottic airways of assorted sizes/cuffed pharyngeal sealer Nasal cannula
Alternative intubation equipment	Tracheal tubes of assorted sizes (including microlaryngeal tubes) Rigid blades of alternate design and size for intubation Tracheal tube guides. Examples include (but are not limited to) semirigid stylets, lighted stylets, forceps designed to manipulate the distal portion of the tracheal tube Intubating supraglottic airway Videolaryngoscope with appropriate stylet Optical laryngoscope Intubating video stylet Flexible intubating bronchoscope along with topical anesthetic and equipment, and airway/bite block Aintree catheter
Emergency airway equipment	Equipment for emergency invasive airway management Jet ventilation equipment
Miscellaneous	Airway exchange catheters of assorted sizes Multiple exhaled carbon dioxide detectors A laminated version of a local accepted difficult airway algorithm/cognitive aid/checklist Defogger

2022 ASA Management of Difficult Airway. Anesthesiology 2022; 136:31

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Video Laryngoscopy **2nd Generation LMA**

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Audience Poll:

"On your first intubation attempt, do you use direct laryngoscopy or video laryngoscopy?"

15

TABLE 4.
META-ANALYSIS SUMMARY: VIDEOLARYNGOSCOPY VERSUS DIRECT LARYNGOSCOPY*

	Studies†	Patients	Effect: Fixed	Effect: P	Effect: Random	Effect: P	Heterogeneity: I^2	Heterogeneity: P
			Odds Ratio‡ (99% CI)					
Laryngoscopic view	8	1,100	0.123 (0.078, 0.194)	< 0.001	0.124 (0.056, 0.275)	< 0.001	53%	0.036
Successful intubation	10	1,213	0.181 (0.097, 0.339)	< 0.001	0.225 (0.063, 0.803)	0.003	52%	0.026
First attempt success	9	624	0.327 (0.161, 0.666)	< 0.001	0.357 (0.170, 0.749)	< 0.001	0%	0.719
Additional maneuvers	6	738	0.379 (0.250, 0.574)	< 0.001	0.311 (0.149, 0.650)	< 0.001	57%	0.041
			Mean Difference (99% CI)					
Intubation time	10	793	−0.158 (−0.347, 0.030)	0.031	−0.036 (−0.652, 0.580)	0.880	90.12%	< 0.001

*Statistics for individual studies and forest plots are available as Supplemental Digital Content 4, http://links.lww.com/ALN/C697. †Number of studies included in the meta-analysis. ‡Continuity correction of 0.5 for zero cell frequencies.

2022 ASA Management of Difficult Airway. Anesthesiology 2022; 136:31

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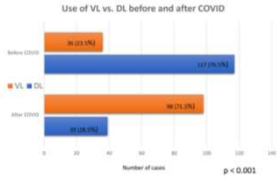
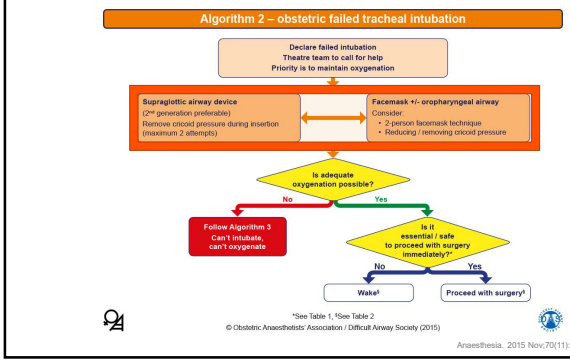
VL vs DL



Outcome	VL	DL	p
n	134	156	
First-pass-success rate— (% [95% CI])	133 (99.3 [95.0–99.9])	154 (98.7 [95.4–99.8])	1.000
Cormack-Lehane view—(% [95% CI])			
Easy (view I–II)	129 (100 [97.2–100])	147 (96.7 [92.4–98.9])	0.064
Difficult (view III–IV)	0 (0 [0–2.8])	5 (3.3 [1.1–7.6])	
Intubation difficulty—(% [95% CI])			
Nondifficult	129 (97.0 [92.4–99.2])	155 (100 [97.6–100])	0.044
Difficult	4 (3.0 [0.8–7.6])	0 (0 [0–2.4)	

Zasso, FB, et al. Anesth Analg. 2024 Nov 19. Epub ahead of print. PMID: 39773729.

17



18

SLMA + Urgent CD

- Category 2 CD: 193 (33.0%) parturients
- Category 3 CD: 391 (67.0%) parturients
- SLMA insertion success rate was 100%:
  - 1st attempt: 574 (98.3%)
  - 2nd attempt: 10 (1.7%).
- No clinical evidence of aspiration or regurgitation in any parturients
- "Our study demonstrated the effective use of the SLMA as an alternative airway device …for category 2 and 3 emergency Cesarean delivery"

Shi. BMC Anesthesiology (2017) 17:169

19

Failed intubation also impacts the Neonate…

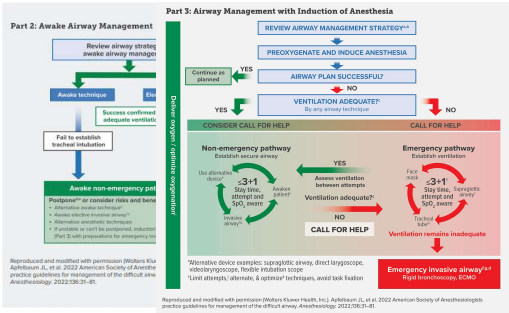
Factors associated with neonatal intensive care unit admission.

Variable	aOR	95% CI	*P* value
Failed tracheal intubation[a]	3.88	1.29–11.65	0.0089
Lowest maternal SpO_2 (per% increase)[b]	0.960	0.927–0.997	0.014
Caesarean section – Category 1[a]	0.783	0.266–2.28	0.63
Birth weight (per 100 g increase)[a]	0.870	0.818–0.938	0.0002
Gestation (per week increase)[c]	0.558	0.451–0.713	<0.0001
5 min Apgar score (per unit increase)[a]	0.501	0.358–0.688	<0.0001

Quinn AC, et al. Eur J Obstet Gynecol Reprod Biol. 2017 Oct;217:181-182.

20

ADULT COGNITIVE AID



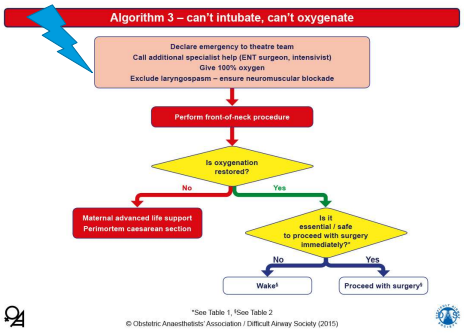
21

Audience Polls:

1. If after a failed intubation, a supraglottic airway is placed with effective ventilation and there is significant fetal distress would you wake the patient up or proceed with the surgery?
Wake up patient or Proceed with surgery

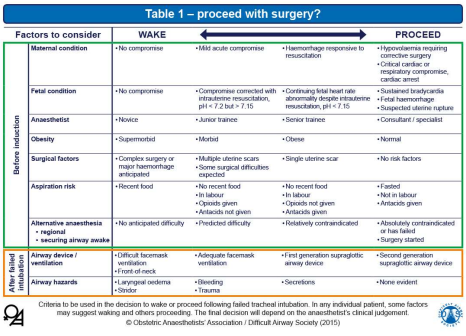
2. If after a failed intubation, you are still unable to provide effective ventilation with either a supraglottic airway or mask ventilation, would you allow the obstetrician to proceed with cesarean delivery in cases of serious fetal distress? (Y/N)

22



Anaesthesia. 2015 Nov;70(11):1286-306

23



Anaesthesia. 2015 Nov;70(11):1286-306

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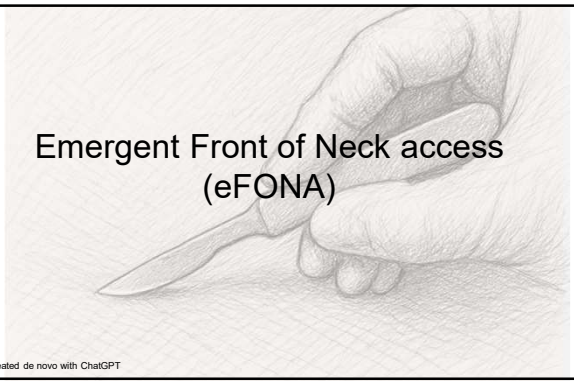
Table 2 – management after failed tracheal intubation

Wake	Proceed with surgery
• Maintain oxygenation • Maintain cricoid pressure if not impeding ventilation • Either maintain head-up position or turn left lateral recumbent • If rocuronium used, reverse with sugammadex • Assess neuromuscular blockade and manage awareness if paralysis is prolonged • Anticipate laryngospasm / can't intubate, can't oxygenate	• Maintain anaesthesia • Maintain ventilation - consider merits of: ▫ controlled or spontaneous ventilation ▫ paralysis with rocuronium if sugammadex available • Anticipate laryngospasm / can't intubate, can't oxygenate • Minimise aspiration risk: ▫ maintain cricoid pressure until delivery (if not impeding ventilation) ▫ after delivery maintain vigilance and reapply cricoid pressure if signs of regurgitation ▫ empty stomach with gastric drain tube if using second-generation supraglottic airway device ▫ minimise fundal pressure ▫ administer H_2 receptor blocker i.v. if not already given • Senior obstetrician to operate • Inform neonatal team about failed intubation • Consider total intravenous anaesthesia
After waking	
• Review urgency of surgery with obstetric team • Intrauterine fetal resuscitation as appropriate • For repeat anaesthesia, manage with two anaesthetists • Anaesthetic options: ▫ Regional anaesthesia preferably inserted in lateral position ▫ Secure airway awake before repeat general anaesthesia	

Anaesthesia. 2015 Nov;70(11):1286-306

25



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26

FONA Recommendations…

Table 1 International recommendations on eFONA techniques.

Country	Professional body	Recommendation
UK Ireland	DAS, RCoA, Association of Anaesthetists, Faculty of Intensive Care Medicine, Intensive Care Society, British Association of Otorhinolaryngologists	'Scalpel-bougie-tube' technique recommended.[2,4,22]
Australia New Zealand	ANZCA	'Scalpel-first' or a 'needle-first' approach' recommended depending on specialist preference.[23]
Canada	The Canadian Difficult Airway Focus Group	Percutaneous needle-guided wide-bore cannula or open surgical approach recommended. Narrow bore cannula techniques only recommended if the clinician very experienced with jet ventilation. Recommend commencing cricothyroidotomy with a 3cm vertical incision over presumed location of the CTM.[24]
USA	ASA	Surgical or percutaneous techniques recommended.[25]

Price & McCoy. Emergency front of neck access in airway Management. BJA Education, 19(8): 246e253 (2019)

27

FONA Considerations

Plan D: Emergency front of neck access

Continue to give oxygen via upper airway
Ensure neuromuscular blockade
Position patient to extend neck

Scalpel cricothyroidotomy

Equipment: 1. Scalpel (number 10 blade)
2. Bougie
3. Tube (cuffed 6.0mm ID)

Laryngeal handshake to identify cricothyroid membrane

Palpable cricothyroid membrane
Transverse stab incision through cricothyroid membrane
Turn blade through 90° (sharp edge caudally)
Slide coude tip of bougie along blade into trachea
Railroad lubricated 6.0mm cuffed tracheal tube into trachea
Ventilate, inflate cuff and confirm position with capnography
Secure tube

Impalpable cricothyroid membrane
Make an 8-10cm vertical skin incision, caudad to cephalad
Use blunt dissection with fingers of both hands to separate tissues
Identify and stabilise the larynx
Proceed with technique for palpable cricothyroid membrane as above

Price & McCoy. Emergency front of neck access in airway Management. BJA Education, 19(8): 246e253 (2019)

28

A Series of Anesthesia-related Maternal Deaths in Michigan, 1985–2003

Jill M. Mhyre, M.D., Monica N. Riesner, M.D.,* Linda S. Polley, M.D.,† Norah N. Naughton, M.D., M.B.A.‡*

Anesthesiology 2007

- **855 deaths**
  - **8 anesthesia-related**
  - **7 anesthesia-contributing**
- No deaths during induction of general anesthesia
- Five from hypoventilation/obstruction during emergence & recovery
- Over half from lapses in postoperative monitoring and inadequate supervision by an anesthesiologist

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QUESTIONS & ANSWERS

30

Leveraging POC Viscoelastic Technology for Better Patient Care: Ten minutes from the Test Tube

John J. Kowalczyk, MD | Shubhangi Sing, MD | Denis Snegovskikh, MD

1

Disclosures

Michaela K. Farber

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John J. Kowalczyk

No conflicts of interest to disclose.

Shubhangi Sing

No conflicts of interest to disclose.

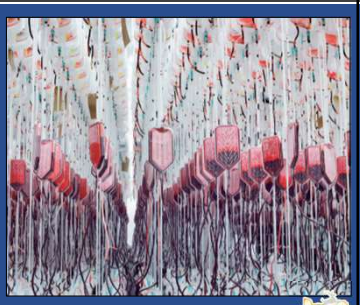
Denis Snegovskikh

No conflicts of interest to disclose.

2

Learning Objectives

1. Compare the differences between the common types of viscoelastic testing - TEG and ROTEM.
2. Summarize the benefits of viscoelastic testing.
3. Interpret ROTEM and TEG 6s results, make a diagnosis, and select an appropriate treatment.
4. Estimate the costs associated with implementing viscoelastic testing and prepare a cost analysis proposal for administration.



3

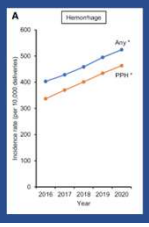
Postpartum Hemorrhage

Definition:

- Blood loss of greater than or equal to 1,000 ml[1] or
- Blood loss accompanied by signs or symptoms of hypovolemia within 24 hours after the birth process

Scope:

- Rate of Hemorrhage: 3-5.3%.[2,3]
- Rate of Transfusion: 0.9-2.3%
- Leading preventable cause of death: 70-90%

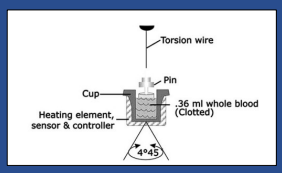


1. Committee on Practice Bulletins-Obstetrics. Obstet Gynecol. 2017 Oct.
2. Reale SC. Anesth Analg. 2020 May
3. Sangara RN. Am J Obstet Gynecol. 2024

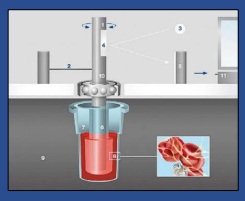
4

TEG and ROTEM

Thromboelastography (TEG)



Thromboelastometry (ROTEM)



1. Whiting D. Am J Hematol. 2014 Feb.

5

TEG 5000 vs ROTEM Delta

6

TEG 6s vs ROTEM Sigma

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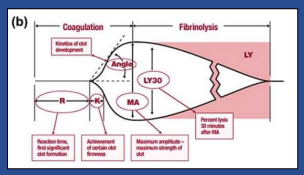
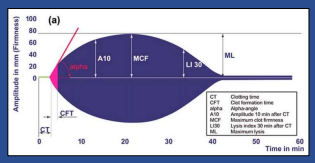
TEG and ROTEM





1. Whiting D. Am J Hematol. 2014 Feb.

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8

TEG Benefits in PPH

- Prospective study showed decrease in blood product usage, particularly FFP and platelets[1]:
  - decreased blood product usage
  - Increased fibrinogen concentrate usage
  - decreased rates of TACO and TRALI
- Retrospective study showed decrease in blood product usage, particularly FFP and platelets[2]:
  - less likely to be admitted to the ICU
  - underwent fewer hysterectomies
  - shorter hospital length of stay
- Prospective observational study showed decrease in blood product usage, particularly FFP, platelets, and cryo[3]:
  - decreased blood product usage
  - Increased fibrinogen concentrate usage
  - decreased rates of TACO

1. Mallaiah S, et al. Anaesthesia. 2015.
2. Snegovskikh D, et al. J Clin Anesth. 2018.
3. McNamara H, et al. Anaesthesia. 2019.

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ROTEM Benefits in PPH

- Prospective study showed decrease in blood product usage, particularly FFP and platelets[1]:
  - decreased blood product usage
  - Increased fibrinogen concentrate usage
  - decreased rates of TACO and TRALI
- Retrospective study showed decrease in blood product usage, particularly FFP and platelets[2]:
  - less likely to be admitted to the ICU
  - underwent fewer hysterectomies
  - shorter hospital length of stay
- Prospective observational study showed decrease in blood product usage, particularly FFP, platelets, and cryo[3]:
  - decreased blood product usage
  - Increased fibrinogen concentrate usage
  - decreased rates of TACO

1. Mallaiah S, et al. Anaesthesia. 2015.
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3. McNamara H, et al. Anaesthesia. 2019.

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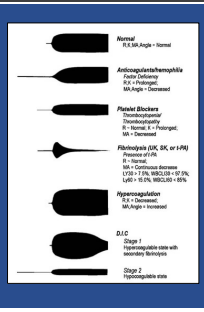
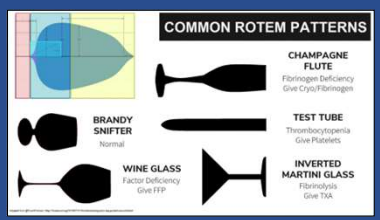
Interpretation: Qualitative Analysis





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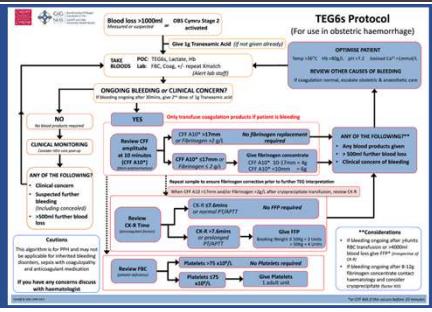
TEG 6s Protocol



1. Gill N. Best Pract Res Clin Anaesthesiol. 2024 Sep.

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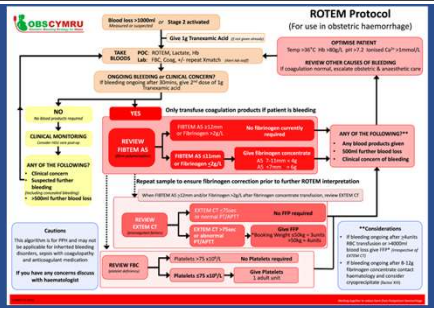
ROTEM Protocol



1. Gill N. Best Pract Res Clin Anaesthesiol. 2024 Sep.

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Interpretation

TEG Variable	TEG Cutoff	ROTEM Variable	ROTEM Cutoff	Deficiency	Treatment
MA CFF (Maximum Amplitude Citrated Functional Fibrinogen)	<11 mm	FIBTEM	<12 mm	Fibrinogen Deficiency	Cryoprecipitate or Fibrinogen Concentrate
CK R Time (Citrated Kaolin Reaction)	>7.6 min	EXTEM Clotting Time	>75 sec	Clotting Factors	FFP (Fresh Frozen Plasma)
MA CRT (Maximum Amplitude Citrated Rapid TEG)	<50 mm	MCF (Maximum Clot Firmness)	???	Platelets	Platelets
LY 30	>10%	LI 30	>10%	Hyperfibrinolysis	Tranexamic Acid
CKH R>>CKR	~ >4min			Heparin / Enoxaparin present	Consider reversal

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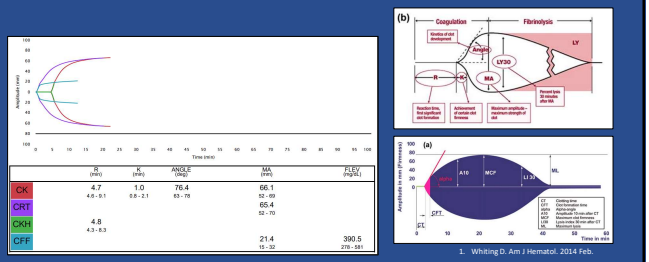
TEG 6s Tracing



1. Whiting D. Am J Hematol. 2014 Feb.

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Example: Case 1

A thromboelastogram is performed on a 29-year-old G2P1 pregnant patient who has been on antepartum with a chronic abruption and repeat bleeds. She again presents to L&D with a 300 mL of vaginal bleeding and recurrent FHR decelerations. After delivery, she experiences postpartum hemorrhage with a QBL of 1,791 mL, and the obstetricians report diffuse bleeding. A thromboelastogram demonstrates an increased K time and decreased alpha angle. Which of the following would most LIKELY correct the abnormality?

A. Cryoprecipitate or Fibrinogen Concentrate
B. Tranexamic Acid
C. Fresh frozen plasma
D. Platelets

	R	K	Angle	MA	FLEV
CK	4.3	1.0	76.4	66.1	
	(4.6-9.1)	(0.8-2.1)	(63-78)	(52-69)	
CRT				65.4	
				(52-70)	
CKH	4.0				
	(4.3-8.3)				
CFF				21.4	390
				(15-32)	(278-581)

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Example: Case 2

You are called to a Labor and Delivery room after a 37-year-old G2 now P2 pregnant patient with a history of severe preeclampsia by blood pressures delivered twins. She has had persistent bleeding and her EBL is now 1,100 mL. Oxytocin, methylergonovine, and carboprost have all been given and the obstetric team are concerned this is coagulopathy from her severe preeclampsia. A thromboelastogram is performed and shown below. Which of the following would most LIKELY correct the abnormality?

A. Cryoprecipitate or Fibrinogen Concentrate
B. Tranexamic Acid
C. Fresh frozen plasma
D. Platelets

	R	K	Angle	MA	FLEV
CK	4.3	4.2	40.1	48.1	
	(4.6-9.1)	(0.8-2.1)	(63-78)	(52-69)	
CRT				60.5	
				(52-70)	
CKH	4.0				
	(4.3-8.3)				
CFF				9.1	216
				(15-32)	(278-581)

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Example: Case 1

A 36 year-old G4 now P4 pregnant patient is undergoing repeat cesarean delivery and hysterectomy for placenta accreta spectrum. She has an EBL of 4.5 L and has had goal-directed transfusion with viscoelastic testing and has received 6 U of pRBCs, 2 U FFP, and 5 grams of fibrinogen concentrate. Based on her most recent thromboelastogram shown below, which of the following is the BEST diagnosis for this patient?

A. Clotting factor deficiency
B. Deficient thrombin formation
C. Hypercoagulable state
D. Thrombocytopenia

	R	K	Angle	MA	FLEV
CK	6.4	0.8	78.4	47.1	
	(4.6-9.1)	(0.8-2.1)	(63-78)	(52-69)	
CRT				41.3	
				(52-70)	
CKH	6.2				
	(4.3-8.3)				
CFF				15.5	332
				(15-32)	(278-581)

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Example: Cases 4

A 32 year-old G2P2 patient with a history of anti phospholipid antibody on enoxaparin since delivery presents to Labor and Delivery 1 week postpartum. She reports that she has bled 1-2 L at home and feels lightheaded. In triage her heart rate is 134 bpm and her blood pressure is 84/44 mmHg after a 1 L fluid bolus. The obstetrics team would like to take her back for a dilatation and curettage for possible retained tissue. A thromboelastogram is performed and shown below. Which of the following would most LIKELY correct the abnormality?

A. Cryoprecipitate
B. Fresh frozen plasma
C. Desmopressin
D. Protamine Sulfate

	R	K	Angle	MA	FLEV
CK	11.8	1.2	74.4	65.1	
	(4.6-9.1)	(0.8-2.1)	(63-78)	(52-69)	
CRT				64.4	
				(52-70)	
CKH	6.1				
	(4.3-8.3)				
CFF				24.5	411
				(15-32)	(278-581)

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Limitation in Viscoelastic Testing

Heparin-like effects:
- TEG 6s - RapidTEG
- ROTEM – APTEM or INTEM/HEPTEM

Platelet Inhibition:
- TEG 6s - Requires platelet mapping cartridge
- ROTEM – Platelet or VerifyNow

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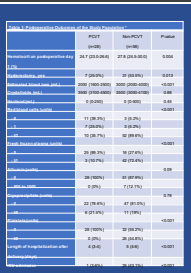
Cost Analysis Proposal: Cost Breakdown

Costs:
- Current cost of a viscoelastic device is about $46,000
- Average cartridge price is $125
- Annual service contract is $8,000
- Annual QC cost is $5,000
- Obstetric hemorrhage – 2-3 tests per patient

1. Snegovskikh D, et al. J Clin Anesth. 2018.

21

Cost Analysis Proposal: Patient Outcomes



	PCVT (n=18)	Non-PCVT (n=19)	P-value
Hematocrit on postoperative day 1 (%)	24.7 (23.0-26.6)	27.8 (26.5-30.0)	0.004
Multiparity, yes	7 (38.9%)	17 (53.9%)	0.372
Estimated blood loss, mL	2000 (1400-2500)	3000 (2000-4000)	<0.001
Transfusion, mL	1800 (1000-4000)	3000 (2000-4700)	0.08
Received, n	0 (0.000)	0 (0-600)	0.45
Peripheral cells (units)			<0.001
0	11 (39.3%)	3 (9.2%)	
1	7 (39.0%)	9 (9.2%)	
>1	10 (35.7%)	32 (89.6%)	
Fresh frozen plasma (units)			<0.001
0	25 (89.3%)	10 (27.6%)	
>1	3 (10.7%)	42 (72.4%)	
Cryoprecipitate (units)			0.09
0	28 (100%)	37 (97.9%)	
>1	0 (0%)	7 (13.1%)	
Platelet transfusion (units)			0.79
0	22 (78.6%)	47 (91.0%)	
>1	6 (21.4%)	11 (19%)	
Platelets (units)			<0.001
0	28 (100%)	12 (32.7%)	
>1	0 (0%)	26 (68.8%)	
Length of hospitalization after delivery (days)	4 (3-6)	8 (6-9)	<0.001
Re-admission	1 (3.6%)	10 (26.3%)	<0.001

* Data are expressed as n (%), median (interquartile range) * Data are expressed as mean (SD)

1. Committee on Practice Bulletins-Obstetrics. Obstet Gynecol. 2017 Oct.

22

Cost Analysis Proposal: Cost Breakdown

Table 2: Cost of Hospitalization for Patients with Severe Postpartum Hemorrhage Managed with or without PCVT

	PCVT (n=17)	Non-PCVT (n=37)	Difference	p-value
Indirect	$5,746.65 ($2,458.16)	$8,585.65 ($4,412.28)	$2,839	0.004
Direct	$6,056.29 ($2,519.45)	$11,833.43 ($7,182.55)	$5,777.14	<0.001
Total	$11,802.94 ($4,936.91)	$20,419.08 ($11,550.47)	$8,616.14	<0.001

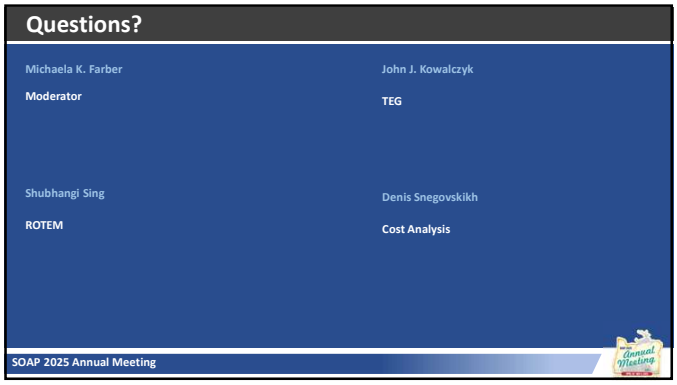
* Data are expressed as mean (SD)

23

Cost Analysis Proposal: Annual ROI Projection (Based on Local Volume)

Return on Investment:
- 1,000 births/year
- 3–5% PPH = 30–50 cases/year
- 10–20% severe PPH = ~5–10 cases/year
- Per Case Savings = $8,616
- Potential annual savings = $43,000–$86,000
- ROI = 1-2 years before you see cost savings

24


Questions?
Michaela K. Farber
Moderator
John J. Kowalczyk
TEG
Shubhangi Sing
ROTEM
Denis Snegovskikh
Cost Analysis
SOAP 2025 Annual Meeting

25

Interpreting POCVT During Acute PPH

Shubhangi Singh
University of Michigan

1

PLAN

- The Pathway and the Patient
- The TEST
- Interpreting the TEST
- TESTING our learning

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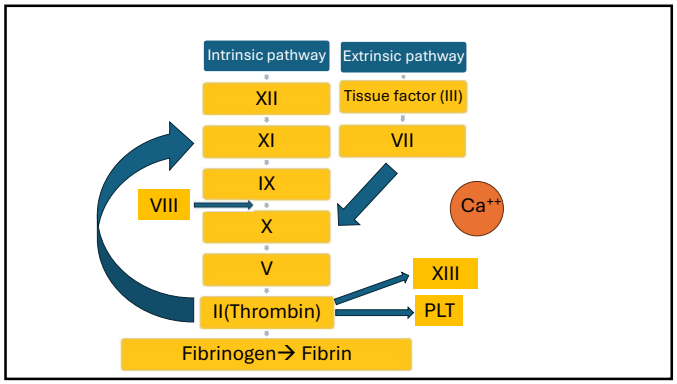

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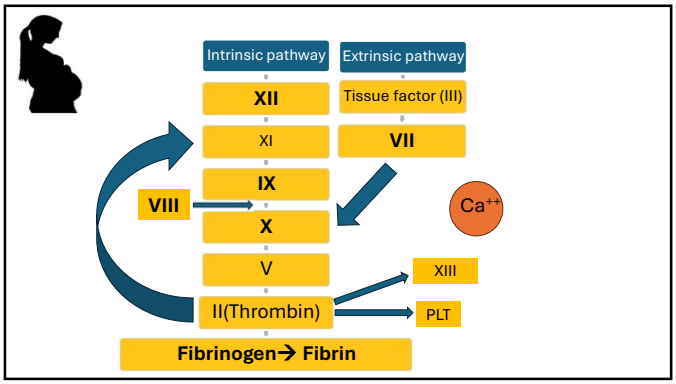

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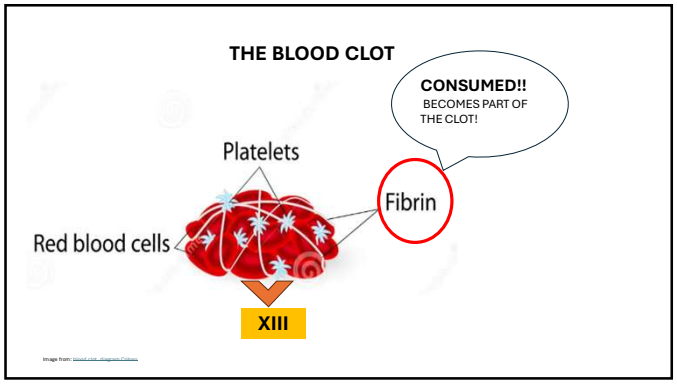

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Charbit et al 2007

The decrease of fibrinogen is an early predictor of the severity of postpartum hemorrhage

The positive predictive value of progression to severe PPH (Hb decrease of ≥ 4g/dL *or* transfusion of at least 4 PRBCs *or* hemostatic intervention *or* death in the first 24 hrs) with a 0 hr (administration of second line uterotonic) fibrinogen level of ***≤ 200 mg/dL*** is 100%.

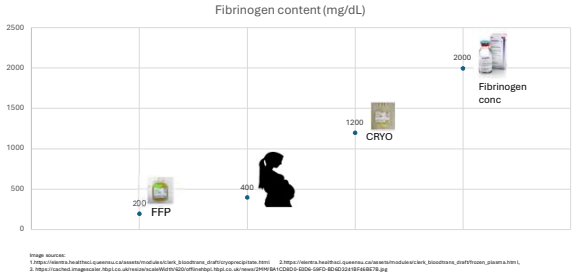
Collins et al 2017

Viscoelastometric-guided early fibrinogen concentrate replacement during postpartum haemorrhage: OBS2, a double-blind randomized controlled trial

Fibrinogen replacement is not required at or ***fibrinogen >200mg/dL (FIBTEM A10 >12mm)***

6

Fibrinogen Sources



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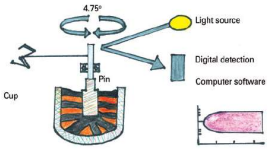
The CONCEPT of Viscoelastic testing

Viscoelastic testing provides **quick**, **comprehensive**, **real-time** assessment of the **functional state** of the coagulation system by analyzing the dynamic **changes in viscoelastic properties** of blood during clotting under **low shear stress.**



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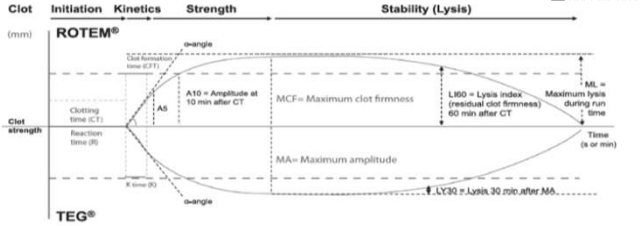
The basic thrombo-elastogram



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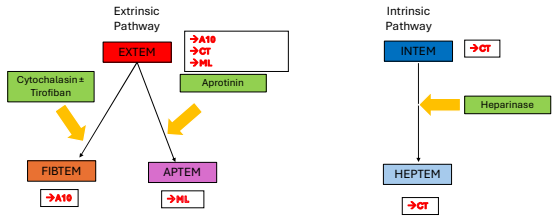
ROTEM



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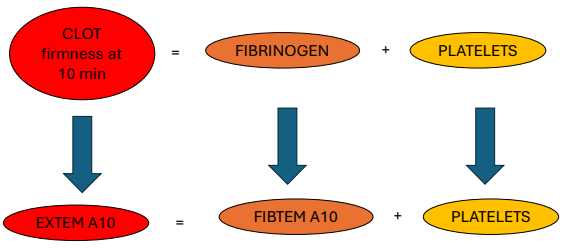


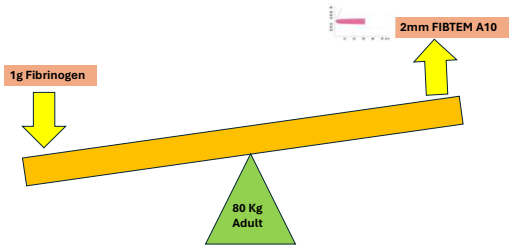
11

Treating the Test

- FIBTEM A10: • ≤12 mm→ Fibrinogen
- EXTEM A10: • <43 with normal FIBTEM A10→ PLT
- EXTEM CT: • ≥80→ FFP
- EXTEM ML: • >5%→TXA

12

So how much fibrinogen should I give?



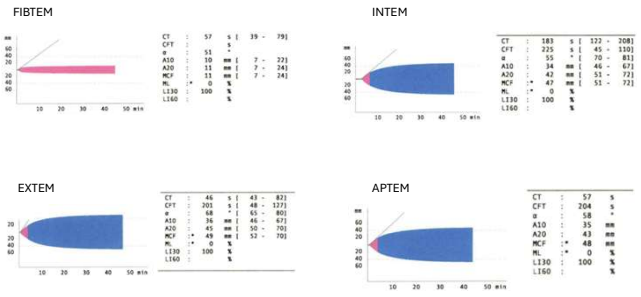
13

32 Y F G1P1 s/p vaginal delivery complicated by severe uterine atony despite oxytocin, methergine, multiple doses of hemabate, miso and 1g TXA.

QBL is at least 3.5 L but there is some blood on the floor unaccounted for. You are called to the bedside to help with the ongoing bleeding. IV is wide open had she has received 1 L of LR already.

You send a VBG and a ROTEM as you get a 16 G IV in.

14



15

What would you do?

a. 1-2g fibrinogen

b. 2 bags of FFP

c. 1 bag of 6 pack PLTs

d. 1L LR

16

What would you do?

a. 1-**2g fibrinogen**

b. 2 bags of FFP

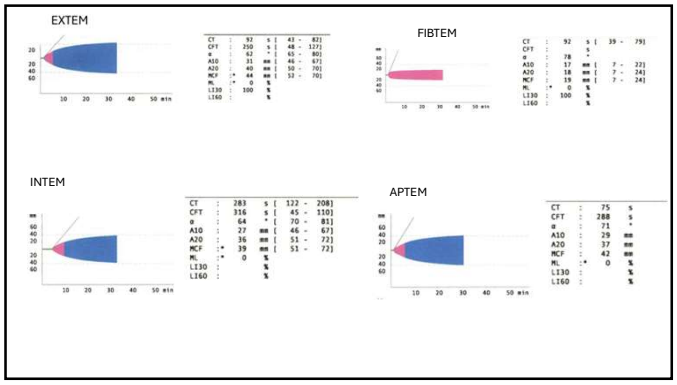
c. 1 bag of 6 pack PLTs

d. 1L LR

17

The patient is then taken to the OR for a D and C, Bakri placement and Lac repair. You have now resuscitated her with a total of 3L crystalloid and 2PRBCs, 2g Fibrinogen. Total EBL is 4.5 L at this point. You send another ROTEM and ABG as you insert an A line.

18



19

What would you do?

a. 1g Fibrinogen

b. 2 units of FFP

c. 1 bag of PLT

d. Both b and c

20

What would you do?

a. 1g Fibrinogen

b. 2 units of FFP

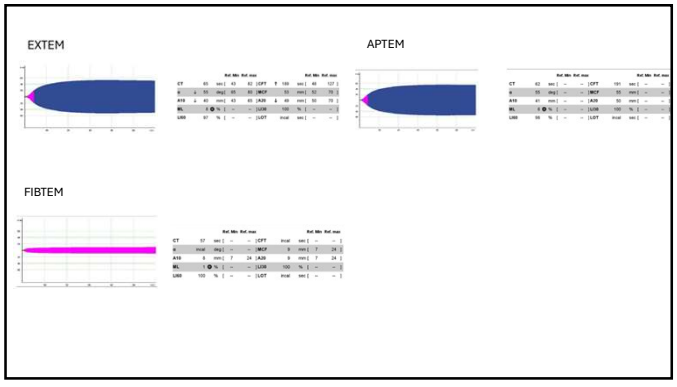
c. 1 bag of PLT

d. Both b and c

21

33 Y F G2P1 came to triage with complaints of abdominal pain. While being worked up, she had a huge fetal decel to 80 bpm, was rushed to the OR and required a STAT C section under GA for terminal fetal bradycardia. Concealed hemorrhage of about 750 cc was revealed at the time of delivery of placenta. QBL at this time is ~950cc. In setting of "soft" BP and tachycardia, you send a VBG and a ROTEM.

22



23

What would you do?

a. 2 units of FFP
b. 3g fibrinogen
c. 1g TXA
d. Both b and c

24

What would you do?

a. 2 units of FFP
b. 3g fibrinogen
c. 1g TXA
d. Both b and c

25

Medical Management of Congenital Heart block: A Multi-Disciplinary Approach

Jordan Abrams, MD Clemens Ortner, MD Abha Khandelwal, MD Jessica Brodt, MBBS

G1P0 with CHB presented at 14 wks for pre-syncope secondary to bradycardia

"Pacemaker deferred given normal chronotropic response to activity and radiation in pregnancy"

IOL at 37w complicated by nausea & retching → vagal response → dropped ventricular beats → fetal decel

Isoproterenol gtt + arterial line → Improved maternal hemodynamics

Patient concern for prolonged labor course + Elevated BPs in setting of improved chronotropy

Intrapartum C/S managed with Isoproterenol & Phenylephrine gtt

In absence of PPM, a beta-agonist infusion can provide chronotropic support though the peripartum period

Given the relative ease of pharmacologic intervention, cutaneous/transvenous pacing should be a last resort for symptomatic bradycardia during labor

Isoproterenol has tocolytic properties and Dopamine has uterotonic properties. These effects are reduced with concomitant oxytocin infusion.

SOAP 2025 Annual Meeting
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Stanford MEDICINE
School of Medicine
Division of Obstetric Anesthesiology and Maternal Health

Easing the Tension

A Multidisciplinary Approach to Pulmonary Hypertension in Pregnancy

Emily Eruysal, MD, Marcia Chen, MD, Joe Bryant-Huppert, MD

DEPARTMENT OF ANESTHESIOLOGY, NEWYORK-PRESBYTERIAN HOSPITAL / WEILL CORNELL MEDICAL CENTER

NewYork-Presbyterian Weill Cornell Medicine

Background

- Pulmonary hypertension (PH) is characterized by elevated pulmonary artery pressure (PAP) and pulmonary vascular resistance (PVR)
- Incidence: 1% of the global population
- Diagnosed when PAP exceeds 20 mmHg
- Maternal mortality rates of 30-50% due to poor tolerance of the physiologic changes (e.g. increased plasma volume and cardiac output)
- Per the World Health Organization, pregnancy is contraindicated in PH patients due to the high risk of maternal cardiac events
- Despite counseling, patients with PH may elect to continue their pregnancies

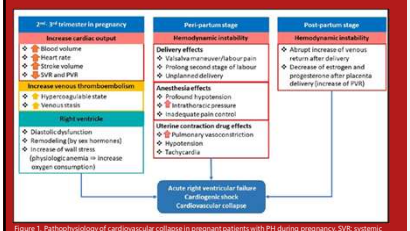

Figure 1. Pathophysiology of cardiovascular collapse in pregnant patients with PH during pregnancy. SVR: systemic vascular resistance; PVR: pulmonary vascular resistance. (Phoophiboon 2021)

Case Presentation

- 31F G2P0010 at 33 weeks 2 days gestational age with PH as a sequelae of severe obstructive sleep apnea, obesity hypoventilation syndrome, and chronic thromboembolic disease was diagnosed with pre-eclampsia with severe features (PEC with SF)
- Other PMH: HTN, asthma, BMI 55, type 2 diabetes mellitus
- TTE: dilated right ventricle, mild PH
- Right heart catheterization (RHC): PAP 53/25, mean PAP 34
- On magnesium and insulin infusions antepartum
- CD planned for following day

Obstetric Anesthesiology Consult/Multidisciplinary Planning

- Delivery by CD with Neuraxial anesthesia
- Avoid triggers to worsening PVR/PAP
  - Hypoxia, Hypercarbia, Acidosis, Pain, Anxiety, HTN, Myocardial depression
- High flow nasal cannula (HFNC) vs continuous positive airway pressure (CPAP)
- Arterial line: close BP monitoring, frequent arterial blood gas (ABG) draws
- Careful use of prophylactic oxytocin
- Recovery in the cardiac intensive care unit (CCU)
- Neonatal resuscitation team at delivery
- Contingency planning
  - availability of nitric oxide, inotropes
  - possible central line and pulmonary artery catheter
  - escalation of respiratory support
  - avoidance of carboprost/methylergonovine

Case Progression

- Standard ASA monitors, ultrasound-guided radial arterial line, additional large bore access attained
- Vasopressin infusion started prophylactically at 1U/h
- Combined low-dose spinal-epidural (CSE) 1cc Hyperbaric Bupivacaine, Fentanyl, Morphine
  - Epidural slowly dosed 2% Lidocaine w/epi to achieve bilateral T4 level
- HFNC titrated to PaO_2 on ABG
- Continued magnesium infusion postpartum; continued insulin infusion until delivery
- Oxytocin infusion started after delivery of anterior shoulder
- Transferred to CCU for recovery, diuresis for worsening PH and volume overload
- Discharged on post-operative day 7 with resolution of PH on RHC

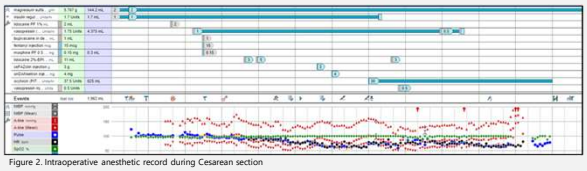

Figure 2. Intraoperative anesthetic record during Cesarean section

Discussion

- Recent studies have shown a decline in maternal mortality among pregnant women with well-controlled PH, ranging 9-25%
- Management: supplemental oxygen, diuretics, and anticoagulation
- Targeted therapy may include endothelin receptor antagonists, prostacyclin analogs, and phosphodiesterase-5 inhibitors

Key Points

- CD preferred over labor to avoid acute increases in PVR
- Neuraxial anesthesia preferred over general anesthesia
- Strongly consider invasive monitoring with arterial line
- ICU must be available for recovery
- Contingency planning for acute decompensation: central access with pulmonary artery catheter (PAC) placement, escalation of respiratory support, inotropic support, and pulmonary dilators
- Multidisciplinary planning between maternal fetal medicine, obstetric anesthesiology, cardiology, and neonatology is imperative for safe delivery

Figure 3. Critical care management for pregnant patients with pulmonary arterial hypertension (PAH) TTE: transthoracic echocardiography; LMWH: low molecular weight heparin; ECMO: extracorporeal membrane oxygenation; VA: veno-arterial. (Phoophiboon 2021)

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ANESTHESIA FOR MATERNAL-ASSISTED CESAREAN DELIVERY

Rebecca Boothe, B.S., Emily E. Sharpe, M.D., Leslie Carranza, M.D

Background

Maternal-Assisted Cesarean Delivery (MACD) is a modified cesarean technique wherein the birthing parent actively participates in the delivery of the infant. This method allows for increased involvement, and supports patient preferences, allowing for greater patient autonomy.

Case

35-year-old G4P3 woman with three prior CD was scheduled for repeat CD at 40w0d, requested a MACD prior to delivery

Preparation

- Protocol developed
- Patient counselling

Pre-op

- Mid-antebrachial IV
- Patient assisted with sterilization, gowning and gloving

Anesthetic

- ECG back pad
- Earlobe pulse oximetry
- Upper arm blood pressure cuff
- Combined spinal-epidural

Delivery

- After hysterotomy, drapes lowered; second gown removed
- Patient assisted delivering infant onto chest
- Delayed cord clamping

Discussion

Why MACD?

- 1 in three birthing people report trauma symptoms following delivery, which is often linked to the lack of choice and control.
- MACD empowers patients through active, hands-on participation.

Patient-centered care, without compromising safety

- Simple adaptations (IV placement, monitoring adjustments) allow MACD while maintaining standard surgical safety protocols.

Cesarean Section in an Impella Dependent Patient

Sierra Trost, MD; Liliana Goelkel Garcia MD; Mikayla Troughton MD; Benjamin Gorbaty MD, Iryna Chugaieva, MD;

Key Points:

- We present a case of successful Impella use to maintain fetal viability in early pregnancy and support hemodynamics during a planned Cesarean delivery (CD) in a patient with anthracycline-induced heart failure.

Management:

- Weekly multidisciplinary meetings
- Discontinuation of heparin in anticipation of neuraxial anesthesthetic
- Arterial line, Central line, Swan placed
- Epidural carefully dosed
- Vasoactive infusions in line
- CT surgery and Impella representative on standby

Background:

- Pregnancy-related physiologic and hemodynamic changes are poorly tolerated by patients with heart failure, placing them at high risk of decompensation. In severe cases, mechanical circulatory support (MCS) may be required. [1]
- The Impella is a temporary mechanical support device that pumps blood from the left ventricle to the proximal aorta. It increases aortic and coronary pressures, unloads the LV, and improves CO while reducing myocardial oxygen demand. [2]

Take-Home:

- MCS should be considered for patients with heart failure as a bridge to viability and CD.
- Multidisciplinary collaboration enhances teamwork and improves patient care.
- Careful planning with adequate hemodynamic monitoring and appropriate personnel on standby can allow the use of neuraxial anesthesia and ensure a safe delivery.

Department of Anesthesiology, University of Minnesota Medical Center, Minneapolis, MN

Management considerations for the obstetric patient with Takayasu's arteritis

Jasmine Kim, MD and Katelyn Scharf, MD

Introduction

Takayasu's arteritis (TAK) is a large vessel vasculitis that classically affects women of childbearing age. It affects the aorta and its branch arteries.

Clinical Case

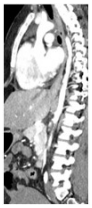
31 year-old G2P0 at 30w6d with a history of TAK presenting with severe range blood pressure from clinic.

HOD 0

HOD 1: Delivery

HOD 1-4: ICU

- Spinal: bupivacaine 7.5mg + fentanyl 15ug + morphine 150ug
- Epidural: lidocaine 2% 5mL



Discussion

Vascular dissections and stenoses

Aortic regurgitation

Narrow blood pressure therapeutic window

Non invasive blood pressure measurement

MICHIGAN MEDICINE
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1

Management of Pregnancy Termination for a Patient with Eisenmenger Syndrome and Chiari I Malformation with Associated Syringomyelia

Jacob Nieb MD MA, Katilynn Neumann MD MEd, Nicole Higgins MD MS, Jennifer Banayan MD
Section of Obstetric Anesthesiology, Department of Anesthesiology, Northwestern Memorial Hospital

Background

- **Arnold Chiari Type 1** is the most prevalent Chiari Malformation, affecting **0.7%** of the population; associated with **syringomyelia** in **25% of patients** (1).
- Delivery Planning: concerns for **brainstem herniation** with unintentional dural puncture; concerns with **elevated ICP** due to Valsalva during stage 2 or with laryngoscopy.
- Theoretical concern for **worsening neurologic function** in patients with symptomatic syringomyelia after neuraxial procedures and vaginal delivery (2).

- Eisenmenger Syndrome is the end-stage result of long-standing unrepaired congenital heart disease lesions, leading to intracardiac **right-to-left shunting** due to **pulmonary hypertension**.
- Maternal mortality for women with Eisenmenger Syndrome ranges between **20-40%** (3).

- Illinois: statutory protection for **abortion as a fundamental right** (4).
- Limits on abortion after **fetal viability** are permitted (4).

Case Timeline

Pre-op

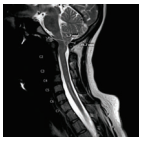
CC: 32-year-old G2P0010 female with upper extremity weakness, DOE

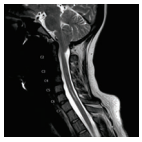
VS: SpO_2 93%

CBC: Hgb 18.5
HCG: positive (6w6d)

Stroke Code: CT brain, CT-A head/carotid with Chiari I and PDA

Admission: further workup





Chiari I (*above*) and Syrinx (*right*)

Multidisciplinary Planning

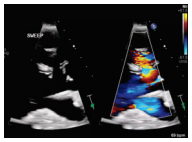
MFM
Complex Family Planning

Obstetric Anesthesiology

Cardiac Surgery
Cardiothoracic Anesthesiology
Perfusion

Congenital Cardiology
Pulmonary Hypertension

Operating Room Services



Infundibular/supracristal ventricular septal defect

Dilation & Curettage

- **Anesthetic Plan:** two large-bore PIVs, minimal sedation (fentanyl, midazolam, ketorolac), paracervical block, in-person interpreter, music therapy.
- **Emergency Planning:** inhaled nitric oxide circuit, arterial line, central line, cardiac surgeon, ECMO.

Post-op

- Routine PACU Care.
- Discharged **POD 1.**
- Continues to follow with congenital cardiology, pulmonology.

Discussion and Teaching Points

- Pregnant patients with severe pHTN and Eisenmenger Syndrome face **high morbidity and mortality**.
- Pregnancy **termination should be offered**.

- **Maintain SVR.**
- **Avoid worsening PVR** (hypoxia, hypercarbia, acidosis, PEEP, hypothermia, sympathetic stimulation).
- **Neuraxial preferred** if no other contraindications.
- Continuous ECG, invasive arterial monitoring, inhaled nitric oxide or prostaglandins.

- Care coordination: **2 weeks**, more than **20 specialists** and providers.
- Ability to avoid legal concerns causing **delays in care** while respecting **patient autonomy** and **dignity**.

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(5) Silversides CK, et al. Pregnancy Outcomes in Women With Heart Disease: The CARPREG II Study. *J Am Coll Cardiol*. 2018 May 29;71(21):2419-2430.

Varicella zoster meningitis: A rare case of disseminated reactivation

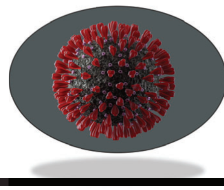
PAUL FRANCOIS MD, LAURA SORABELLA MD, KAITLYN BRENNAN DO, MPH

1. Department of Anesthesiology, Vanderbilt University Medical Center, Nashville, TN.

DEPARTMENT OF ANESTHESIOLOGY
VANDERBILT UNIVERSITY MEDICAL CENTER

Background

- VZV primary infection or reactivation can lead to more severe sequalae in the pregnant population. A pregnant mother is at the highest risk for a VZV complication during the third trimester.
- Patient with disseminated VZV infection, including those with VZV meningitis, should be closely followed for pneumonia symptoms, as this is associated with high mortality in pregnancy.
- Vertical transmission rate of VZV is estimated to be <2 % and is often associated with a primary infection. There is no significant data to show an association with reactivation of VZV and vertical transmission.



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Case Report

34-year-old G4P3003 with no PMHx presented at 22w1d following 2 weeks of fatigue associated with pruritic and painful skin lesions.

Physical Exam

T: 97.6 F - BP: 105/63 (MAP 75) - HR: 58- RR: 18- SpO2: 100%

Patient reported headache, photophobia, and neck rigidity. Small vesicular and crusted lesion on erythematous base noted on right buttock with radiation to her medial thigh.

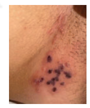

Image 1: Vesicular lesions found on the patient

Laboratory Evaluation

BMP				CBC		
136	109	8	8.6		11.3	
3.4	20	0.60; 0.60	84	8.8	><	173
					33	

		CSF STUDIES
Tube 1	08/22/24	Tube Number CSF
Colorless Cl...	08/22/24	Gross Appearance CSF
178 ^	08/22/24	Nucleated Cells CSF
0	08/22/24	RBC Count CSF
100	08/22/24	Total Cells CSF
48	08/22/24	Neutrophil CSF
33	08/22/24	Lymphocyte CSF
12	08/22/24	Monocyte/Macrophage CSF
3	08/22/24	Eosinophil CSF
4	08/22/24	Atypical cell CSF
See Diff Below	08/22/24	Manual Diff CSF
Atypical l...	08/22/24	Comment CSF
44 v	08/22/24	Glucose CSF
71 ^	08/22/24	Protein CSF

Results of CSF studies obtained by obstetric anesthesia team.

Management

- Following confirmatory CSF studies patient was started on IV acyclovir for 14 days. Patient remained inpatient for 9 days for electrolyte repletion and symptom management. Patient was subsequently discharged with PICC for continued antibiotic administration.
- Ultimately patient had quick resolution of symptoms following acyclovir and delivered a healthy boy at 39w1d using nitrous oxide for labor analgesia.

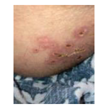

Image 2: Vesicular lesions following treatment with acyclovir

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Case Points

- Prior to 24 weeks, VZV vertical transmission has been detected clinically/serologically in neonates at varying rates.
- Some studies have transmission linked at 8% of virologically confirmed maternal VZV[3].
- Intrauterine growth restriction was found in up to 23 % of cases with low birth weight being universal[3.1].
- One case control study showed a statistically significant risk of preterm birth rate of 5.6%, compared with 14.3% for women with chickenpox in pregnancy[3,1].
- Timely diagnosis and appropriate antiviral therapy are crucial to maternal and fetal outcomes.

References:

1. Ray, B., Singhal, D., Kumar, A., Borle, A., & Baidya, D. (2012). Anesthesia for cesarean section in a parturient with acute varicella: Is general anesthesia better than neuraxial anesthesia?. Journal of Obstetric Anaesthesia and Critical Care, 2(2), 105. https://link-gale-com.proxy.library.vanderbilt.edu/apps/doc/A313201521/AONE?u=tel_a_vanderbilt&sid=bookmark-AONE&xid=44a83e0f
2. Mourad, M., Gershon, M., Mehta, S. K., Crucian, B. E., Hubbard, N., Zhang, J., & Gershon, A. (2022). Silent Reactivation of Varicella Zoster Virus in Pregnancy: Implications for Maintenance of Immunity to Varicella. Viruses, 14(7). http://dx.doi.org.proxy.library.vanderbilt.edu/10.3390/v14071438
3. Janardhan, A. L., Gupta, N., Prakash, S., & Gogna, R. L. (2016). Anesthetic management of a parturient with varicella presenting for cesarean delivery. International Journal of Obstetric Anesthesia, 28, 92–94. https://doi.org/10.1016/j.ijoa.2016.06.002
4. Lamont, R.F., Sobel, J.D., Carrington, D., Mazaki-Tovi, S., Kusanovic, J.P., Vaisbuch, E. and Romero, R. (2011), Varicella-zoster virus (chickenpox) infection in pregnancy. BJOG: An International Journal of Obstetrics & Gynaecology, 118: 1155-1162. https://doi-org.proxy.library.vanderbilt.edu/10.1111/j.1471-0528.2011.02983.x

IARS
International Anesthesia Research Society

Anesthesia & Analgesia and SOAP Co-Sponsored Workshop: How to Be a Great A&A Peer Reviewer

Thomas R. Vetter, MD, MPH, MFA
Deputy Editor-in-Chief, *Anesthesia & Analgesia*
Professor, Department of Surgery and Perioperative Care
University of Texas at Austin Dell Medical School

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SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

Thomas R. Vetter

SPEAKER DISCLOSURE

I have nothing to disclose.

2

Workshop Learning Objectives

- **Acquire** new and refine existing manuscript peer reviewer skills
- **Identify** and realize the benefits of serving as a journal peer reviewer
- **Enhance** individual scholarly contribution and professional achievement
- **Promote** greater diversity and inclusion among medical journal peer reviewers

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3

Basic Agenda and Housekeeping Details

- Welcome (!) and Introduction: 15 to 20 minutes
- Brief "Overview of Scientific Peer Review Process"
- Session 1 for 35 to 40 minutes
- Co-facilitator dyads rotate tables once
- Session 2 for 35 to 40 minutes
- Group Q&A: 15 minutes – longer if so desired…
- Very informal, interactive format: **experiential**
- **No such thing as a "stupid question"**
- **No such thing as a right or wrong answer or thought**

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4

Workshop Facilitator Dyads: A&A-SOAP Collaboration

Table 1 → 2

Thomas Vetter, MD, MPH, MFA: University of Texas at Austin, Austin, TX
Jill Mhyre, MD: University of Arkansas for Medical Sciences, Little Rock, AR

Table 2 → 1

Ashraf Habib, MBBCh, MSc, MHSc: Duke University, Durham, NC
Cynthia Wong, MD: University of Iowa, Iowa City, IA

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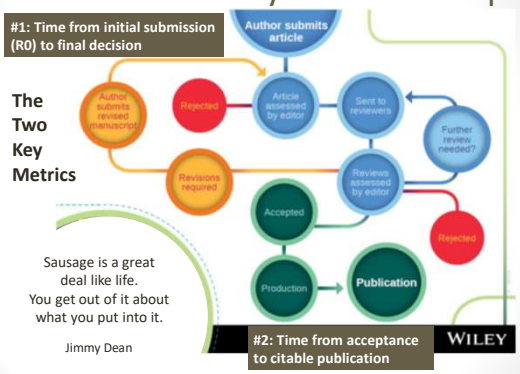
5

The Life Journey of a Manuscript

#1: Time from initial submission (R0) to final decision

The Two Key Metrics



Sausage is a great deal like life. You get out of it about what you put into it.

Jimmy Dean

#2: Time from acceptance to citable publication

https://authorservices.wiley.com/Reviewers/journal-reviewers/what-is-peer-review/the-peer-review-process.html

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6

Why Should YOU Peer Review?

- You have an obligation to review if you're also submitting papers to peer-reviewed journals.
- The experience will help you write your own papers & understand the review process:
  - Critiquing others' work
  - Seeing the critiques that others make of the same work
  - Seeing how authors respond to critiques
- Exposure to the cutting edge of the discipline
- Reputational benefits—and also consequences
- Future possibility of your own professional advancement

"Good Practice in Peer Review" by Rebecca Sear
https://osf.io/aujs4
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7

Who and What Is Peer Review For?

- Peer reviewers have two audiences:

1. **The author**
   - Peer review allows authors to improve the quality of their work.
2. **The editor**
   - Peer review provides editors with the information required to make final decisions on manuscripts.

- Your review needs to address **both** audiences.

"Good Practice in Peer Review" by Rebecca Sear
https://osf.io/aujs4
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What Is Peer Review For?

- To improve research quality
- What are the costs of getting it wrong?
- Review too generously:
  - Allow low quality research into the literature
  - "Why is so much bad research published?"
- Review too harshly:
  - Keep publishable research out of the literature
  - Only half of biomedical research is published—likely partly due to bias to publish only positive results
  - Inefficiency: increase the burden on editors and reviewers when papers have to be submitted to multiple journals before they get published

"Good Practice in Peer Review" by Rebecca Sear
https://osf.io/aujs4
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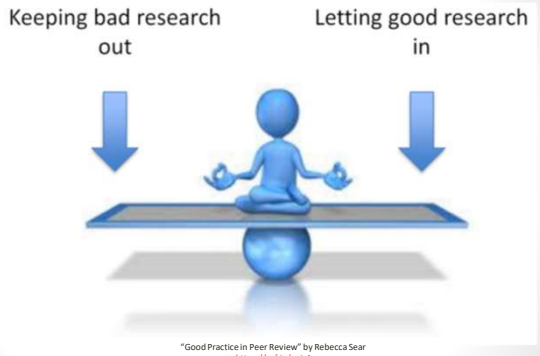
9

Getting the Peer Review Balance Right



"Good Practice in Peer Review" by Rebecca Sear
https://osf.io/aujs4
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The Vital Role of Your Peer Review

- "**Every** journal depends on the hard work of reviewers like you, who test and refine each article before publication."
- When you use a peer review checklist, it will be easier to rate each of the parts in the paper you're reviewing according to their strength. This will also make sure you don't miss any critical steps in the process.

https://editorresources.taylorandfrancis.com/reviewer-guidelines/review-checklist/
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Six Basic Framing Questions

- When reading & reviewing the manuscript, ask yourself:

1) What do the author(s) want to know?: **motivation**
2) What did they do?: **approach and methods**
3) Why was it done that way?: **context within the field**
4) What do results in text, figures, tables show?: **plausible**
5) How did the author(s) interpret the results?: **logical**
6) What should be done next?: **applicable**

▶ Regarding this last question, the author(s) may provide some suggestions in the Discussion, but the key is to ask yourself what you think should come next.

Carey MA, Steiner KL, Petri WA Jr (2020) Ten simple rules for reading a scientific paper. PLoS Comput Biol 16(7): e1008032.
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12

High Quality in Peer Review: Top 10 Tips for Peer Review

1. Respond promptly to a review request, whether you are accepting or declining; if declining, use the opportunity to recommend other early career researchers, who may not be on the editor's radar, as alternative reviewers.
2. Think about your audiences: your comments need to both aid the Editor in making a decision, and also provide constructive feedback to the authors.
3. Focus first on the methodology and data. If the data, methodology and analysis is suitable and sound, then problems with interpretation and presentation can usually be easily fixed.

https://royalsociety.org/blog/2019/09/tips-in-peer-review/

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High Quality in Peer Review: Top 10 Tips for Peer Review

4. Evaluate the manuscript you have in front of you; do not be tempted to insist the authors write the paper that you would have written instead.
5. Ask yourself whether all of the information is available to replicate the authors' study and interpret their results. Many journals now ask for all data to be made available – check this if applicable.
6. Reviewers can add considerable value by ensuring that the paper is clearly and appropriately presented. For example: is the manuscript clearly written, does the abstract adequately summarize the study, are figures a fair and clear representation of the results?

https://royalsociety.org/blog/2019/09/tips-in-peer-review/

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High Quality in Peer Review: Top 10 Tips for Peer Review

7. It is not the reviewer's role to 'edit' the language or presentation, but you should make suggestions to the author to improve readability, and flag to the editor if the quality of the language makes it too difficult to understand the scientific content.
8. Don't just focus on the paper's contents – flag to the editor any concerns regarding ethics and research integrity, data availability, transparency, etc.
9. Let the editor know if there are aspects that you don't feel competent in assessing.
10. Read your review carefully before submitting. Make sure that it is clear and constructive, doesn't use jargon or potentially confusing terminology, and it is polite and professional.

https://royalsociety.org/blog/2019/09/tips-in-peer-review/

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What Does a Good Review Look Like?

- Brief overview of your opinion on paper
- Structure your review
  - Consider dividing into major/minor points and essential/non-essential recommendations
  - Consider ordering points by importance
  - Distinguish between things that MUST be fixed before publication: like problems with methods, interpretation of data, and those which don't need to be fixed but are suggestions for improving the current research or for future research efforts
- Be constructive -- you are "talking to" a colleague: so be the authors' "critical friend"

"Good Practice in Peer Review" by Rebecca Sear
https://osf.io/aujs4

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What Does a Good Review Look Like?

- Provide details of where problems lie AND recommendations for fixing these problems
- Be clear
  - "I recommend rejection because _____."
  - "I recommend this issue is addressed because _____."
- Don't be reluctant to offer praise
- Be polite and respectful
  - Golden rule of reviewing: "Do unto others as you would have done unto you"
  - Comments to editor box may be a place to express slightly stronger, though still polite, views

"Good Practice in Peer Review" by Rebecca Sear
https://osf.io/aujs4

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17

What Does a Bad Review Look Like?

- Unstructured stream of consciousness
- Criticizes or applauds without explanation:
  - "This paper does not make a strong enough contribution to merit publication in a top journal like XX."
  - "This is a strong paper whose publication I enthusiastically support."
- The recommendation to accept or to reject is not consistent with the comments:
  - Recommends rejection on the basis of clearly fixable problems
  - Describes fundamental and unfixable problems, and then recommends the authors be asked to revise

"Good Practice in Peer Review" by Rebecca Sear
https://osf.io/aujs4

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18

A Few Shiny Pearls of Wisdom

- … all actors in this altruistic network should abide by the **Golden Rule of Reviewing**: review for others as you would have others review for you.
- … a simple, **additional golden rule of peer review**: If you wouldn't say it in person, don't say it in an anonymous review.
- Say yes to reviewing whenever your duties and schedule allow; provide a thorough, fair, and constructive critique of the work; and do it at your first opportunity regardless of the deadline.

McPeek MA, DeAngelis DL, Shaw RG, et al. The golden rule of reviewing. The American Naturalist. 2009 May;173(5):E155-8.
Glen AS. A New "Golden Rule" for Peer Review? Bulletin of the Ecological Society of America. 2014 Oct 1;95(4):431-4.

19

How to Become a Reviewer

- There is no one way to become a reviewer, but there are some common routes. These include:

1) Asking a colleague who already reviews for a journal to recommend you
2) Networking with editors at professional conferences
3) Becoming a member of a specialty society and then networking with other members in your area
4) Contacting journals directly to inquire if they are seeking new reviewers
5) Seeking mentorship from senior colleagues
6) Working for senior researchers who may then delegate peer review duties to you

https://authorservices.wiley.com/Reviewers/journal-reviewers/becoming-a-reviewer.html/index.html

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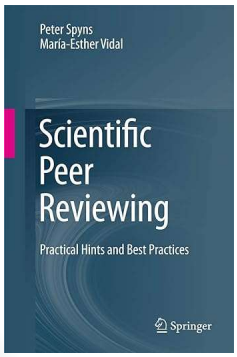
If Looking for a Basic Primer…



- Practical introduction to the practice of peer reviewing, **especially targeting junior researchers**
- Illustrated by a large set of commented good and bad examples
- Applicable to journal papers, conference abstracts, research grants, and project proposals

2016, Springer, **67 Pages**
ISBN: 978-3319250830

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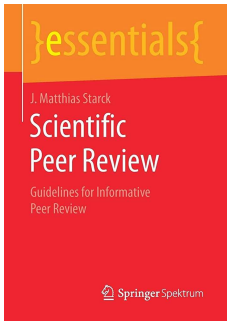
If Looking for a Deeper Dive…

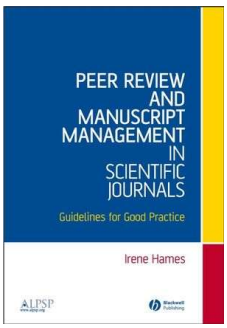


… comprehensively guides the reader through all the ***essential*** steps of writing an expert review for a scientific journal … **provides a critical guide how to write good, informative and fair peer reviews**.

October 2017, Springer Spektrum, 68 Pages
ISBN: 978-3658199142

22

If Looking for a Really Deep Dive…



This comprehensive yet concise book provides a thorough and complete guide to **every aspect of managing the peer review process** for scientific journals.

April 2007, Wiley-Blackwell, 320 Pages
ISBN: 978-1405131599

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Concluding Thought About Peer Review

"Getting an Education from MIT is like **taking a drink from a Fire Hose**." Jerome Weisner, former MIT President

http://hacks.mit.edu/Hacks/by_year/1991/fire_hydrant/

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KEEP
CALM
And
Let's Just
Have FUN
Thank you for participating in this peer review workshop offering…
We are here to learn as much from you, as you from us.
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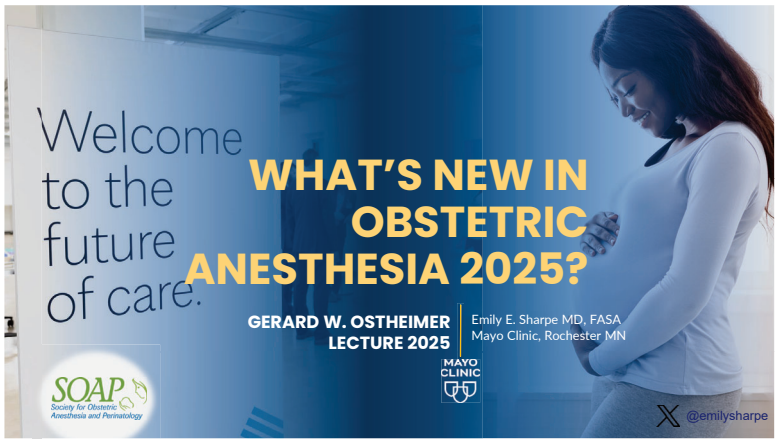
SOAP
Society for Obstetric Anesthesia and Perinatology

25

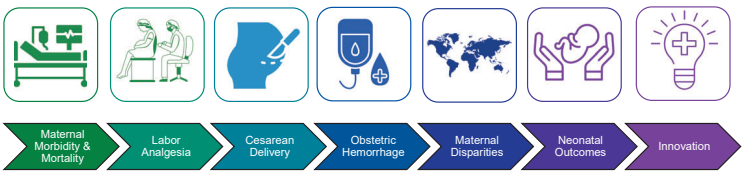


DISCLOSURES

- No financial disclosures

@emilysharpe

THEMES



MATERNAL MORBIDITY & MORTALITY

1

Cardiac Arrest In Obstetric Patients Receiving Anaesthetic Care: Results From The 7th National Audit Project Of The Royal College Of Anaesthetists

D.N. Lucas, Kursumovic E, Cook TM, et al.

- Hemorrhage was leading cause of cardiac arrest
- Prior to conversion of GA for hemorrhage, patient should be promptly and adequately resuscitated
- Cardiac arrest is a recognized complication of spinal anesthesia
- Beware of the unrecognized intrathecal catheter; Spinal after failed top-up epidural can result in high neuraxial block

AIM
Describe incidence, risk factors, & outcomes of cardiac arrest in patients receiving anesthetic care

METHODS
Case registry of perioperative cardiac arrests

POPULATION
UK, all NHS hospitals
June 2021-June 2022

Cause Cardiac Arrest	n
Hemorrhage	7
High neuraxial block	6
Bradyarrhythmia	6
Amniotic fluid embolism	4
Drug Error	2
Anaphylaxis	1
Pulmonary Embolism	1
Severe hypoxemia	1
Vagal outflow	1
Other	12

- 28 cases of cardiac arrest (3% of NAP7)
- 21% of patients were black (vs 6% of all NAP7 pts)

ACCOMPANYING EDITORIAL:
Monks DT, Singh PM, Palanisamy A

12

High Neuraxial Block in Obstetrics: A 2.5-Year Nationwide Surveillance Approach in the Netherlands

Beenakkers ICM, Schaap TP, van den Bosch OFC

Spinal anesthesia after epidural analgesia in labor is a common cause of high neuraxial block.

AIM
Assess the incidence and clinical features of high neuraxial block in obstetrics

METHODS
Prospective nationwide population-based cohort study: Netherlands Obstetric Surveillance System (NethOSS)

POPULATION
All hospitals in the Netherlands with a maternity unit

November 1, 2019-May 1, 2022

OUTCOMES
Cases of high neuraxial block requiring ventilatory support or requiring cardiopulmonary resuscitation.

BMI	Anesthetic	Location
23	SSS for CD after LEA	OR
29	SSS for CD after LEA	OR
29	SSS for CD after LEA	OR
26	LEA	Labor Room
30	SSS for CD	OR

- 148,483 neuraxial procedures in 2.5 years
- High neuraxial block in 7 cases, 2 didn't meet criteria
- The estimated incidence 1 in 29,770 neuraxial procedures in labor (95% CI, 1:12,758–1:91,659)

4

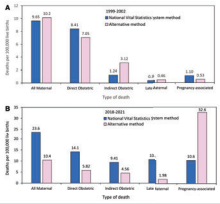
Maternal Mortality In The United States: Are The High And Rising Rates Due To Changes In Obstetrical Factors, Maternal Medical Conditions, Or Maternal Mortality Surveillance?

Joseph KS, Lisonkova S, Boutin A, et al.

The high and rising rates of maternal mortality in the United States are a consequence of **changes in maternal mortality surveillance**, with reliance on the pregnancy checkbox leading to an **increase in misclassified maternal deaths**.

AIM
Assess if rising rates of US maternal mortality reflect changes in obstetrical factors, maternal medical conditions, or maternal mortality surveillance

METHODS
1. National Vital Statistics System methodology
2. Definition-based approach; requires 1 mention of pregnancy among causes of death



- **NVSS**: Maternal deaths increased from 9.65 (n=1550) in 1999-2002 to 23.6 per 100,000 live births (n=3489) in 2018-2021
- **Alternative Definition**: 10.2 in the 1999-2002 period (n=1633) and 10.4 per 100,000 live births in the 2018-2021 period (n=1537)

5

ACOG

Despite New Manuscript, Incontrovertible Evidence Proves the Unacceptably High U.S. Maternal Mortality Rate

- Data systems need to be improved
- Authors created discrete categories to discredit pregnancy checkbox, which was not created to fabricate a problem. It was created to address an existing one.
- To reduce the U.S. maternal mortality crisis to an 'overestimation' is irresponsible and minimizes the many lives lost and the families that have been deeply affected.

CDC

Have U.S. deaths from pregnancy complications tripled?

CDC pushes back on study claiming overestimates

- The authors' methods, "are known to produce a substantial undercount of maternal mortality. There are maternal deaths occurring that would not otherwise be identified if the death certificate didn't include a pregnancy checkbox."
- "The AJOG report confirms a prior CDC analysis, which found that the pregnancy box is sometimes mistakenly checked on death certificates," contributing to "some overcounting."

6

Why improved surveillance is critical for reducing maternal deaths in the United States: a response to the American College of Obstetricians and Gynecologists

Joseph KS, Lisonkova S, Boutin A, et al.

The authors addressed:

- Why the study was conducted
- Minimizing concerns regarding maternal mortality
- Race and ethnicity specific maternal mortality
- Concern regarding underestimation vs overestimation
- Others highlighting problems with maternal mortality estimates
- Perinatal mental health conditions
- Improving maternal health care requires greater investment

7

The contribution of suicide to maternal mortality: A nationwide population-based cohort study

Lommerse KM, Merelle S, Rietvald AL, et al.

Surveillance and suicide prevention strategies with focus on **the entire first year postpartum** should be developed

AIM
Identify the incidence, proportion, and risk factors of maternal suicide

POPULATION
Women who died during pregnancy or 1 year postpartum vs. reference population 25–45 y.o. in Netherlands; 2006-2020

METHODS
Cause of Death Register and Medical Birth Register were linked to identify women who died within 1 year postpartum

OUTCOMES
Comparison of incidence and proportion of maternal suicides, risk factors, underreporting of postpartum suicides.

- 68 women were identified
- MSR 2.6 per 100,000 live births (95% CI 2.0-3.2) in 2006-2020 vs 2.5 per 100,000 in 1996–2005
- Proportion of maternal deaths increased 18% to 28%
- 34 (53%) were primiparous., 11 (55%) had a psychiatric history, 13 (65%) were in psychiatric treatment at the time of death
- Low education level was a risk factor (odds ratio 4.2, 95% confidence interval 2.3–7.9).

102

Perinatal depression and risk of mortality: nationwide, register based study in Sweden

Hagatulah N, Bränn E, Valdimarsdóttir UA, et al.

The **increased mortality** was **most pronounced** during the **first year** after perinatal depression diagnosis.

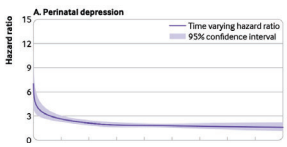
AIM
Determine whether women with perinatal depression are at an increased risk of death

POPULATION
Swedish national health registers

January 1, 2001 to December 31, 2018

METHODS
Matched cohort study based on the nationwide population.
Sibling comparison to further control for shared familial confounding

OUTCOMES
Primary outcome: Death due to any cause.



- Women with perinatal depression are at increased risk of death (**HR 3.26** [95% CI 2.95 to 3.60])
- Adjusted for pregnancy characteristics: **HR 2.11** (1.86 to 2.40)

7

Maternal Mortality: A National Institutes of Health Pathways to Prevention Panel Report

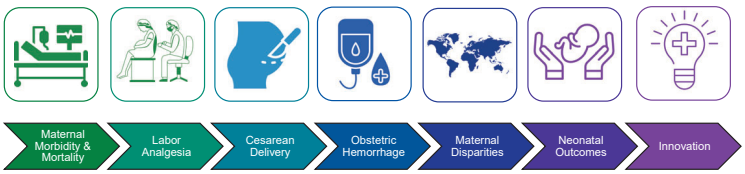
Davidson KW, Terry MB, Reis PJ, et al.

AIM
Propose a conceptual framework and national blueprint for research and the transformative change needed to prevent maternal morbidity and mortality

METHODS
NIH 3-day workshop to address maternal mortality in the US

POPULATION
November 29-December 1, 2022

1. Comprehensive multilevel life course conceptual framework for policy, research, and clinical transformations
2. Strengthen the research methods used in the science of maternal health
3. Establish programs of research to conduct needed prevention and treatment studies to guide efforts to reduce maternal morbidity and mortality
4. Pay for Evidence-Based Clinical Approaches and Train the Needed Workforce
5. A Maternal Morbidity and Mortality Prevention Moonshot



LABOR ANALGESIA

37

Epidural Analgesia During Labour And Severe Maternal Morbidity: Population Based Study

Kearns RJ, Kyzayeva A, Halliday LOE, et al.

Labor epidural analgesia was associated with a **35% reduction** in **severe maternal morbidity**

More pronounced in patients with medical indications for neuraxial analgesia.

AIM
Determine effect of neuraxial analgesia on SMM; Explore if effect is greater in medical indication for neuraxial labor analgesia or preterm labor.

METHODS
6 administrative databases were linked;

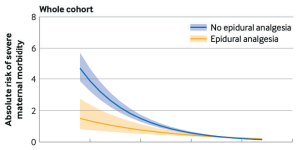
24 to 42+6 weeks GA included

POPULATION
All laboring patients in all NHS hospitals in Scotland

January 1, 2007 and 31 December 31, 2019

OUTCOMES
Severe maternal morbidity

- Epidural labor analgesia associated with reduction in SMM (aRR 0.65, 95% CI 0.50 to 0.85)
- Epidural associated with greater reduction in SMM with medical indication vs w/o medical indication: (aRR 0.50, 0.34 to 0.72) vs. (aRR 0.67, 0.43 to 1.03)



41

Sacral sensory blockade from 27-gauge pencil-point dural puncture epidural analgesia or epidural analgesia in laboring nulliparous parturients: a randomized controlled trial.

Frassanito L, Filetici N, Piersanti A, et al.

DPE with a **27g** spinal needle had **higher incidence of sacral blockade** than epidural within an hour after placement.
Supplemental analgesia and time to adequate analgesia did not differ

AIM
Evaluate sacral sensory blockade with a 27-gauge DPE vs Epidural

POPULATION
Nulliparous, singleton, term parturients request neuraxial labor analgesia

METHODS
RCT 27 g DPE (n=54) or Epidural (n=54)
PIEB 10 mL/hourly 0.1% Ropivacaine + 0.5 mcg/mL sufentanil.

OUTCOMES
1°: Bilateral S2 blockade at 20 min.

2°: Time to achieve NRS≤3

- DPE had higher incidence S2 blockade (47 (87%) vs. 23 (43%), ARR 44%, 95% CI 28% to 60%; P < 0.001)

Outcome	Favors
S2 blockade – 20 min	DPE
S2 blockade – 60 min	DPE
Time to sacral blockade	DPE
Time to adequate analgesia	← →
Rescue Boluses	← →
Sacral blockade prior to delivery	← →

39

Intrathecal Catheter Placement After Inadvertent Dural Puncture In The Obstetric Population: Management For Labour And Operative Delivery. Guidelines From The Obstetric Anaesthetists' Association

Griffiths SK, Russell R, Broom MA, et al.

AIM
Provide evidence-based guidelines on the insertion and management of intrathecal catheters

METHODS
OAA working party: Systematic review and guidelines

ACCOMPANYING EDITORIAL:
Binyamin Y, Orbach-Zinger S, Heesen M.

Intrathecal Catheter Placement	• 2-4 cm advancement (considering risks of migration or dislodgement
Labor Analgesia Initiation	• Isobaric bupivacaine 2.5 mg + fentanyl 15 mcg • Consistent use of solution throughout labor
Labor Analgesia Maintenance	• Intermittent boluses or continuous infusion • Careful BP monitoring q 5min for 15 minutes • Hourly sensory block assessments
Monitoring	• Continuous FHR monitoring • Rigorous motor block assessments
Operative Delivery	• Incremental local anesthetic dosing in the OR. • Limit each bolus to bupivacaine 2.5 mg to minimize risk of high block
Safety	• Clear catheter labeling • Drug administration by anesthesiologists only • Robust multidisciplinary communication
Follow-up	• Daily review • Discharge instructions • Debriefing 6-8 weeks postpartum

23

Consensus Statement on Pain Management for Pregnant Patients with Opioid-Use Disorder from the Society for Obstetric Anesthesia and Perinatology, Society for Maternal-Fetal Medicine, and American Society of Regional Anesthesia and Pain Medicine

Lim G, Carvalho B, George RB, et al.

Early antenatal evaluations by anesthesia providers

Individualized approach to pain management

AIM
Provide recommendations for clinicians and health care providers, focused on peripartum pain management in people with OUD

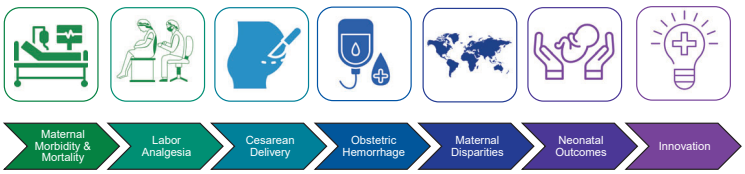
METHODS
Working group of subject matter experts from SOAP, ASRA, and SMFM

OUTCOMES
Prenatal optimization and medication management

Labor analgesia and postvaginal delivery analgesia

Postcesarean delivery analgesia

- May experience more pain and have higher analgesic requirements during and after delivery
- Antenatal anesthesia consultation is recommended
- Early neuraxial labor analgesia is recommended
- Limited evidence to support or refute nonopioid neuraxial adjuvants for postcesarean analgesia
- Abdominal wall blocks may offer analgesia and opioid-sparing benefits



CESAREAN DELIVERY

50

Intravenous Calcium To Decrease Blood Loss During Intrapartum Cesarean Delivery: A Randomized Controlled Trial

Ansari J, Yarmosh A, Michel G, et al.

Calcium chloride is well tolerated and may reduce blood loss during intrapartum cesarean delivery.

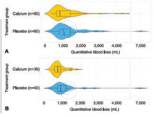
AIM
Evaluate whether prophylactic 1 g IV CaCl reduces blood loss during intrapartum CD

POPULATION
Single-center
Laboring patients, received oxytocin, intrapartum CD

METHODS
RCT: 1-g IV CaCl (n=60) vs placebo (n=60)
Prespecified subgroup analysis: exclude nonatonic bleeding

OUTCOMES
1°: QBL
2°: PPH, uterotonics, transfusion, HCT, side effects

- All pts median (IQR) QBL:
  - IV Calcium:840 (650-1434)
  - Placebo: 1051 (795-1395)
- Nonatonic bleeding excluded: Calcium **reduced QBL by 356 mL** (95% CI 159-515, P = 0.001)



Bioequivalence study confirmed **3:1** dose ratio calcium gluconate to calcium chloride

51

Second-line Uterotonics For Uterine Atony: A Randomized Controlled Trial

Cole NM, Kim JJ, Lumbreras-Marquez MI, et al.

No difference in efficacy between methylergonovine and carboprost.

Use either agent according to patient comorbidities & drug contraindications

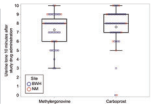
AIM
Evaluate comparative efficacy of 2nd-line uterotonics: methylergonovine and carboprost

POPULATION
Dual-Center
Parturients undergoing non-emergent CD
Mar 2019-Apr 2022

METHODS
Prospective, double-blind, RCT
Uterine atony → 0.2 mg IM methylergonovine or 0.25 mg IM carboprost

OUTCOMES
1°: Uterine tone score (0-10 NRS) 10 min
2°:Uterine tone 5 min, additional uterotonics, QBL, transfusion, etc.

- Mean (SD) 10 min tone:
- Methylergonovine: 7.3± 1.7
- Carboprost: 7.6± 2.1
- No meaningful differences secondary outcomes.



52

Maintenance infusion rate of oxytocin after initial 1-IU bolus for elective Cesarean delivery: a dose-finding study.

Boonstra L, Carvalho JCA, Turner W, et al.

After a 1 IU bolus of oxytocin, a maintenance infusion of 4.5 IU/hr provides adequate uterine tone for patients undergoing scheduled cesarean delivery.

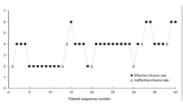
AIM
Determine ED90 oxytocin maintenance infusion after initial oxytocin bolus, scheduled CD

POPULATION
Single-center
Term, pregnant, scheduled CD under spinal anesthesia
N=40 analyzed

METHODS
Prospective, double-blind, dose-finding, biased coin up-down design
Oxytocin infusion rates: 2 to 16 IU/hr

OUTCOMES
1°: Satisfactory uterine tone at 5 min until PACU discharge
2°: QBL, PPH, Transfusion, additional uterotonics, side effects

- ED90 oxytocin: 4.5 IU/hr (95% CI 3.3 to 5.5)
- 18% received additional uterotonics



ACCOMPANYING EDITORIAL:
Sharpe EE, Sviggum HP

53 Oxytocin At Elective Cesarean Delivery: A Dose-finding Study In Pregnant People With Twin Pregnancy

Peska E, Balki M, Pfeifer W, et al.

Oxytocin requirement in twin gestation 10 x higher.

Bolus of 5 IU oxytocin for scheduled CD

AIM
ED_{90} bolus dose of oxytocin twin pregnancy scheduled CD

POPULATION
Single-center

Twins, ≥36 weeks' GA

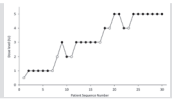
Scheduled CD with spinal anesthesia (n=30)

METHODS
Double-blind, dose-finding study, biased coin up-down allocation design

Oxytocin bolus 0.5 IU to 5 IU over 1 min

OUTCOMES
1°: Satisfactory uterine tone at 2 min
2°: Adverse effects, rescue uterotonics, vasopressor use, EBL

- ED_{90} oxytocin:
- **4.38 IU** (95% CI, 3.68-4.86) – Isotonic regression
- **3.41 IU** (95% CI, 2.8-3.98) – Dixon & Mood



60 Pain During Cesarean Delivery: A Patient-related Prospective Observational Study Assessing The Incidence And Risk Factors For Intraoperative Pain And Intravenous Medication Administration

Sanchez J, Prabhu R, Guglielminotti J, et al.

Incidence of PDCD was 11.5%

15% of patients received IV analgesics, even if not reporting pain

AIM
Determine incidence self-reported PDCD and identify patterns of unplanned IV medication admin

POPULATION
English-speaking parturients having CD under neuraxial anesthesia (n=399);

May-Sept 2022

METHODS
Prospective, observational study.

Survey assessing woman's experience with anesthesia and PDCD

OUTCOMES
1°: Incidence of self-reported pain at start and/or during CD

2°: Unplanned IV med administration

- PDCD 11.5% (46/399)
- Epidural extension: 18.5% [12.7-25.7]
- Women w/ PDCD more likely: substance abuse, IOL, epidural extension, intrapartum CD
- Unplanned IVM: 21.5% (127/403)

63 Evaluation Of The 'Sip Til Send' Regimen Before Elective Caesarean Delivery Using Bedside Gastric Ultrasound: A Paired Cohort Pragmatic Study

Harnett C, Connors J, Kelly S, et al.

'Sip Til Send' protocol of liberal hydration with water was noninferior to standard fasting prior to scheduled CD

AIM
Compare residual gastric volumes with 'Sip Til Send" protocol for scheduled CD

POPULATION
Nonlaboring patients for scheduled CD, fasted.

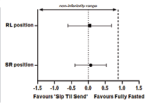
Feb-May 2023

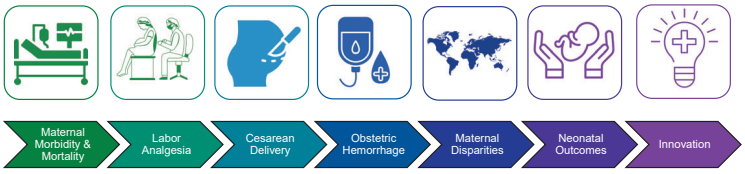
METHODS
Paired cohort prospective observational study'Sip Til Send': sip water regularly to max 170 mL/hour 20% non-inferiority

OUTCOMES
1°: Difference in gastric antrum CSA fasted (n=5) vs Sip Til Send (n=54)

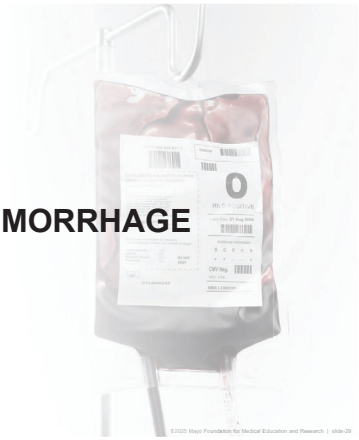
2°: Gastric volume, Perlas 2 grading, correlation fasting time and gastric volume

- Fasted vs SipTilSend CSA:
- Semi-recumbent: 3.51 (3.16 to 3.86) vs 3.58 (3.23 to 3.94); P=0.775
- Right lateral: 4.45 (3.94 to 4.95) vs. 4.49 (3.99 to 4.98); P=0.896





OBSTETRIC HEMORRHAGE



88 Baseline Haemoglobin Variability By Measurement Technique In Pregnant People On The Day Of Childbirth

Caulfield KC, McMahon O, Dennis AT

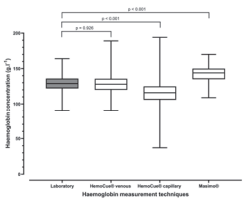
Venous HemoCue can provide an **accurate baseline hemoglobin** assessment.

AIM
Compare accuracy of HemoCue & non-invasive Masimo w/ lab Hgb measurements

POPULATION
Single-center

ASA 2 Pregnant pts planned vaginal delivery (n=180)

METHODS
4 samples compared:
-Laboratory Hgb
-Venous HemoCue
-Capillary HemoCue
-Noninvasive hgb measurement



- No significant difference between laboratory hgb & HemoCue venous hgb
- Significant difference between laboratory and capillary HemoCue and Masimo noninvasive hgb

84 Tranexamic Acid For Postpartum Bleeding: A Systematic Review And Individual Patient Data Meta-analysis Of Randomised Controlled Trials

Ker K, Sentilhes L, Shakur-Still H, et al.

Tranexamic acid **reduces risk of life-threatening bleeding**

Cannot exclude modest increase in thrombosis

AIM
Quantify effects of tranexamic acid in women giving birth.

POPULATION
54,404 women from five high-quality RCTs

METHODS
Systematic review with IPD meta-analysis

OUTCOMES
1° Effectiveness: Life-threatening bleeding (death or surgical intervention)

1° Safety: Thrombosis

- Life-threatening bleeding, OR 0.77 (0.63–0.93)
- TXA: 0.65% (178/27,300)
- Placebo: 0.85% (230/27,093)
- Thromboembolic Events, OR 0.96 (0.65–1.41)
- TXA: 0.2% (50/26,571)
- Placebo: 0.2% (52/26,373)

85 Development And Validation Of An Automated, Real-time Predictive Model For Postpartum Hemorrhage

Ende HB, Domenico HJ, Polic A, et al.

Study risk distribution in your patients

Reflect on resources

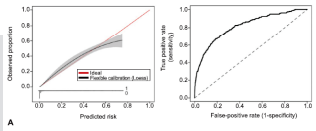
AIM
Develop and validate PPH predictive model and compare performance

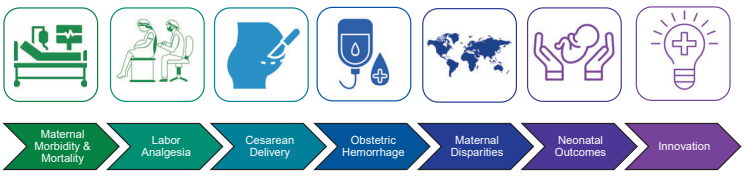
POPULATION
Single-center
All deliveries Jan 1, 2018 – April 30, 2022
15,735 patients

METHODS
Risk factors/predictors collected from EHR.
Logistic regression model created.
First 80%- Derivation Last 20% - Validation

OUTCOMES
Postpartum hemorrhage + transfusion

- 235 (1.4%) cases PPH
- Final model demonstrated AUC of 0.81 (95% CI, 0.79–0.84) and excellent calibration
- Model outperformed CMQCC risk assessment tool





MATERNAL DISPARITIES & GLOBAL HEALTH

118 Development Of A Prediction Model Of Postpartum Hospital Use Using An Equity-focused Approach

Janevic T, Tomalin LE, Glazer KB, et al.

Incorporating structural determinants into clinical prediction models may help identify those at risk of poor health due to structural racism and disadvantage.

Has potential potential to reduce racial-ethnic inequities in postpartum health

AIM
Develop a risk prediction model to identify individuals high risk of postpartum hospital use (PHU)

POPULATION
Individuals delivered in a NYC hospital (n=323,981) between Jan 2016 to Nov 2017

METHODS
Assessed individual level variables, SMM, & SSDOH
Developed model to predict composite PHU and Cause-specific PHU
Equity analysis

OUTCOMES
30-Day postpartum hospital use

Cause of PHU

- 5.7% incidence PHU (4.2% Asian, 8.8% Black, 7.4% Hispanic, & 3.3% White)
- Logistic regression achieve AUC 0.689

122 Racial And Ethnic Disparities In Epidural Blood Patch Utilization Among Obstetric Patients In The United States: A Nationwide Analysis, 2016–2020

Potnuru PP, Jonna S, Orlando B, et al.

Racial & ethnic **minoritized group receive** epidural blood patch for postdural puncture headache at a **lower rate**.

AIM
Evaluate EBP risk among obstetric patients with PDPH by race & ethnicity

POPULATION
Hospitalizations during which parturients developed PDPH (n=49,300)

METHODS
National Inpatient Sample
Identified PDPH & EBP
Adjusting for confounders, multilevel mixed-effects logistic regression model

OUTCOMES
EBP rate among parturients that developed PDPH

	No EBP, n(%)	EBP, n(%)	Adjusted OR (99% CI)	*P* value
White non-Hispanic	13,250 (47.3)	14,765 (52.7%)	Ref	Ref
Black non-Hispanic	3740 (59.7)	2520 (40.3)	0.69 (0.56-0.84)	<.001
Hispanic	5100 (55.5)	4085 (44.5)	0.80 (0.68–0.95)	.001
Asian/Pac Island	1775 (55.3)	1435 (44.7)	0.74 (0.58–0.96)	.003

- EBP performed in 48.8% PDPH hospitalizations
- EBP rates lower in Black, Hispanic, & Asian

116 Cross-sectional Survey To Assess Hospital System Readiness For Hemorrhage During And After Cesarean Delivery In Africa

Crowther M, Dyer RA, Bishop DG, et al.

Many hospitals in Africa still do not have recommended PPH measures

Access to secondary uterotonic very limited

AIM
Determine readiness of hospital systems to implement WHO PPH recommendations

POPULATION
African Perioperative Research Group network lead investigators

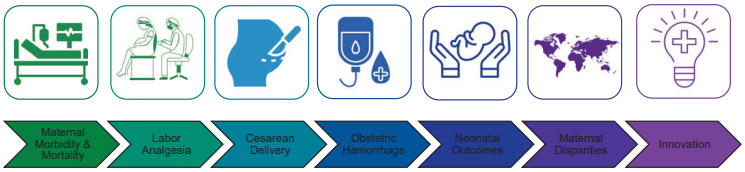
March-May 2023

METHODS
Survey to evaluate WHO recommendations for prevention & treatment PPH

OUTCOMES
1°: Hospital readiness WHO

2°: Availability blood, resources, postop care

- 140 responses from 29 African countries
- Oxytocin and misoprostol available in 93.5% and 73.2% hospitals
- Access to carbetocin (8.7%) & methylergonovine (25.9%)
- Other Availability:
  - Emergency blood available in 73.4%
  - Written PPH protocol 83.1%
  - Uterine massage performed 84.2%
  - Tranexamic acid available in 69.8%



NEONATAL OUTCOMES

137 Infant Deaths After Texas' 2021 Ban On Abortion In Early Pregnancy

Gemmill A, Margerison CE, Stuart EA,

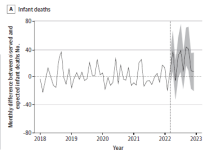
Restrictive abortion policy in Texas suggests increase in infant death, particularly due to congenital abnormalities

AIM
Examine impact of Texas abortion ban on infant mortality

POPULATION
All recorded infant deaths from the state of Texas and 28 comparison states

METHODS
- Extracted monthly infant and neonatal death counts.
- Estimated differences between observed counts and estimation in absence of ban

OUTCOMES
Monthly counts & rates of infant (<1 year) & neonatal (<28 days)



- Between 2021 and 2022, 255 additional infant deaths in TX. 12.9% increase in Texas vs 1.8% in rest of US

135 Behavioural Disorders After Prenatal Exposure To Anaesthesia For Maternal Surgery

Ing C, Silber JH, Lackraj D, et al.

Prenatal exposure to general anaesthesia was associated with a 31% increase in the risk of diagnosis of DIBD
Higher risk after second or third trimester exposure than after first trimester exposure

AIM
Evaluate whether prenatal exposure to GA is associated w/ developing behavioral disorder in children

POPULATION
Medicaid Analytic eXtract database (1993-2013)

>16 million deliveries

METHODS
Deliveries and infants were linked.

Infants prenatally exposed to GA compared to unexposed

OUTCOMES
1°: Age of diagnosis or disruptive or internalizing behavior disorder (DIBD)

2°: Independent behavioral disorders

- 34,271 children exposed to GA
- Prenatally exposed children 31% more likely to receive DIBD diagnosis (HR 1.31, 95% CI, 1.23-1.4)
- Higher hazard secondary neuropsychiatric outcomes

COMMENTARY:
by Ende HB, Habib AS, Lim G, Landau R, Beilin Y, Wong CA

130 Video Versus Direct Laryngoscopy For Urgent Intubation Of Newborn Infants

Geraghty LE, Dunne EA, Ní Chathasaigh CM, et al.

In neonates requiring urgent tracheal intubation, VL resulted in greater success on 1st attempt.

AIM
Determine whether video laryngoscopy results in increased success on 1st attempt in neonates

POPULATION
Single-center

Neonates needing intubation

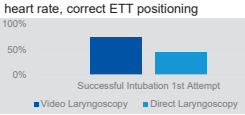
Any gestation

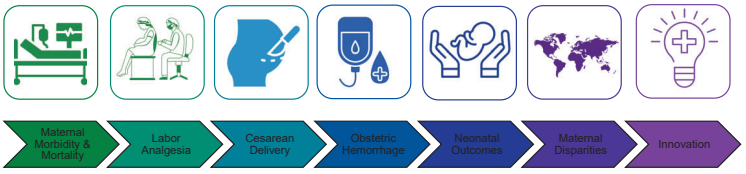
METHODS
RCT, 1:1 video laryngoscopy (n=107) vs direct laryngoscopy (n=107)

OUTCOMES
1°: Successful intubation on 1st attempt

2°: Lowest O_2 saturation, lowest heart rate, correct ETT positioning

- Significantly more neonates in VL group were successfully intubated on first attempt.
- Median attempts VL=1 DL=2





INNOVATION

155 Artificial Intelligence Guided Screening For Cardiomyopathies In An Obstetric Population: A Pragmatic Randomized Clinical Trial.

Adedinsewo DA, Morales-Lara AC, Afolabi BB, et al.

AI-guided screening doubled the diagnosis of peripartum cardiomyopathy in Nigeria

AIM
Evalulate the effectiveness of ECG-based deep learning model for diagnosing cardiomyopathy

POPULATION
6 hospitals in Nigeria

1,195 pregnant women or within 12 months postpartum

METHODS
RCT usual care or AI-guided screening for LVSD

Digital stethoscope AI prediction and 12-lead ECG - AI

OUTCOMES
1°: New diagnosis peripartum cardiomyopathy

2°: Impaired LV function, effectiveness AI-ECG tools

- Digital Stethoscope 24 (4.1%) cases vs. 12 (2%) control diagnosed LVSD; OR 2.12, 95% CI, 1.05-4.27; P = 0.032
- 12-lead ECG 18 (3.1%) cases vs. 11 (1.8%) control diagnosed LVSD; OR 1.72, 95% CI, .8-3.67; P=0.158

163 AI-augmented Vs. Conventional Cardiac POCUS Training: A Pilot Study Among Obstetric Anesthesiologists

Johnson S, Feldman S, Gessouroun R, et al.

AI-guidance could facilitate POCUS training in limited-resource institutions

AIM
Determine if AI-augmentation could facilitate cardiac POCUS training

POPULATION
Women who died during pregnancy or 1 year postpartum vs. reference population 25–45 y.o. in Netherlands; 2006-2020

METHODS
Cause of Death Register and Medical Birth Register were linked to identify women who died within 1 year postpartum

OUTCOMES
Frequency of POCUS use

Self-perception image acquisition proficiency

- 6 months post-training, both groups displayed increase in frequency of cardiac POCUS use and self-perception of sill.
- AI-augmented group improved significantly more.

Gerard W. Ostheimer 2025 Lecture

Presented at SOAP 2025, Portland OR

Emily E. Sharpe, MD, FASA

Associate Professor of Anesthesiology

Mayo Clinic, Rochester MN

The Gerard W. Ostheimer lecture presents the prior year in review of articles that are novel and relevant to obstetric anesthesiology. First presented in 1975 as "What's New in Obstetric Anesthesia?", it was renamed in his honor in 1998. The contents of this syllabus contain a review of the 2024 literature.

Journals Included in Literature Search:

Acta Anaesth Scand
Acta Obstet Gynecol Scand
Am J Epidem
Am J Obstetric Gynecol
Am J Obstetric Gynecol MFM
Am J Perinatal
Am J Respir Crit Care Med
Anaesth Crit Care Pain Med
Anaesthe Intensive Care
Anaesthesia
Anesth Analg
Anesthesiology
Ann Intern Med
Arch Gynecol Obstet
Aust N Z J Obstet Gynaecol
Birth
BJOG
BMC Anesthesiol
BMJ
BMJ Open Quality
BMJ Quality and Safety
Br J Anaesth
Can J Anesthesia
Chest
Circulation
Clin Obstet Gynecol
CMAJ
Cochrane Db Syst Rev
Crit Care
Crit Care Med
Current opinion in Anaesthesiology
Diabetologia
Early Human Development
Epidemiology
Eur Heart
Eur J Anaesthesiol
Eur J Obstet Gynecol Reprod Biol
Eur J of Pain
Fertil and Steril
Heart
Hypertens Pregnancy
Hypertension
Int J Cardiol
Int J of Developmental Neuroscience
Int J Gynaecol Obstet
Int J Obstet Anesth
Intensive Care Med
J Am Coll Cardiol
J Am Heart Assoc
J of Anesthesia
J Clin Anesth
J Clin Epidemiol
J Gen Intern Med
J Intensive Care Med
J of Pain
J of Pediatrics
J of Perinatology
J of Thrombosis and Haemostasis
JAMA
JAMA Intern Med
JAMA netw open
JAMA Pediatrics
JAMA Surg
Lancet

Lancet Child Adolesc Health
Lancet Glob Health
Lancet Respir Med
MMWR Morb Mortal Wkly Rep
Natl Vital Stat Rep
Nature
Neurotoxicol Teratol
New Engl J Med
Obstet Gynecol
Pain
Pain Med
Pediatrics
PLOS Glob Public Health
PLoS Med
PLoS One
Pregnancy Hypertension
Reg Anesth Pain Med
Resuscitation
Science
Semin Perinatol
Semin Respir Crit Care Med
Sleep
Thromb Res
Transfusion

Detailed Search Strategy

Last search was completed on March 3, 2025.

Acknowledgement: search strategy incorporated search strategies from Dr. Pervez Sultan's 2023 Ostheimer lecture and Dr. Melissa Bauer's 2024 Ostheimer lecture and executed by Larry J. Prokop, MLIS (Medical Librarian at Mayo Clinic)

Database(s): Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions 1946 to January 25, 2024

Search Strategy:

Searches

exp *cesarean section/ or exp *delivery, obstetric/ or exp *episiotomy/ or exp *extraction, obstetrical/ or exp *fetus/ or exp* Infant, Newborn/ or exp *labor, induced/ or exp *labor, obstetric/ or exp *labor onset/ or exp *labor presentation/ or exp* Mothers/ or exp *obstetric labor complications/ or exp *obstetrics/ or exp *parturition/ or exp *postnatal care/ or exp *postpartum period/ or exp *pregnancy/ or exp *pregnant women/ or exp *uterine contraction/

(((labor or labour or birth or births or birthing or vaginal or vaginally) adj5 (delivery or delivered)) or ((labor or labour) adj3 (induced or onset or presentation or stage or staging or stages)) or ((vaginal or vaginally) adj3 (birth or births or birthed or birthing)) or antepartum or breech or caesarean or caesareans or caesarian or caesarians or "cephalopelvic disproportion" or cesarean or cesareans or cesarian or childbirth or childbirths or chorioamnionitis or "c-section" or delivery or dystocia or endometritis or episiotomies or episiotomy or fetal or fetus or foetal or foetus or labor or labour or maternal or neonatal or newborn or obstetric or obstetrical or obstetrics or parturition or perinatal or "placenta accreta" or "placenta increta" or "placenta percreta" or "placenta previa" or postnatal or postpartum or pregnancies or pregnancy or pregnant or "premature birth" or prenatal or "uterine contraction" or "uterine contractions" or "uterine rupture" or "vaginal deliveries" or "vaginal delivery" or "vasa previa").ti.

1 or 2

exp *analgesia, obstetrical/ or exp *anesthesia, obstetrical/

(((obstetric or obstetrics or obstetrical or labor or labour or birth or birthing or childbirth or cesarean or cesareans or pregnant or pregnancy or perinatal) adj6 (spine or spinal)) or ((obstetric or obstetrics or obstetrical or labor or labour or birth or births or birthed or birthing or childbirth or childbirths or cesarean or pregnant or pregnancy or perinatal or cervix or cervical or paracervical) adj6 (analgesia or analgesias or analgesic or analgesics or anesthesia or anesthesias or anesthetic or anesthetics or anaesthesia or anaesthesias or anaesthetic or anaesthetics or epidural or CSE or DPE))).ti.

4 or 5

3 or 6

("Acta Anaesthesiol Scand" or "Acta Obstet Gynecol Scand" or "Am J Epidemiol" or "Am J Obstet Gynecol" or "Am J Obstet Gynecol MFM" or "Am J Perinatol" or "Am J Respir Crit Care Med" or "Anaesth Crit Care Pain Med" or "Anaesth Intensive Care" or Anaesthesia or "Anesth Analg" or Anesthesiology or "Ann Intern Med" or "Arch Gynecol Obstet" or "Aust N Z J Obstet Gynaecol" or Birth or BJOG or "BMC anesthesiol" or BMJ or "BMJ Open Qual" or "BMJ Qual Saf" or "Br J Anaesth" or "Can J Anaesth" or Chest or Circulation or "Clin Obstet Gynecol" or CMAJ or "Cochrane Database Syst Rev" or "Crit Care" or "Crit Care Med" or "Curr Opin Anaesthesiol" or Diabetologia or "Early Hum Dev" or Epidemiology or "Eur Heart J" or "Eur J Anaesthesiol" or "Eur J Obstet Gynecol Reprod Biol" or "Eur J Pain" or "Fertil Steril" or Heart or "Hypertens Pregnancy" or Hypertension or "Int J Cardiol" or "Int J Dev Neurosci" or "Int J Gynaecol Obstet" or "Int J Obstet Anesth" or "Intensive Care Med" or "J Am Coll Cardiol" or "J Am Heart Assoc" or "J ANESTH" or "J Clin Anesth" or "J Clin Epidemiol" or "J Gen Intern Med" or "J Intensive Care Med" or "J Pain" or "J Pediatr" or "J Perinatol" or "J Thromb Haemost" or JAMA or "JAMA Intern Med" or "JAMA netw open" or "Jama Pediatr" or "JAMA Surg" or Lancet or "Lancet Child Adolesc Health" or "Lancet Glob Health" or "Lancet Respir Med" or "MMWR Morb Mortal Wkly Rep" or "N Engl J Med" or "Natl Vital Stat Rep" or Nature or "Neurotoxicol Teratol" or "Obstet Gynecol" or Pain or "Pain Med" or Pediatrics or "PLOS Glob Public Health" or "PLoS Med" or "PLoS One" or "Pregnancy Hypertens" or "Reg Anesth Pain Med" or Resuscitation or Science or "Semin Perinatol" or "Semin Respir Crit Care Med" or Sleep or "Thromb Res" or Transfusion).io.

7 and 8

limit 9 to english language

10 not (exp animals/ not exp humans/)

11 not (case reports.pt. or "case report".ti. or "case series".ti. or comment.pt. or congress.pt.)

limit 12 to yr="2024"

remove duplicates from 13

Acknowledgement: Despite the rigorous process to select manuscripts for this year's syllabus, numerous high-quality, impactful papers were not included. I'm grateful for the opportunity to have explored the literature on obstetric anesthesiology and women's health and extend my gratitude to all the authors who have dedicated significant effort towards enhancing the health of women everywhere.

References and abstracts for included articles

Maternal Morbidity & Mortality

1. Lucas DN, Kursumovic E, Cook TM, Kane AD, Armstrong RA, Plaat F, Soar J. **Cardiac arrest in obstetric patients receiving anaesthetic care: results from the 7th National Audit Project of the Royal College of Anaesthetists.** Anaesthesia. 2024 May;79(5):514-523.

   The 7th National Audit Project (NAP7) of the Royal College of Anaesthetists studied peri-operative cardiac arrest. Additional inclusion criteria for obstetric anaesthesia were: cardiac arrest associated with neuraxial block performed by an anaesthetist outside the operating theatre (labour epidural analgesia); and cardiac arrest associated with remifentanil patient-controlled analgesia. There were 28 cases of cardiac arrest in obstetric patients, representing 3% of all cardiac arrests reported to NAP7, giving an incidence of 7.9 per 100,000 (95%CI 5.4-11.4 per 100,000). Obstetric patients were approximately four times less likely to have a cardiac arrest during anaesthesia care than patients having non-obstetric surgery. The single leading cause of peri-operative cardiac arrest in obstetric patients was haemorrhage, with underestimated severity and inadequate early resuscitation being contributory factors. When taken together, anaesthetic causes, high neuraxial block and bradyarrhythmia associated with spinal anaesthesia were the leading causes overall. Two patients had a cardiac arrest related to labour neuraxial analgesia. There were no cardiac arrests related to failed airway management or remifentanil patient-controlled analgesia.

   With an editorial by Monks D T, Singh PM, and Palanisamy A. **Preventing maternal cardiac arrest: how do we reach the next level of safety in obstetric anaesthesia?** Anaesthesia Jan 12 2024;12():12

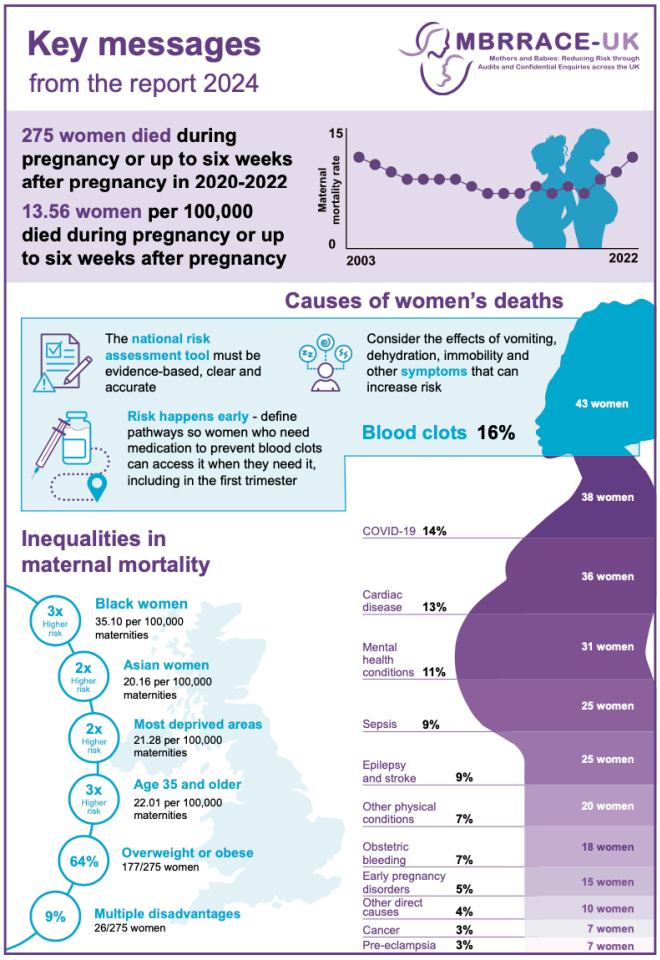
2. Davidson KW, Terry MB, Braveman P, Reis PJ, Timmermans S, Epling JW. **Maternal Mortality: A National Institutes of Health Pathways to Prevention Panel Report**. Obstet Gynecol. 2024 Mar 1;143(3):e78-e85

   The National Institutes of Health's (NIH) Pathways to Prevention panel on postpartum health provides a consensus statement on the evidence, research gaps, and future priorities to prevent maternal morbidity and mortality. The panel reviewed an NIH-commissioned evidence review and workshop that included epidemiologic studies, demonstration interventions, and other maternal morbidity and mortality research to create these national recommendations. The panel concludes that a maternal morbidity and mortality crisis reflects a systemic failure of current U.S. health care, research efforts, and social policies. The panel recommends improving maternal health through a "maternal morbidity and mortality prevention moonshot" that adopts a comprehensive, multilevel life course conceptual framework; strengthens the research methods used within the science of maternal health; establishes and conducts national prevention, treatment, and policy interventions; and reimburses evidence-informed clinical approaches to improve maternal health across the life course. Without a national focus on fundamentally transformative interventions and other initiatives aimed at redressing structural racism and inequities in health care, current interventions and clinical advances in maternal morbidity and mortality prevention will remain tragically insufficient.

3. Felker A, Patel R, Kotnis R, Kenyon S, Marian Knight M (Eds.) on behalf of MBRRACE-UK. **Saving Lives, Improving Mothers' Care Compiled Report - Lessons learned to inform maternity care from the**

UK and Ireland. Confidential Enquiries into Maternal Deaths and Morbidity 2020-22. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2024.

This report includes the surveillance information for women who died during and after pregnancy for 2020-22. The maternal mortality rate for this period is significantly higher than that reported that for 2017-19 and this remains significantly higher when deaths due to COVID-19 are excluded. The reasons for this increasing rate are multiple. It was evident from the care of the women reviewed in the confidential enquires that service-related changes necessitated by the COVID-19 pandemic impacted women's care as many faced significant delays when accessing pre-hospital care and others were not provided with specialist supports, such as interpreter services, due to limited availability. However, there were many factors that assessors identified that may be contributing to the increased rate of maternal mortality independent of the COVID-19 pandemic. As discussed in this and previous reports, the current maternity population is becoming more complex. Many of the women who died were older than 35 years of age and the majority were overweight or obese. Many also had multiple morbidities or had multiple adversities including mental health conditions and social complexities. Inequalities also continue persist amongst women from Black and Asian ethnic backgrounds and in women living in the most deprived areas. Addressing these inequalities, complexities and mental health concerns must remain an important focus in order to improve outcomes and prevent maternal deaths.



4. Joseph KS, Lisonkova S, Boutin A, Muraca GM, Razaz N, John S, Sabr Y, Chan WS, Mehrabadi A, Brandt JS, Schisterman EF, Ananth CV. **Maternal mortality in the United States: are the high and rising rates due to changes in obstetrical factors, maternal medical conditions, or maternal mortality surveillance?** Am J Obstet Gynecol. 2024 Apr;230(4):440.e1-440.e13

Background: National Vital Statistics System reports show that maternal mortality rates in the United States have nearly doubled, from 17.4 in 2018 to 32.9 per 100,000 live births in 2021. However, these high and rising rates could reflect issues unrelated to obstetrical factors, such as changes in maternal medical conditions or maternal mortality surveillance (eg, due to introduction of the pregnancy checkbox). **Objective:** This study aimed to assess if the high and rising rates of maternal mortality in the United States reflect changes in obstetrical factors, maternal medical conditions, or maternal mortality surveillance. **Study design:** The study was based on all deaths in the United States from 1999 to 2021. Maternal deaths were identified using the following 2 approaches: (1) per National Vital Statistics System methodology, as deaths in pregnancy or in the postpartum period, including deaths identified solely because of a positive pregnancy checkbox, and (2) under an alternative formulation,

as deaths in pregnancy or in the postpartum period, with at least 1 mention of pregnancy among the multiple causes of death on the death certificate. The frequencies of major cause-of-death categories among deaths of female patients aged 15 to 44 years, maternal deaths, deaths due to obstetrical causes (ie, direct obstetrical deaths), and deaths due to maternal medical conditions aggravated by pregnancy or its management (ie, indirect obstetrical deaths) were quantified. **Results:** Maternal deaths, per National Vital Statistics System methodology, increased by 144% (95% confidence interval, 130-159) from 9.65 in 1999-2002 (n=1550) to 23.6 per 100,000 live births in 2018-2021 (n=3489), with increases occurring among all race and ethnicity groups. Direct obstetrical deaths increased from 8.41 in 1999-2002 to 14.1 per 100,000 live births in 2018-2021, whereas indirect obstetrical deaths increased from 1.24 to 9.41 per 100,000 live births: 38% of direct obstetrical deaths and 87% of indirect obstetrical deaths in 2018-2021 were identified because of a positive pregnancy checkbox. The pregnancy checkbox was associated with increases in less specific and incidental causes of death. For example, maternal deaths with malignant neoplasms listed as a multiple cause of death increased 46-fold from 0.03 in 1999-2002 to 1.42 per 100,000 live births in 2018-2021. Under the alternative formulation, the maternal mortality rate was 10.2 in 1999-2002 and 10.4 per 100,000 live births in 2018-2021; deaths from direct obstetrical causes decreased from 7.05 to 5.82 per 100,000 live births. Deaths due to preeclampsia, eclampsia, postpartum hemorrhage, puerperal sepsis, venous complications, and embolism decreased, whereas deaths due to adherent placenta, renal and unspecified causes, cardiomyopathy, and preexisting hypertension increased. Maternal mortality increased among non-Hispanic White women and decreased among non-Hispanic Black and Hispanic women. However, rates were disproportionately higher among non-Hispanic Black women, with large disparities evident in several causes of death (eg, cardiomyopathy).
Conclusion: The high and rising rates of maternal mortality in the United States are a consequence of changes in maternal mortality surveillance, with reliance on the pregnancy checkbox leading to an increase in misclassified maternal deaths. Identifying maternal deaths by requiring mention of pregnancy among the multiple causes of death shows lower, stable maternal mortality rates and declines in maternal deaths from direct obstetrical causes.

5. Zahn C. **Despite New Manuscript, Incontrovertible Evidence Proves the Unacceptably High U.S. Maternal Mortality Rate**. ACOG News Release, Mar 13, 2024. Available at: https://www.acog.org/news/news-releases/2024/03/despite-new-manuscript-incontrovertible-evidence-proves-unacceptably-high-us-maternal-mortality-rate; Accessed 6/17/24.

   This news release was in response to the article by Joseph et al. above. The release stated the manuscript presented an incomplete picture of maternal mortality by downplaying the preventability of maternal deaths. While it highlighted declines in deaths from conditions like hypertension and hemorrhage due to national programs, it inadequately addressed persistent racial health disparities and rising mortality from conditions such as cardiomyopathy and placenta accreta syndrome. The critique also challenged the authors' dismissal of the pregnancy checkbox as a valid data source, emphasizing that multiple data systems, including maternal mortality review committees, provide crucial insights, particularly into postpartum deaths from mental health conditions. With nearly 30% of pregnancy-related deaths occurring 43 to 365 days postpartum, the need for comprehensive surveillance and systemic improvements remains urgent. Maternal health is not just about reducing mortality but also addressing morbidity and disparities. Dismissing these issues risks undermining ongoing efforts to improve maternal outcomes.

6. Joseph KS, Lisonkova S, Boutin A, Muraca GM, Razaz N, John S, Sabr Y, Chan WS, Mehrabadi A, Brandt JS, Schisterman EF, Ananth CV. **Why improved surveillance is critical for reducing maternal deaths in the United States: A response to the American College of Obstetricians and Gynecologists**. Am J Obstet Gynecol. 2024 Aug;231(2):e87-e92

In this response to the American College of Obstetricians and Gynecologists, the authors reiterated the important findings of their study and provided a considered reply to the concerns expressed.

7. Lommerse KM, Mérelle S, Rietveld AL, Berkelmans G, van den Akker T; Netherlands Audit Committee Maternal Mortality and Morbidity. **The contribution of suicide to maternal mortality: A nationwide population-based cohort study.** BJOG. 2024 Sep;131(10):1392-1398

Objective: To identify the incidence and characteristics of maternal suicide. **Design:** Nationwide population-based cohort study. **Setting:** The Netherlands, 2006-2020. **Population:** Women who died during pregnancy or within 1 year postpartum, and a reference population of women aged 25-45 years. **Methods:** The Cause of Death Register and Medical Birth Register were linked to identify women who died within 1 year postpartum. Data were combined with deaths reported to the Audit Committee for Maternal Mortality and Morbidity (ACMMM), which performs confidential enquiries. Maternal suicides were compared with a previous period (1996-2005). Risk factors were obtained by combining vital statistics databases. **Main outcome measures:** Comparison of incidence and proportion of maternal suicides among all maternal deaths over time, sociodemographic and patient-related risk factors and underreporting of postpartum suicides. **Results:** The maternal suicide rate remained stable with 68 deaths: 2.6 per 100 000 live births in 2006-2020 versus 2.5 per 100 000 in 1996-2005. The proportion of suicides among all maternal deaths increased from 18% to 28%. Most suicides occurred throughout the first year postpartum (64/68); 34 (53%) of the women who died by suicide postpartum were primiparous. Compared with mid-level, low educational level was a risk factor (odds ratio 4.2, 95% confidence interval 2.3-7.9). Of 20 women reported to the ACMMM, 11 (55%) had a psychiatric history and 13 (65%) were in psychiatric treatment at the time of death. Underreporting to ACMMM was 78%. **Conclusions:** Although the overall maternal mortality ratio declined, maternal suicides did not and are now the leading cause of maternal mortality if late deaths up to 1 year postpartum are included. Data collection and analysis of suicides must improve.

8. Osei-Poku GK, Prentice JC, Easter SR, Diop H. **Delivery at an inadequate level of maternal care is associated with severe maternal morbidity.** Am J Obstet Gynecol. 2024 Nov;231(5):546.e1-546.e20.

Background: Implementing levels of maternal care is one strategy proposed to reduce maternal morbidity and mortality. The levels of maternal care framework outline individual medical and obstetrical comorbidities, along with hospital resources required for individuals with these different comorbidities to deliver safely. The overall goal is to match individuals to hospitals so that all birthing people get appropriate resources and personnel during delivery to reduce maternal morbidity. **Objective:** This study examined the association between delivery in a hospital with an inappropriate level of maternal care and the risk of experiencing severe maternal morbidity. **Study design:** The 40 birthing hospitals in Massachusetts were surveyed using the Centers for Disease Control and Prevention's Levels of Care Assessment Tool. We linked individual delivery hospitalizations from the Massachusetts Pregnancy to Early Life Longitudinal Data System to hospital-level data from the Levels of Care Assessment Tool surveys. Level of maternal care guidelines were used to outline 16 high-risk conditions warranting delivery at hospitals with resources beyond those considered basic

(level I) obstetrical care. We then used the Levels of Care Assessment Tool assigned levels to determine if delivery occurred at a hospital that had the resources to meet an individual's needs (ie, if a patient received risk-appropriate care). We conducted our analyses in 2 stages. First, multivariable logistic regression models predicted if an individual delivered in a hospital that did not have the resources for their risk condition. The main explanatory variable of interest was if the hospital self-assessed their level of maternal care to be higher than the Levels of Care Assessment Tool assigned level. We then used logistic regression to examine the association between delivery at an inappropriate level hospital and the presence of severe maternal morbidity at delivery. **Results:** Among 64,441 deliveries in Massachusetts from January 1 to December 31, 2019, 33.2% (21,415/64,441) had 1 or more of the 16 high-risk conditions that require delivery at a center designated as a level I or higher. Of the 21,415 individuals with a high-risk condition, 13% (2793/21,415), equating to 4% (2793/64,441) of the entire sample, delivered at an inappropriate level of maternal care. Birthing individuals with high-risk conditions who delivered at a hospital with an inappropriate level had elevated odds (adjusted odds ratio, 3.34; 95% confidence interval, 2.24-4.96) of experiencing severe maternal morbidity after adjusting for patient comorbidities, demographics, average hospital severe maternal morbidity rate, hospital level of maternal care, and geographic region. **Conclusion:** Birthing people who delivered in a hospital with risk-inappropriate resources were substantially more likely to experience severe maternal morbidity. Delivery in a hospital with a discrepancy in their self-assessment and the Levels of Care Assessment Tool assigned level substantially predicted delivery in a hospital with an inappropriate level of maternal care, suggesting inadequate knowledge of hospitals' resources and capabilities. Our data demonstrate the potential for the levels of maternal care paradigm to decrease severe maternal morbidity while highlighting the need for robust implementation and education to ensure everyone receives risk-appropriate care.

9. Crump C, Sundquist J, Sundquist K. **Adverse Pregnancy Outcomes and Long-Term Mortality in Women**. JAMA Intern Med. 2024 Jun 1;184(6):631-640.

Importance: Women with adverse pregnancy outcomes, such as preterm delivery or preeclampsia, have higher future risks of cardiometabolic disorders; however, little is known about their long-term mortality risks. A better understanding of such risks is needed to facilitate early identification of high-risk women and preventive actions. **Objective:** To determine long-term mortality risks associated with 5 major adverse pregnancy outcomes in a large population-based cohort of women. **Design, setting, and participants:** This national cohort study in Sweden used the Swedish Medical Birth Register, containing prenatal and birth information for nearly all deliveries in Sweden since 1973, to identify women who had a singleton delivery during 1973 to 2015. All 2 195 667 such women with information for pregnancy duration and infant birth weight were included in the study. Data were analyzed from March to September 2023. **Exposure:** Adverse pregnancy outcomes (preterm delivery, small for gestational age, preeclampsia, other hypertensive disorders, and gestational diabetes), identified from nationwide birth records. **Main outcome and measures:** All-cause and cause-specific mortality through December 31, 2018. Cox regression was used to compute hazard ratios (HRs) for mortality associated with specific adverse pregnancy outcomes, adjusted for other maternal factors. Cosibling analyses assessed for confounding by shared familial (genetic or environmental) factors. **Results:** In 56 million person-years of follow-up to a median (IQR) age of 52 (42-61) years, 88 055 women (4%) died (median [IQR] age at death, 59 [50-67] years). All 5 adverse pregnancy outcomes were independently associated with increased mortality. Across the entire follow-up (≤46 years after delivery), adjusted HRs for all-cause mortality associated with specific adverse pregnancy outcomes

were as follows: gestational diabetes, 1.52 (95% CI, 1.46-1.58); preterm delivery, 1.41 (95% CI, 1.37-1.44); small for gestational age, 1.30 (95% CI, 1.28-1.32); other hypertensive disorders, 1.27 (95% CI, 1.19-1.37); and preeclampsia, 1.13 (95% CI, 1.10-1.16). All HRs remained significantly elevated even 30 to 46 years after delivery. These effect sizes were only partially (0%-45%) reduced after controlling for shared familial factors in cosibling analyses. Women who experienced multiple adverse pregnancy outcomes had further increases in risk. Several major causes of death were identified, including cardiovascular and respiratory disorders and diabetes. **Conclusions and relevance:** In this large national cohort study, women who experienced any of 5 major adverse pregnancy outcomes had increased mortality risks that remained elevated more than 40 years later. Women with adverse pregnancy outcomes need early preventive evaluation and long-term follow-up for detection and treatment of chronic disorders associated with premature mortality.

10. Pham H, Thompson-Felix T, Czamara D, Rasmussen JM, Lombroso A, Entringer S, Binder EB, Wadhwa PD, Buss C, O'Donnell KJ. **The effects of pregnancy, its progression, and its cessation on human (maternal) biological aging.** Cell Metab. 2024 May 7;36(5):877-878.

    This study aimed to replicate and expand on Poganik et al.'s findings by analyzing longitudinal DNA methylation (DNAm) data from a low-risk pregnancy cohort at the University of California Irvine. Blood samples from 119 women were collected at early, mid, and late pregnancy, with a subset of 68 providing a fourth sample three months postpartum. Using these samples, researchers estimated biological aging through principal component-based epigenetic clocks (PCHorvath1, PCPhenoAge, PCGrimAge), an updated GrimAge estimator (GrimAge2), and a pace of aging biomarker (PACE), which offer greater robustness against technical variation than conventional methods. Hierarchical generalized additive models were used to examine whether pregnancy stage is associated with accelerated biological aging and if these effects reverse postpartum, adjusting for maternal and demographic factors. Findings showed that biological age increased significantly from early to late pregnancy across multiple epigenetic biomarkers, with a notable reversal at three months postpartum. Pre-pregnancy BMI influenced aging trajectories, with higher BMI linked to greater biological aging postpartum. Breastfeeding was associated with lower biological age estimates independent of BMI. Sensitivity analyses confirmed that gestational weight gain did not predict biological aging, while adjustments for cell-type proportions reduced but did not eliminate the associations observed. The state of pregnancy and its progression is associated with significantly greater changes in biological aging than would be accounted for by the passage of chronological time (age) and the results provides support for the notion that pregnancy may act as a naturally occurring physiological stressor.

11. Pritschet L, Taylor CM, Cossio D, Faskowitz J, Santander T, Handwerker DA, Grotzinger H, Layher E, Chrastil ER, Jacobs EG. **Neuroanatomical changes observed over the course of a human pregnancy.** Nat Neurosci. 2024 Nov;27(11):2253-2260

    Pregnancy is a period of profound hormonal and physiological changes experienced by millions of women annually, yet the neural changes unfolding in the maternal brain throughout gestation are not well studied in humans. Leveraging precision imaging, we mapped neuroanatomical changes in an individual from preconception through 2 years postpartum. Pronounced decreases in gray matter volume and cortical thickness were evident across the brain, standing in contrast to increases in white

matter microstructural integrity, ventricle volume and cerebrospinal fluid, with few regions untouched by the transition to motherhood. This dataset serves as a comprehensive map of the human brain across gestation, providing an open-access resource for the brain imaging community to further explore and understand the maternal brain.

12. Beenakkers ICM, Schaap TP, van den Bosch OFC. **High Neuraxial Block in Obstetrics: A 2.5-Year Nationwide Surveillance Approach in the Netherlands.** Anesth Analg. 2024 Dec 1;139(6):1165-1169.

Background: High neuraxial block is a rare but serious adverse event in obstetric anesthesia that can ultimately lead to respiratory insufficiency and cardiac arrest. Previous reports on its incidence are limited to populations in the United Kingdom and the United States. Little is known about the incidence and clinical features of high neuraxial block in the Netherlands, where the presence of anesthesiologists in the labor and delivery unit is comparatively lower. We aimed to assess the incidence and clinical features of high neuraxial block in obstetrics and to formulate ways to improve obstetric anesthesia on a national level. **Methods:** This nationwide, prospective, population-based cohort study was designed to identify cases of high neuraxial block requiring ventilatory support (with supraglottic airway device or tracheal intubation) or cardiopulmonary resuscitation between November 2019 and May 2022. Cases were prospectively collected using the Netherlands Obstetric Surveillance System (NethOSS) in all hospitals with a maternity unit. Complete case file copies were obtained to determine risk factors and clinical course. **Results:** During the study period, 5 cases of high neuraxial block requiring tracheal intubation were identified. The estimated incidence of high neuraxial block requiring tracheal intubation was 1 in 29,770 neuraxial procedures in labor (95% confidence interval, 1:12,758-1:91,659). Three of 5 identified cases occurred in the operating room after single-shot spinal anesthesia for Cesarean delivery after epidural analgesia in labor. One case developed in the labor ward due to an inadvertent intrathecal or subdural catheter placed for labor analgesia. The fifth case followed single-shot spinal anesthesia for elective Cesarean delivery. All 5 patients were successfully extubated in the operating room after Cesarean delivery, without the need for intensive care admission. There were no cardiac arrests and no neonatal deaths. **Conclusions:** High neuraxial block requiring tracheal intubation is a rare but impactful complication in obstetric anesthesia, potentially affecting both mother and fetus. Spinal anesthesia after epidural analgesia in labor is a common cause of high neuraxial block. Meticulous follow-up of epidurals in labor facilitates conversion to surgical anesthesia and may therefore reduce the need for spinal anesthesia after epidural analgesia. Large-scale surveillance systems in obstetric anesthesia are needed to identify those at risk, as well as to formulate further strategies to mitigate this burden.

Sepsis:

13. Main EK, Fuller M, Kovacheva VP, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Cortes MS, Rosenstein MG, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Bauer ME. **Performance Characteristics of Sepsis Screening Tools During Delivery Admissions.** Obstet Gynecol. 2024 Mar 1;143(3):326-335

Objective: To evaluate the screening performance characteristics of existing tools for the diagnosis of sepsis during delivery admissions. **Methods:** This was a case-control study using electronic health record data, including vital signs and laboratory results, for all delivery admissions of patients with sepsis from 59 nationally distributed hospitals. Patients with sepsis were matched by gestational age at delivery in a 1:4 ratio with patients without sepsis to create a comparison group. Patients with chorioamnionitis and sepsis were compared with a complete cohort of patients with chorioamnionitis without sepsis. Multiple screening criteria for sepsis were evaluated: the CMQCC (California Maternal Quality Care Collaborative), SIRS (Systemic Inflammatory Response Syndrome), the MEWC (the Maternal Early Warning Criteria), UKOSS (United Kingdom Obstetric Surveillance System), and the MEWT (Maternal Early Warning Trigger Tool). Sensitivity, false-positive rates, and C-statistics were reported for each screening tool. Analyses were stratified into cohort 1, which excluded patients with chorioamnionitis-endometritis, and cohort 2, which included those patients. **Results:** Delivery admissions at 59 hospitals were extracted for patients with sepsis. Cohort 1 comprised 647 patients with sepsis, including 228 with end-organ injury, matched with a control group of 2,588 patients without sepsis. Cohort 2 comprised 14,591 patients with chorioamnionitis-endometritis, of whom 1,049 had sepsis and 238 had end-organ injury. In cohort 1, the CMQCC and the UKOSS pregnancy-adjusted criteria had the lowest false-positive rates (6.9% and 9.6%, respectively) and the highest C-statistics (0.92 and 0.91, respectively). Although other screening criteria, such as SIRS and the MEWC, had similar sensitivities, it was at the cost of much higher false-positive rates (21.3% and 38.3%, respectively). In cohort 2, including all patients with chorioamnionitis-endometritis, the highest C-statistics were again for the CMQCC (0.67) and UKOSS (0.64). All screening tools had high false-positive rates, but the false-positive rates for the CMQCC and UKOSS were substantially lower than those for SIRS and the MEWC. **Conclusion:** During delivery admissions, the CMQCC and UKOSS pregnancy-adjusted screening criteria have the lowest false-positive results while maintaining greater than 90% sensitivity rates. Performance of all screening tools was degraded in the setting of chorioamnionitis-endometritis.

14. Bauer ME, Fuller M, Kovacheva V, Elkhateb R, Azar K, Caldwell M, Chiem V, Foster M, Gibbs R, Hughes BL, Johnson R, Kottukapally N, Rosenstein MG, Cortes MS, Shields LE, Sudat S, Sutton CD, Toledo P, Traylor A, Wharton K, Main E. **Performance Characteristics of Sepsis Screening Tools During Antepartum and Postpartum Admissions.** Obstetrics & Gynecology Mar 01 2024;143(3):336-345

Objective: To evaluate the performance characteristics of existing screening tools for the prediction of sepsis during antepartum and postpartum readmissions. **Methods:** This was a case-control study using electronic health record data obtained between 2016 and 2021 from 67 hospitals for antepartum sepsis admissions and 71 hospitals for postpartum readmissions up to 42 days. Patients in the sepsis case group were matched in a 1:4 ratio to a comparison cohort of patients without sepsis admitted antepartum or postpartum. The following screening criteria were evaluated: the CMQCC (California Maternal Quality Care Collaborative) initial sepsis screen, the non-pregnancy-adjusted SIRS (Systemic Inflammatory Response Syndrome), the MEWC (Maternal Early Warning Criteria), UKOSS (United Kingdom Obstetric Surveillance System) obstetric SIRS, and the MEWT (Maternal Early Warning Trigger Tool). Time periods were divided into early pregnancy (less than 20 weeks of

gestation), more than 20 weeks of gestation, early postpartum (less than 3 days postpartum), and late postpartum through 42 days. False-positive screening rates, C-statistics, sensitivity, and specificity were reported for each overall screening tool and each individual criterion. **Results:** We identified 525 patients with sepsis during an antepartum hospitalization and 728 patients with sepsis during a postpartum readmission. For early pregnancy and more than 3 days postpartum, non-pregnancy-adjusted SIRS had the highest C-statistics (0.78 and 0.83, respectively). For more than 20 weeks of gestation and less than 3 days postpartum, the pregnancy-adjusted sepsis screening tools (CMQCC and UKOSS) had the highest C-statistics (0.87-0.94). The MEWC maintained the highest sensitivity rates during all time periods (81.9-94.4%) but also had the highest false-positive rates (30.4-63.9%). The pregnancy-adjusted sepsis screening tools (CMQCC, UKOSS) had the lowest false-positive rates in all time periods (3.9-10.1%). All tools had the lowest C-statistics in the periods of less than 20 weeks of gestation and more than 3 days postpartum. **Conclusion:** For admissions early in pregnancy and more than 3 days postpartum, non-pregnancy-adjusted sepsis screening tools performed better than pregnancy-adjusted tools. From 20 weeks of gestation through up to 3 days postpartum, using a pregnancy-adjusted sepsis screening tool increased sensitivity and minimized false-positive rates. The overall false-positive rate remained high.

With an editorial by Shields AD and Tse BC. **Finding the Needle in the Haystack: Challenges and Future Directions in Maternal Sepsis Recognition**. Obstetrics & Gynecology Mar 01 2024;143(3):323-325

15. Liu LY, Wen T, Reddy UM, Mourad M, Goffman D, Nathan L, Sheen JJ, D'Alton ME, Friedman AM. **Risk Factors, Trends, and Outcomes Associated With Postpartum Sepsis Readmissions.** Obstet Gynecol. 2024 Mar 1;143(3):346-354.

Objective: To evaluate the prevalence, timing, clinical risk factors, and adverse outcomes associated with postpartum readmissions for maternal sepsis. **Methods:** We conducted a retrospective cohort study of delivery hospitalizations and 60-day postpartum readmissions for females aged 15-54 years with and without sepsis using the 2016-2020 Nationwide Readmissions Database. Temporal trends in sepsis diagnoses during delivery hospitalizations and 60-day postpartum readmissions were analyzed with the National Cancer Institute's Joinpoint Regression Program to estimate the average annual percent change with 95% CIs. Logistic regression models were fit to determine whether delivery hospitalization characteristics were associated with postpartum sepsis readmissions, and unadjusted and adjusted odds ratios with 95% CIs were reported. Adverse outcomes associated with sepsis during delivery hospitalization and readmission were described, including death, severe morbidity, a critical care composite, and renal failure. **Results:** Overall, 15,268,190 delivery hospitalizations and 256,216 associated 60-day readmissions were included after population weighting, of which 16,399 (1.1/1,000 delivery hospitalizations) had an associated diagnosis of sepsis at delivery, and 20,130 (1.3/1,000 delivery hospitalizations) had an associated diagnosis of sepsis with postpartum readmission. A sepsis diagnosis was present in 7.9% of all postpartum readmissions. Characteristics associated with postpartum sepsis readmission included younger age at delivery, Medicaid insurance, lowest median ZIP code income quartile, and chronic medical conditions such as obesity, pregestational diabetes, and chronic hypertension. Postpartum sepsis readmissions were

associated with infection during the delivery hospitalization, including intra-amniotic infection or endometritis, wound infection, and delivery sepsis. Sepsis diagnoses were associated with 24.4% of maternal deaths at delivery and 38.4% postpartum, 2.2% cases of nontransfusion severe morbidity excluding sepsis at delivery and 13.6% postpartum, 15.6% of critical care composite diagnoses at delivery and 30.1% postpartum, and 11.1% of acute renal failure diagnoses at delivery and 36.4% postpartum. **Conclusion:** Sepsis accounts for a significant proportion of postpartum readmissions and is a major contributor to adverse outcomes during delivery hospitalizations and postpartum readmissions.

Maternal Comorbidities

Cardiac Disease

16. Castleman J, Curtis S, Fox C, Hudsmith L, Nolan L, Geoghegan J, Metodiev Y, Roberts E, Morse L, Nisbet A, Foley P, Wright I, Thomas H, Morris K, Adamson D, De Bono J. **Cardiac implantable electronic devices in pregnancy: A position statement**. BJOG. 2024 Dec;131(13):1739-1746.

    The aim of this document is to provide guidance for the management of women and birthing people with a permanent pacemaker (PPM) or implantable cardioverter defibrillator (ICD). Cardiac devices are becoming more common in obstetric practice and a reference document for contemporary evidence-based practice is required. Where evidence is limited, expert consensus has established recommendations. The purpose is to improve safety and reduce the risk of adverse events relating to implanted cardiac devices during pregnancy, birth and the postnatal period.

17. Lewey J, Beckie TM, Brown HL, Brown SD, Garovic VD, Khan SS, Miller EC, Sharma G, Mehta LS. **Opportunities in the Postpartum Period to Reduce Cardiovascular Disease Risk After Adverse Pregnancy Outcomes: A Scientific Statement From the American Heart Association**. Circulation. 2024 Feb 13;149(7):e330-e346.

    Adverse pregnancy outcomes are common among pregnant individuals and are associated with long-term risk of cardiovascular disease. Individuals with adverse pregnancy outcomes also have an increased incidence of cardiovascular disease risk factors after delivery. Despite this, evidence-based approaches to managing these patients after pregnancy to reduce cardiovascular disease risk are lacking. In this scientific statement, we review the current evidence on interpregnancy and postpartum preventive strategies, blood pressure management, and lifestyle interventions for optimizing cardiovascular disease using the American Heart Association Life's Essential 8 framework. Clinical, health system, and community-level interventions can be used to engage postpartum individuals and to reach populations who experience the highest burden of adverse pregnancy outcomes and cardiovascular disease. Future trials are needed to improve screening of subclinical cardiovascular disease in individuals with a history of adverse pregnancy outcomes, before the onset of symptomatic disease. Interventions in the fourth trimester, defined as the 12 weeks after delivery, have great potential to improve cardiovascular health across the life course.

18. Meng ML, Schroder J, Lindley K. **Obstetric anesthesia management of dilated cardiomyopathies and heart failure: a narrative review.** Int J Obstet Anesth. 2024 Nov;60:104251.

Pregnancy in patients with dilated cardiomyopathy carries a significantly increased risk of maternal mortality or severe morbidity, and pregnancy is typically considered contraindicated for patients with severely reduced ventricular function. Nonetheless, anesthesiologists will still encounter patients with cardiomyopathy requiring delivery or termination care. This review describes how NT-ProBNP testing and echocardiography can help with early recognition of heart failure in pregnancy, and describes a suggested approach to anesthetic management of patients with cardiomyopathies or acute heart failure, including hemodynamic goals, use of vasoactive medications and mechanical support. Vaginal delivery, with effective neuraxial anesthesia is the preferred mode of delivery in most patients with cardiomyopathy, with cesarean delivery reserved for maternal or fetal indications. The Pregnancy Heart Team is vital in coordinating the multidisciplinary care necessary to safely support these patients through pregnancy.

19. Naoum EE, O'Neil ER, Shamshirsaz AA. **Extracorporeal membrane oxygenation (ECMO) in pregnancy and peripartum: a focused review.** Int J Obstet Anesth. 2024 Nov;60:104247.

    As the medical complexity of pregnant patients increases, the rate of maternal morbidity has risen. Maternal cardiovascular disease is a leading cause of maternal morbidity and mortality followed closely by sepsis and infection, both of which may be associated with respiratory failure. There has been an expansion in the application of extracorporeal life support in pregnant and peripartum patients which requires obstetric anesthesiologists to understand the indications, obstetric and medical considerations, relative advantages and potential complications of this invasive technology in this population. Obstetricians and anesthesiologists who care for women on the labor floor must strive to recognize at-risk and deteriorating patients, facilitate escalation of care when appropriate, and engage consultant teams to consider the need for extracorporeal support in high-risk circumstances. This article reviews the epidemiology, indications, specific considerations, potential complications, and outcomes of extracorporeal life support in pregnant and peripartum patients.

20. Sharpe EE, Rose CH, Tweet MS. **Obstetric anesthesia considerations in pregnancy-associated myocardial infarction: a focused review**. Int J Obstet Anesth. 2024 Nov;60:104233.

    Pregnancy-associated myocardial infarction (PAMI) is a rare but serious complication that can occur either during pregnancy or postpartum. The etiologies of PAMI are atherosclerosis, spontaneous coronary artery dissection, coronary thrombosis, coronary embolism, and coronary vasospasm. Therapy of acute PAMI depends largely on the ECG presentation, hemodynamic stability, and suspected etiology of myocardial infarction. Anesthetic management during delivery in patients with PAMI should consist of early and carefully titrated neuraxial analgesia and anesthesia, maintenance of normal sinus rhythm, preservation of afterload, and monitoring for and avoiding myocardial ischemia. To improve the care of women with PAMI, a multidisciplinary team of cardiologists, maternal fetal medicine specialists, obstetric providers, neonatologists, and anesthesiologists must work collectively to manage these complex patients.

Preeclampsia:

21. Meng ML, Li Y, Fuller M, Lanners Q, Habib AS, Federspiel JJ, Quist-Nelson J, Shah SH, Pencina M, Boggess K, Krishnamoorthy V, Engelhard M. **Development and Validation of a Predictive Model for Maternal Cardiovascular Morbidity Events in Patients With Hypertensive Disorders of Pregnancy.** Anesth Analg. 2024 Nov 6.

Background: Hypertensive disorders of pregnancy (HDP) are a major contributor to maternal morbidity, mortality, and accelerated cardiovascular (CV) disease. Comorbid conditions are likely important predictors of CV risk in pregnant people. Currently, there is no way to predict which people with HDP are at risk of acute CV complications. We developed and validated a predictive model for all CV events and for heart failure, renal failure, and cerebrovascular events specifically after HDP. **Methods:** Models were created using the Premier Healthcare Database. The inclusion criteria for the model dataset were delivery with an HDP with discharge from October 1, 2015 to December 31, 2020. Machine learning methods were used to derive predictive models of CV events occurring during delivery hospitalization (Index Model) or during readmission (Readmission Model) using a training set (60%) to estimate model parameters, a validation set (20%) to tune model hyperparameters and select a final model, and a test set (20%) to evaluate final model performance. **Results:** The total model cohort consisted of 553,658 deliveries with an HDP. A CV event occurred in 6501 (1.2%) of the delivery hospitalizations. Multilabel neural networks were selected for the Index Model and Readmission Model due to favorable performance compared to alternatives. This approach is designed for prediction of multiple events that share risk factors and may cooccur. The Index Model predicted all CV events with area under the receiver operating curve (AUROC) 0.878 and average precision (AP) 0.239 (cerebrovascular events: AUROC 0.941, heart failure: AUROC 0.898, and renal failure: AUROC 0.885). With a positivity threshold set to achieve ≥90% sensitivity, model specificity was 65.0%, 83.5%, 68.6%, and 65.6% for predicting all CV events, cerebrovascular events, heart failure, and renal failure, respectively. CV events within 1 year of delivery occurred in 3018 (0.6%) individuals. The Readmission Model predicted all CV events with AUROC 0.717 and AP 0.022 (renal failure: AUROC 0.748, heart failure: AUROC 0.734, and cerebrovascular events AUROC 0.698). Feature importance analysis indicated that the presence of chronic renal disease, cardiac disease, pulmonary hypertension, and preeclampsia with severe features had the greatest effect on the prediction of CV events. **Conclusions:** Among individuals with HDP, our multilabel neural network model predicted CV events at delivery admission with good classification and events within 1 year of delivery with fair classification.

22. Vinogradov R, Kavanagh ON, Palmer J, Murphy P, Curtis E, Kamali F, Robson S. **A randomised crossover design study comparing the pharmacokinetics and pharmacodynamics of two single Doses of ORal Aspirin (75 mg v 150mg) in pregnant women at risk of pre-eclampsia (DORA): implications on assessing aspirin response and patient adherence to therapy.** Am J Obstet Gynecol. 2024 Oct 21:S0002-9378(24)01084-6.

Background: Pregnancy is associated with physiological changes that can alter the pharmacokinetic and pharmacodynamic profile of many drugs. Low-dose aspirin is used for preeclampsia prevention; however, aspirin's pharmacokinetics and pharmacodynamics are poorly studied in pregnant women. **Objective:** The aim of this study was to compare the pharmacodynamics of 2 common doses of aspirin (75 and 150 mg) used for preeclampsia prevention in high-risk women by examining their effect on thromboxane B2 inhibition. A secondary objective sought to assess if salicylic acid could be used as means to evaluate adherence to aspirin. **Study design:** Fourteen pregnant women from a large maternity unit in England, eligible for prophylactic aspirin according to National Institute for Health and Care Excellence guidance, were recruited into 2×2 randomized crossover trial. Blood samples were collected at baseline, 1, 2, 3, 4, 15, 16, 17, 18, and 19 hours postingestion of either 75 or 150 mg of aspirin with a 7-day washout period. Plasma concentrations of salicylic acid, the primary metabolite of aspirin, were determined using high performance liquid chromatography.

Pharmacodynamic response to aspirin was assessed by measuring serum thromboxane B2 concentrations by an enzyme-linked immunosorbent assay. Analyte data were compared using nonparametric test statistics for paired values (Wilcoxon Signed Rank Test) and areas under serum SA concentration versus time curve. Pharmacokinetic modeling was used to bridge the data arising from the overnight sampling break. **Results:** A single dose of 150 mg of aspirin produced higher plasma exposure of SA in comparison to 75 mg (median SA areas under serum SA concentration vs time curve0-19 16.7 μg∗h/ml [interquartile range 15.2-19.3] vs 6.8 μg∗h/ml [interquartile range 6.1-8.3], P<.001). Pharmacokinetic models suggest that plasma SA concentrations could be detected above the maximum concentration recorded at baseline for the first 11 hours after 75 mg and for 12 hours after 150-mg aspirin dosing, providing a time frame to confirm recent aspirin ingestion. The 150-mg aspirin dose produced a greater normalized reduction in serum thromboxane B2 (median normalized reduction 95.7% [interquartile range 92.6%-97.3%] than the 75-mg dose median normalized reduction 84.6% [interquartile range 77.3%-92.3%], P<.007). **Conclusion:** Compared to the 75-mg dose, 150 mg of aspirin more effectively inhibits thromboxane B2, providing rationale for further investigation of effectiveness of higher doses for preeclampsia prevention. Despite limitations, measuring serum SA concentration could still be used in future models to test adherence if done within 11 to 12 hours after ingestion.

Opioid Use Disorder:

23. Lim G, Carvalho B, George RB, Bateman BT, Brummett CM, Ip VHY, Landau R, Osmundson S, Raymond B, Richebe P, Soens M, Terplan M. **Consensus Statement on Pain Management for Pregnant Patients with Opioid-Use Disorder from the Society for Obstetric Anesthesia and Perinatology, Society for Maternal-Fetal Medicine, and American Society of Regional Anesthesia and Pain Medicine.** Anesth Analg. 2024 Nov 6.

Pain management in pregnant and postpartum people with an opioid use disorder requires a balance among the risks associated with opioid tolerance, including withdrawal or return to opioid use, considerations around the social needs of the maternal-infant dyad, and the provision of adequate pain relief for the birth episode that is often characterized as the worst pain a person will experience in their lifetime. This multidisciplinary consensus statement from the Society for Obstetric Anesthesia and Perinatology, the Society for Maternal-Fetal Medicine, and the American Society of Regional Anesthesia and Pain Medicine provides a framework for pain management in obstetrical patients with opioid use disorder. The purpose of this consensus statement is to provide practical and evidence-based recommendations and is targeted to healthcare providers in obstetrics and anesthesiology. The statement is focused on prenatal optimization of pain management, labor analgesia and postvaginal delivery pain management, and postcesarean delivery pain management. Topics include a discussion of nonpharmacologic and pharmacologic options for pain management, medication management for opioid use disorder (eg, buprenorphine, methadone), considerations regarding urine drug testing and other social aspects of care for maternal-infant dyads, and a review of current practices. The authors provide evidence-based recommendations to optimize pain management while reducing risks and the complications associated with opioid use disorder in the peripartum period. Ultimately, this multidisciplinary consensus statement provides practical and concise clinical guidance to optimize pain management for people with opioid use disorder in the context of pregnancy to improve maternal and perinatal outcomes.

24. Straub L, Bateman BT, Hernández-Díaz S, Zhu Y, Suarez EA, Vine SM, Jones HE, Connery HS, Davis JM, Gray KJ, Lester B, Terplan M, Zakoul H, Mogun H, Huybrechts KF. **Comparative Safety of In Utero Exposure to Buprenorphine Combined With Naloxone vs Buprenorphine Alone.** JAMA. 2024 Sep 10;332(10):805-816.

Importance: Buprenorphine combined with naloxone is commonly used to treat opioid use disorders outside of pregnancy. In pregnancy, buprenorphine alone is generally recommended because of limited perinatal safety data on the combination product. **Objective:** To compare perinatal outcomes following prenatal exposure to buprenorphine with naloxone vs buprenorphine alone. **Design, settings, and participants:** Population-based cohort study using health care utilization data from Medicaid-insured beneficiaries in the US from 2000 to 2018. The cohort was restricted to pregnant individuals linked to their liveborn infants, with maternal Medicaid enrollment from 3 months before pregnancy to 1 month after delivery and infant enrollment for the first 3 months after birth, unless they died sooner. **Exposure:** Use of buprenorphine with naloxone vs buprenorphine alone during the first trimester based on outpatient dispensings. **Main outcomes and measures:** Outcomes included major congenital malformations, low birth weight, neonatal abstinence syndrome, neonatal intensive care unit admission, preterm birth, respiratory symptoms, small for gestational age, cesarean delivery, and maternal morbidity. Confounder-adjusted risk ratios were calculated using propensity score overlap weights. **Results:** This study identified 3369 pregnant individuals exposed to buprenorphine with naloxone during the first trimester (mean [SD] age, 28.8 [4.6] years) and 5326 exposed to buprenorphine alone or who switched from the combination to buprenorphine alone by the end of the first trimester (mean [SD] age, 28.3 [4.5] years). When comparing buprenorphine combined with naloxone with buprenorphine alone, a lower risk for neonatal abstinence syndrome (absolute risk, 37.4% vs 55.8%; weighted relative risk, 0.77 [95% CI, 0.70-0.84]) and a modestly lower risk for neonatal intensive care unit admission (absolute risk, 30.6% vs 34.9%; weighted relative risk, 0.91 [95% CI, 0.85-0.98]) and small for gestational age (absolute risk, 10.0% vs 12.4%; weighted relative risk, 0.86 [95% CI, 0.75-0.98]) was observed. For maternal morbidity, the comparative rates were 2.6% vs 2.9%, respectively, and the weighted relative risk was 0.90 (95% CI, 0.68-1.19). No differences were observed with respect to major congenital malformations overall, low birth weight, preterm birth, respiratory symptoms, or cesarean delivery. Results were consistent across sensitivity analyses. **Conclusions and relevance:** There were similar and, in some instances, more favorable neonatal and maternal outcomes for pregnancies exposed to buprenorphine combined with naloxone compared with buprenorphine alone. For the outcomes assessed, compared with buprenorphine alone, buprenorphine with naloxone during pregnancy appears to be a safe treatment option. This supports the view that both formulations are reasonable options for the treatment of opioid use disorder in pregnancy, affirming flexibility in collaborative treatment decision-making.

Hyperemesis Gravidarum:

25. Fejzo M, Rocha N, Cimino I, Lockhart SM, Petry CJ, Kay RG, Burling K, Barker P, George AL, Yasara N, Premawardhena A, Gong S, Cook E, Rimmington D, Rainbow K, Withers DJ, Cortessis V, Mullin PM, MacGibbon KW, Jin E, Kam A, Campbell A, Polasek O, Tzoneva G, Gribble FM, Yeo GSH, Lam BYH, Saudek V, Hughes IA, Ong KK, Perry JRB, Sutton Cole A, Baumgarten M, Welsh P, Sattar N, Smith GCS, Charnock-Jones DS, Coll AP, Meek CL, Mettananda S, Hayward C, Mancuso N, O'Rahilly S. **GDF15 linked to maternal risk of nausea and vomiting during pregnancy**. Nature. 2024 Jan;625(7996):760-767.

GDF15, a hormone acting on the brainstem, has been implicated in the nausea and vomiting of pregnancy, including its most severe form, hyperemesis gravidarum (HG), but a full mechanistic understanding is lacking1-4. Here we report that fetal production of GDF15 and maternal sensitivity to it both contribute substantially to the risk of HG. We confirmed that higher GDF15 levels in maternal blood are associated with vomiting in pregnancy and HG. Using mass spectrometry to detect a naturally labelled GDF15 variant, we demonstrate that the vast majority of GDF15 in the maternal plasma is derived from the feto-placental unit. By studying carriers of rare and common genetic variants, we found that low levels of GDF15 in the non-pregnant state increase the risk of developing HG. Conversely, women with β-thalassaemia, a condition in which GDF15 levels are chronically high5, report very low levels of nausea and vomiting of pregnancy. In mice, the acute food intake response to a bolus of GDF15 is influenced bi-directionally by prior levels of circulating GDF15 in a manner suggesting that this system is susceptible to desensitization. Our findings support a putative causal role for fetally derived GDF15 in the nausea and vomiting of human pregnancy, with maternal sensitivity, at least partly determined by prepregnancy exposure to the hormone, being a major influence on its severity. They also suggest mechanism-based approaches to the treatment and prevention of HG.

26. Kohn R, Ashana DC, Vranas KC, Viglianti EM, Hauschildt K, Chen C, Vail EA, Moroz L, Gershengorn HB. **The association of pregnancy with outcomes among critically ill reproductive-aged women: A propensity-score matched retrospective cohort analysis**. Chest. 2024 Oct;166(4):765-777.

Background: The maternal mortality rate in the United States is unacceptably high. However, the relative contribution of pregnancy to these outcomes is unknown. Studies comparing outcomes among pregnant vs nonpregnant critically ill patients show mixed results and are limited by small sample sizes. **Research question:** What is the association of pregnancy with critical illness outcomes? **Study design and methods:** We performed a retrospective cohort study of women 18 to 55 years of age who received invasive mechanical ventilation (MV) on hospital day 0 or 1 or who demonstrated sepsis on admission (infection with organ failure) discharged from Premier Healthcare Database hospitals from 2008 through 2021. The exposure was pregnancy. The primary outcome was in-hospital mortality. We created propensity scores for pregnancy (using patient and hospital characteristics) and performed 1:1 propensity score matching without replacement within age strata (to ensure exact age matching). We performed multilevel multivariable mixed-effects logistic regression for propensity-matched pairs with pair as a random effect.

Results: Three thousand ninety-three pairs were included in the matched MV cohort, and 13,002 pairs were included in the sepsis cohort. The characteristics of both cohorts were well balanced (all standard mean differences, < 0.1). Among matched pairs, unadjusted mortality was 8.0% vs 13.8% for MV and 1.4% vs 2.3% for sepsis among pregnant and nonpregnant patients, respectively. In adjusted regression, pregnancy was associated with lower odds of in-hospital mortality (MV: OR, 0.50; 95% CI, 0.41-0.60; P < .001; sepsis: OR, 0.52; 95% CI, 0.40-0.67; P < .001).

Interpretation: In this large US cohort, critically ill pregnant women receiving MV or with sepsis showed better survival than propensity score-matched nonpregnant women. These findings must be interpreted in the context of likely residual confounding.

27. Nicholson L, Axon E, Daru J, Rogozińska E. **Effect and safety of intravenous iron compared to oral iron for treatment of iron deficiency anaemia in pregnancy.** Cochrane Database Syst Rev. 2024 Dec 9;12(12):CD016136.

    Intravenous iron likely slightly increases Hb levels and likely reduces anaemia in pregnancy compared to oral iron. Hb levels postpartum may be slightly increased with intravenous iron, but the effect on postpartum severe anaemia status is very uncertain. Intravenous iron may result in little to no difference in PPH, and blood transfusion rates are likely unaffected by route of administration. Synthesis of adverse outcomes proved challenging due to their rarity and suboptimal reporting. The effects of intravenous iron on maternal mortality and admissions to the ICU are very uncertain, and there is likely little to no difference between groups in severe infections and prolonged hospital stay. Intravenous iron likely does not increase AEs and may not increase serious AEs; however, the 95% CIs in both cases include potential harm. Furthermore, this finding should be treated cautiously due to the varied adverse event profiles of both types of iron preparations. Data from the ongoing multicentre trials may address some of the identified evidence gaps. However, there is a clear need to strengthen the co-ordination of research efforts around clinically important time points of outcome measure, homogeneity of their definition, and safety reporting.

Labor and Delivery

28. Hamilton EF, Zhoroev T, Warrick PA, Tarca AL, Garite TJ, Caughey AB, Melillo J, Prasad M, Neilson D, Singson P, McKay K, Romero R. **New labor curves of dilation and station to improve the accuracy of predicting labor progress**. Am J Obstet Gynecol. 2024 Jul;231(1):1-18.

    Background: The diagnosis of failure to progress, the most common indication for intrapartum cesarean delivery, is based on the assessment of cervical dilation and station over time. Labor curves serve as references for expected changes in dilation and fetal descent. The labor curves of Friedman, Zhang et al, and others are based on time alone and derived from mothers with spontaneous labor onset. However, labor induction is now common, and clinicians also consider other factors when assessing labor progress. Labor curves that consider the use of labor induction and other factors that influence labor progress have the potential to be more accurate and closer to clinical decision-making. **Objective:** This study aimed to compare the prediction errors of labor curves based on a single factor (time) or multiple clinically relevant factors using two modeling methods: mixed-effects regression, a standard statistical method, and Gaussian processes, a machine learning method. **Study design:** This was a longitudinal cohort study of changes in dilation and station based on data from 8022 births in nulliparous women with a live, singleton, vertex-presenting fetus ≥35 weeks of gestation with a vaginal delivery. New labor curves of dilation and station were generated with 10-fold cross-validation. External validation was performed using a geographically independent group. Model variables included time from the first examination in the 20 hours before delivery; dilation, effacement, and station recorded at the previous examination; cumulative contraction counts; and use of epidural anesthesia and labor induction. To assess model accuracy, differences between each model's predicted value and its corresponding observed value were calculated. These prediction errors were summarized using mean absolute error and root mean squared error statistics. **Results:** Dilation curves based on multiple parameters were more accurate than those derived from time alone. The mean absolute error of the multifactor methods was better (lower) than those of the single-

factor methods (0.826 cm [95% confidence interval, 0.820-0.832] for the multifactor machine learning and 0.893 cm [95% confidence interval, 0.885-0.901] for the multifactor mixed-effects method and 2.122 cm [95% confidence interval, 2.108-2.136] for the single-factor methods; P<.0001 for both comparisons). The root mean squared errors of the multifactor methods were also better (lower) than those of the single-factor methods (1.126 cm [95% confidence interval, 1.118-1.133] for the machine learning [P<.0001] and 1.172 cm [95% confidence interval, 1.164-1.181] for the mixed-effects methods and 2.504 cm [95% confidence interval, 2.487-2.521] for the single-factor [P<.0001 for both comparisons]). The multifactor machine learning dilation models showed small but statistically significant improvements in accuracy compared to the mixed-effects regression models (P<.0001). The multifactor machine learning method produced a curve of descent with a mean absolute error of 0.512 cm (95% confidence interval, 0.509-0.515) and a root mean squared error of 0.660 cm (95% confidence interval, 0.655-0.666). External validation using independent data produced similar findings. **Conclusion:** Cervical dilation models based on multiple clinically relevant parameters showed improved (lower) prediction errors compared to models based on time alone. The mean prediction errors were reduced by more than 50%. A more accurate assessment of departure from expected dilation and station may help clinicians optimize intrapartum management.

29. Cai R, Chen L, Xing Y, Deng Y, Li J, Guo F, Liu L, Xie C, Yang J. **Oxytocin with calcium vs oxytocin for induction of labor in women with term premature rupture of membranes: a randomized controlled trial.** Am J Obstet Gynecol MFM. 2024 Nov;6(11):101502.

Background: Intravenous calcium administration has shown promise in enhancing uterine contractions and reducing blood loss during cesarean delivery, but this regimen has not been compared in vaginal labor induction. **Objective:** This study aimed to determine the efficacy of oxytocin combined with calcium vs oxytocin alone for inducing labor in women with term premature rupture of membranes. **Study design:** This single-blind, randomized controlled trial was conducted between October 2022 and May 2023 at a tertiary university hospital. Patients diagnosed with premature rupture of membranes were randomly allocated into 2 groups. The intervention group received a bolus of 10 mL of calcium gluconate followed by a continuous infusion of oxytocin via a pump (n=210), whereas the control group received only oxytocin infusion (n=218). The primary outcome was successful vaginal deliveries within 24 hours after labor induction. The secondary outcomes included the interval from labor induction to delivery, vaginal delivery blood loss, and maternal and neonatal complications. **Results:** Baseline characteristics, including maternal age, body mass index, and Bishop score before labor induction, were comparable between the groups. The rate of vaginal delivery within 24 hours after labor induction was statistically higher in the intervention group (79.52% vs 70.64%; P=.04). The participants in the intervention group experienced a shortened interval between labor induction and delivery (10.48 vs 11.25 hours; P=.037) and demonstrated a higher success rate in labor induction assessed by the onset of the active phase (93.80% vs 87.61%; P=.04) without increasing the cesarean delivery rate. Reduced hemorrhage was observed in the intervention group (242.5 vs 255.0 mL; P=.0015), and the maternal and neonatal outcomes were comparable between the groups. **Conclusion:** The coadministration of calcium and oxytocin in labor induction among pregnancies with premature rupture of membranes was more efficient and safer than the administration of oxytocin alone. Our research suggests that the combination therapy of calcium and oxytocin may offer significant advantages during the process of labor induction and result in better outcomes.

30. Chirumbole DL, Gandhi M, Clark SL, Tolcher MC. **Pharmacologic venous thromboembolism prophylaxis for preterm prelabor rupture of membranes.** Am J Obstet Gynecol MFM. 2024 Jul;6(7):101393.

Background: Pregnant patients with preterm prelabor rupture of membranes (PPROM) may experience prolonged hospitalization, which is an indication for pharmacologic venous thromboembolism (VTE) prophylaxis according to certain international guidelines. The proportion of patients who deliver unexpectedly and within a period during which pharmacologic prophylaxis would be expected to impact coagulation is unknown. **Objective:** To estimate the proportion of patients with PPROM who would deliver within 12 hours of typical dosing of pharmacologic VTE prophylaxis if administered routinely for antepartum admissions >72 hours. **Study design:** This is a retrospective cohort study from a database including patients admitted for expectant management of PPROM January 2011 to September 2020. The outcome of the study was the proportion of patients who remained undelivered 72 hours after admission and experienced an unplanned delivery potentially within 12 hours of enoxaparin administration. We evaluated patients undelivered after 72 hours due to international recommendations to initiate VTE prophylaxis in hospitalized patients after 72 hours. Unplanned delivery was defined as onset of spontaneous labor or other indication for immediate delivery. Timing of delivery was analyzed based on usual timing of enoxaparin administration daily at approximately 8 am and the recommendation to withhold regional anesthesia until 12 hours after a prophylactic dose. **Results:** 1381 deliveries were identified as PPROM out of the 49,322 deliveries in our database. 139 cases were included after the following exclusions: delivery >35 weeks (N=641), rupture of membranes >34 weeks (N=145), delivery <72 hours after admission (N=409), insufficient data (N=35), and duplicates (N=12). Sixty of the 139 (43%) had an unplanned delivery, while 33 of these (24% of total) occurred within 12 hours of enoxaparin administration. **Conclusion:** A quarter of patients admitted for PPROM had an unplanned delivery within 12 hours of typical enoxaparin dosing. This cohort may experience harm (ineligibility for regional anesthesia, risks of general anesthesia, increased risk of bleeding) if given routine pharmacologic VTE prophylaxis. Risk/benefit considerations should be discussed with patients in considering pharmacologic versus mechanical prophylaxis during prolonged hospitalization for PPROM.

31. Biswas S, Toro M, Horgan R, McLaren RA Jr, Berghella V, Al-Kouatly HB. **Propranolol to decrease time to delivery: a meta-analysis of randomized controlled trials.** Am J Obstet Gynecol MFM. 2024 Oct;6(10):101459.

Objective: To assess the effect of propranolol on time to delivery among patients undergoing induction or augmentation of labor. **Data sources:** PubMed, Scopus, Cochrane Library, ClinicalTrials.gov, and CINAHL (EBSCO) were searched from inception to December 2023. **Study eligibility criteria:** Randomized controlled trials (RCTs) that examined the impact of propranolol on time to delivery among patients undergoing induction or augmentation of labor were included. RCTs that included stillbirth before randomization, non-randomized trials, observational, cohort, case control, or studies in which the control group included an intervention other than standard care were excluded. **Study appraisal and synthesis methods:** Primary outcome was time to delivery after administration of propranolol among patients undergoing induction or augmentation of labor. The summary measures were reported as summary mean difference (MD) or relative risk with 95% confidence interval (CI). **Results:** Nine RCTs including 1,182 patients were included in this meta-analysis. Five studies investigated the effect of propranolol among patients undergoing induction of

labor (IOL) and demonstrated a significant decrease in time to delivery (MD, -91.5 minutes, 95% CI -110.6 to -72.4). Four studies investigated the effect of propranolol among patients undergoing augmentation of labor and showed no significant decrease in time to delivery (MD, -2.98 minutes, 95% CI -21.6 to 15.6). Our pooled analysis demonstrated that the use of propranolol in IOL and augmentation was associated with a decrease in time to delivery from administration of propranolol compared to placebo (mean difference, -46.15 minutes, 95% CI -59.48 to -32.81). The meta-analysis found no increased risk of PPH, blood transfusion, cesarean delivery rates, or NICU admission with the use of propranolol during labor. **Conclusion:** The use of propranolol during induction of labor shortens overall time to delivery by about 91 minutes and did not significantly decrease time to delivery in those undergoing augmentation of labor.

32. Bouvet L, Fabre J, Roussin C, Nadal C, Dezavelle S, Vial F, Le Gouez A, Soued M, Keita H, Zein W, Desgranges FP, Thuet V, Boucekine M, Duclos G, Leone M, Zieleskiewicz L. **Prevalence and factors associated with high-risk gastric contents in women admitted to the maternity unit for childbirth: a prospective multicentre cohort study.** Br J Anaesth. 2024 Mar;132(3):553-561.

Background: This multicentre prospective observational study sought to determine the prevalence and the factors associated with high-risk gastric contents in women admitted to the maternity unit for childbirth, and to identify the clinical situations in which ultrasound assessment of gastric contents would be most helpful (i.e. when the prevalence of high-risk gastric contents is close to 50%). **Methods:** Ultrasound assessments of gastric contents were performed within the first hour after admission to the maternity unit. The prevalence of high-risk gastric contents was calculated and variables associated with high-risk gastric contents were identified using logistic regression analyses. **Results**: A total of 1003 parturients were analysed. The prevalence of high-risk gastric contents was 70% (379/544; 95% confidence interval: 66-74%) in women admitted in spontaneous labour and 65% (646/1003; 95% confidence interval: 61-67%) in the whole cohort. Lower gestational age, increased fasting duration for solids, and elective Caesarean delivery were independently associated with reduced likelihood of high-risk gastric contents. In women admitted in spontaneous labour and in the whole cohort, the prevalence of high-risk gastric contents ranged from 85% to 86% for fasting duration for solids <6 h, 63%-68% for fasting 6-8 h, 54%-55% for fasting 8-12 h, and 47%-51% for fasting 12 h. **Conclusions**: Around two-thirds of parturients had high-risk gastric contents within the first hour after admission to the maternity unit. Our results suggest that gastric emptying for solids continues in labouring women, and that gastric ultrasound would be most helpful when fasting duration is 8 h.

33. Ni X, Li J, Wu QW, Zhou SQ, Xu ZD, Liu ZQ. **Ultrasound evaluation of gastric emptying of high-energy semifluid solid beverage in parturients during labor at term: a randomized controlled trial.** J Anesth. 2024 Feb;38(1):29-34.

Purpose: What to intake during labor is controversial. The purpose of this study was to compare the gastric emptying of high-energy semifluid solid beverage (HESSB) versus that of carbohydrate (CHO) solution of equal calories and volume by evaluating the gastric antral cross-sectional area (CSA) using ultrasonography in parturients during labor at term. **Methods:** The study was conducted at a maternity and infant hospital between June and October 2020. Forty parturients scheduled for epidural labor analgesia during labor at term were randomly assigned to receive HESSB (300 mL, n = 20) or CHO (300 mL, n = 20). Gastric antral CSA was measured at baseline and 5, 30, 60, 90, and 120 min after

consumption of the drink. The primary outcome was gastric antral CSA at 120 min in the HESSB group and CHO group. **Results:** The gastric antral CSA between the HESSB group and CHO group at 120 min was not statistically significant (2.73 cm2 ± 0.55 vs. 2.55 cm2 ± 0.72, P = 0.061). All patients returned to baseline at 120 min after intake of 300 mL isocaloric HESSB and CHO, confirmed by evaluation of gastric antral CSA. The visual analog scale score for satiety was higher in the HESSB group (P < 0.001), with better taste satisfaction (7[5-8] vs. 5[4-6], P < 0.001). **Conclusion:** The change of gastric antral cross-sectional area after HESSB is similar to the corresponding calories and volume of CHO and the gastric emptying of HESSB can be emptied within 2 h with better taste satisfaction and satiety in pregnant women under labor analgesia.

34. Marcus JK, Fawcus S. **Clinical algorithms for management of third stage abnormalities.** BJOG. 2024 Aug;131 Suppl 2:37-48.

Aims: To develop algorithms for identifying, managing and monitoring postpartum haemorrhage (PPH) and other third stage of labour abnormalities after vaginal delivery. **Population:** Women with low-risk singleton term pregnancies who have had a vaginal delivery. **Setting:** Hospital settings with a particular focus on healthcare facilities in low- and middle-income countries (LMICs). **Search strategy:** Searches for international and national guidance documents, research databases (Cochrane, Medline and CINAHL) and published systematic reviews. Searches were limited to work published in English between 1 January 2008 and 31 December 2018. **Case scenarios:** Four interlinked case scenarios were identified for algorithm development: (1) an approach to PPH after vaginal delivery, (2) uterine atony, (3) genital tract trauma and (4) retained placenta/placental products. **Conclusions:** The development of clear approaches to the assessment, resuscitation, treatment and monitoring of the four case scenarios are presented as algorithms, based on available evidence. They need to be field tested and evaluated for effectiveness, and may be adapted for electronic decision support tools using artificial intelligence in different settings. Further research is needed around multimodal sequential packages of care for PPH, conservative surgical measures, resuscitation in LMICs, and how a respectful maternity care focus can be incorporated into the algorithms.

35. Sharpe EE, Corbett LM, Rollins MD. **Medication errors and mitigation strategies in obstetric anesthesia.** Curr Opin Anaesthesiol. 2024 Dec 1;37(6):736-742.

Purpose of review: Medication administration errors represent a significant yet preventable cause of patient harm in the peripartum period. Implementation of best practices contained in this manuscript can significantly reduce medication errors and associated patient harm. **Recent findings:** Cases of medication errors involving unintended intrathecal administration of tranexamic acid highlight the need to improve medication safety in peripartum patients and obstetric anesthesia. **Summary:** In obstetric anesthesia, medication errors can include wrong medication, dose, route, time, patient, or infusion setting. These errors are often underreported, have the potential to be catastrophic, and most can be prevented. Implementation of various types of best practice cost effective mitigation strategies include recommendations to improve drug labeling, optimize storage, determine correct medication prior to administration, use non-Luer epidural and intravenous connection ports, follow patient monitoring guidelines, use smart pumps and protocols for all infusions, disseminate medication safety educational material, and optimize staffing models. Vigilance in patient care and

implementation of improved patient safety measures are urgently needed to decrease harm to mothers and newborns worldwide.

36. Chaillet N, Mâsse B, Grobman WA, Shorten A, Gauthier R, Rozenberg P, Dugas M, Pasquier JC, Audibert F, Abenhaim HA, Demers S, Piedboeuf B, Fraser WD, Gagnon R, Gagné GP, Francoeur D, Girard I, Duperron L, Bédard MJ, Johri M, Dubé E, Blouin S, Ducruet T, Girard M, Bujold E. **Perinatal morbidity among women with a previous caesarean delivery (PRISMA trial): a cluster-randomised trial**. Lancet. 2024 Jan 6;403(10421):44-54.

Background: Women with a previous caesarean delivery face a difficult choice in their next pregnancy: planning another caesarean or attempting vaginal delivery, both of which are associated with potential maternal and perinatal complications. This trial aimed to assess whether a multifaceted intervention, which promoted person-centred decision making and best practices, would reduce the risk of major perinatal morbidity among women with one previous caesarean delivery. **Methods:** We conducted an open, multicentre, cluster-randomised, controlled trial of a multifaceted 2-year intervention in 40 hospitals in Quebec among women with one previous caesarean delivery, in which hospitals were the units of randomisation and women the units of analysis. Randomisation was stratified according to level of care, using blocked randomisation. Hospitals were randomly assigned (1:1) to the intervention group (implementation of best practices and provision of tools that aimed to support decision making about mode of delivery, including an estimation of the probability of vaginal delivery and an ultrasound estimation of the risk of uterine rupture), or the control group (no intervention). The primary outcome was a composite risk of major perinatal morbidity. This trial was registered with ISRCTN, ISRCTN15346559. **Findings:** 21 281 eligible women delivered during the study period, from April 1, 2016 to Dec 13, 2019 (10 514 in the intervention group and 10 767 in the control group). None were lost to follow-up. There was a significant reduction in the rate of major perinatal morbidity from the baseline period to the intervention period in the intervention group as compared with the control group (adjusted odds ratio [OR] for incremental change over time, 0·72 [95% CI 0·52-0·99]; p=0·042; adjusted risk difference -1·2% [95% CI -2·0 to -0·1]). Major maternal morbidity was significantly reduced in the intervention group as compared with the control group (adjusted OR 0·54 [95% CI 0·33-0·89]; p=0·016). Minor perinatal and maternal morbidity, caesarean delivery, and uterine rupture rates did not differ significantly between groups. **Interpretation:** A multifaceted intervention supporting women in their choice of mode of delivery and promoting best practices resulted in a significant reduction in rates of major perinatal and maternal morbidity, without an increase in the rate of caesarean or uterine rupture.

Labor Analgesia

37. Kearns, Rachel J.; Kyzayeva, Aizhan; Halliday, Lucy O. E.; Lawlor, Deborah A.; Shaw, Martin; Nelson, Scott M. **Epidural analgesia during labour and severe maternal morbidity: population based study**. BMJ. 2024 May 22;385:e077190.

Objectives: To determine the effect of labour epidural on severe maternal morbidity (SMM) and to explore whether this effect might be greater in women with a medical indication for epidural analgesia during labour, or with preterm labour. **Design:** Population based study. **Setting:** All NHS hospitals in Scotland. **Participants:** 567 216 women in labour at 24+0 to 42+6 weeks' gestation between 1 January 2007 and 31 December 2019, delivering vaginally or through unplanned caesarean section. **Main**

outcome measures: The primary outcome was SMM, defined as the presence of ≥1 of 21 conditions used by the US Centers for Disease Control and Prevention (CDC) as criteria for SMM, or a critical care admission, with either occurring at any point from date of delivery to 42 days post partum (described as SMM). Secondary outcomes included a composite of ≥1 of the 21 CDC conditions and critical care admission (SMM plus critical care admission), and respiratory morbidity. **Results:** Of the 567 216 women, 125 024 (22.0%) had epidural analgesia during labour. SMM occurred in 2412 women (4.3 per 1000 births, 95% confidence interval (CI) 4.1 to 4.4). Epidural analgesia was associated with a reduction in SMM (adjusted relative risk 0.65, 95% CI 0.50 to 0.85), SMM plus critical care admission (0.46, 0.29 to 0.73), and respiratory morbidity (0.42, 0.16 to 1.15), although the last of these was underpowered and had wide confidence intervals. Greater risk reductions in SMM were detected among women with a medical indication for epidural analgesia (0.50, 0.34 to 0.72) compared with those with no such indication (0.67, 0.43 to 1.03; P<0.001 for difference). More marked reductions in SMM were seen in women delivering preterm (0.53, 0.37 to 0.76) compared with those delivering at term or post term (1.09, 0.98 to 1.21; P<0.001 for difference). The observed reduced risk of SMM with epidural analgesia was increasingly noticeable as gestational age at birth decreased in the whole cohort, and in women with a medical indication for epidural analgesia. **Conclusion:** Epidural analgesia during labour was associated with a 35% reduction in SMM, and showed a more pronounced effect in women with medical indications for epidural analgesia and with preterm births. Expanding access to epidural analgesia for all women during labour, and particularly for those at greatest risk, could improve maternal health.

38. Tan HS, Tan CW, Sultana R, Chen HY, Chua T, Rahman N, Gandhi M, Sia ATH, Sng BL. **The association between epidural labour analgesia and postpartum depression: a randomised controlled trial.** Anaesthesia. 2024 Apr;79(4):357-367.

There is conflicting evidence regarding the association between epidural labour analgesia and risk of postpartum depression. Most previous studies were observational trials with limited ability to account for confounders. We aimed to determine if epidural analgesia was associated with a significant change in the incidence of postpartum depression in this randomised controlled trial. We enrolled women aged 21-50 years old with a singleton fetus ≥ 36 weeks gestation. Patients were advised regarding available labour analgesic modalities during enrolment (epidural block; intramuscular pethidine; nitrous oxide; or intravenous remifentanil). On request for analgesia, patients were offered the modality that they had been allocated randomly to first. Blinded investigators recorded patient and obstetric characteristics within 24 h of delivery and assessed for postpartum depression at 6-10 weeks following delivery using the Edinburgh Postnatal Depression Scale (score ≥ 13 considered positive for postpartum depression). The modified intention-to-treat population consisted of all patients who received any form of labour analgesia, while per-protocol consisted of patients who received their randomised modality as their first form of labour analgesia. Of 881 parturients allocated randomly (epidural n = 441, non-epidural n = 440), we analysed 773 (epidural n = 389, non-epidural n = 384); 62 (15.9%) of women allocated to epidural group developed postpartum depression compared with 65 (16.9%) women allocate to the non-epidural group. There were no significant differences in the incidence of postpartum depression between the two groups (adjusted risk difference (95%CI) 1.6 (-3.0-6.3%), p = 0.49). Similar results were obtained with per-protocol analysis (adjusted risk difference (95%CI) -1.0 (-8.3-6.3%), p = 0.79). We found no significant difference in the risk of postpartum depression between patients who received epidural labour analgesia and those who utilised non-epidural analgesic modalities.

39. Griffiths SK, Russell R, Broom MA, Devroe S, Van de Velde M, Lucas DN. **Intrathecal catheter placement after inadvertent dural puncture in the obstetric population: management for labour and operative delivery. Guidelines from the Obstetric Anaesthetists' Association.** Anaesthesia. 2024 Dec;79(12):1348-1368.

Background: Anaesthetists of all grades who work on a labour ward are likely to be involved in the insertion or management of an intrathecal catheter after inadvertent dural puncture at some point in their careers. Although the use of intrathecal catheters after inadvertent dural puncture in labour has increased in popularity over recent decades, robust evidence on best practice has been lacking. **Methods:** The Obstetric Anaesthetists' Association set up an expert working party to review the literature. A modified Delphi approach was used to produce statements and recommendations on insertion and management of intrathecal catheters for labour and operative delivery following inadvertent dural puncture during attempted labour epidural insertion. Statements and recommendations were graded according to the US Preventive Services Task Force grading methodology. **Results:** A total of 296 articles were identified in the initial literature search. Further screening identified 111 full text papers of relevance. A structured narrative review was produced which covered insertion of an intrathecal catheter; initial dosing; maintenance of labour analgesia; topping-up for operative delivery; safety features; complications; and recommended follow-up. The working party agreed on 17 statements and 26 recommendations. These were generally assigned a low or moderate level of certainty. The safety of mother and baby were a key priority in producing these guidelines. **Conclusions:** With careful management, intrathecal catheters can provide excellent labour analgesia and may also be topped-up to provide anaesthesia for caesarean or operative vaginal delivery. The use of intrathecal catheters, however, also carries the risk of significant drug errors which may result in high- or total-spinal anaesthesia, or even cardiorespiratory arrest. It is vital that all labour wards have clear guidelines on the use of these catheters, and that staff are educated as to their potential complications.

With an editorial by Binyamin Y, Orbach-Zinger S, and Heesen M. **Beyond the puncture: new guidelines for intrathecal catheter management in obstetric anesthesia.** International Journal of Obstetric Anesthesia Dec 10 2024;61():104311

40. Uppal V, Russell R, Sondekoppam RV, Ansari J, Baber Z, Chen Y, DelPizzo K, Dirzu DS, Kalagara H, Kissoon NR, Kranz PG, Leffert L, Lim G, Lobo C, Lucas DN, Moka E, Rodriguez SE, Sehmbi H, Vallejo MC, Volk T, Narouze S. **Evidence-based clinical practice guidelines on postdural puncture headache: a consensus report from a multisociety international working group.** Reg Anesth Pain Med. 2024 Jul 8;49(7):471-501.

Introduction: Postdural puncture headache (PDPH) can follow unintentional dural puncture during epidural techniques or intentional dural puncture during neuraxial procedures such as a lumbar puncture or spinal anesthesia. Evidence-based guidance on the prevention, diagnosis or management of this condition is, however, currently lacking. This multisociety guidance aims to fill this void and provide practitioners with comprehensive information and patient-centric recommendations to prevent, diagnose and manage patients with PDPH. **Methods**: Based on input from committee members and stakeholders, the committee cochairs developed 10 review questions deemed important for the prevention, diagnosis and management of PDPH. A literature search for each question was performed in MEDLINE (Ovid) on 2 March 2022. The results from each search were

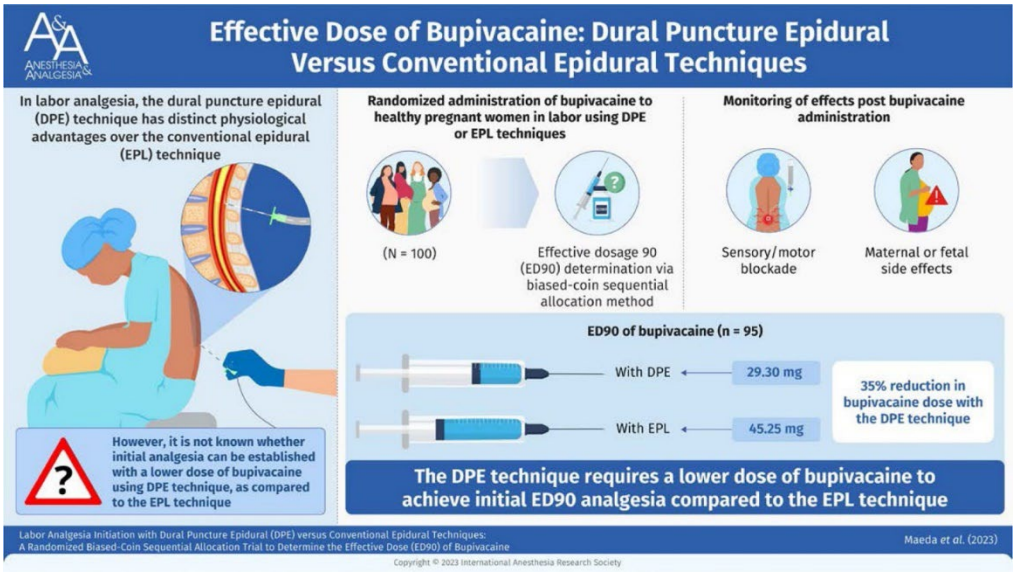
imported into separate Covidence projects for deduplication and screening, followed by data extraction. Additional relevant clinical trials, systematic reviews and research studies published through March 2022 were also considered for the development of guidelines and shared with contributors. Each group submitted a structured narrative review along with recommendations graded according to the US Preventative Services Task Force grading of evidence. The interim draft was shared electronically, with each collaborator requested to vote anonymously on each recommendation using two rounds of a modified Delphi approach. **Results**: Based on contemporary evidence and consensus, the multidisciplinary panel generated 50 recommendations to provide guidance regarding risk factors, prevention, diagnosis and management of PDPH, along with their strength and certainty of evidence. After two rounds of voting, we achieved a high level of consensus for all statements and recommendations. Several recommendations had moderate-to-low certainty of evidence. **Conclusions**: These clinical practice guidelines for PDPH provide a framework to improve identification, evaluation and delivery of evidence-based care by physicians performing neuraxial procedures to improve the quality of care and align with patients' interests. Uncertainty remains regarding best practice for the majority of management approaches for PDPH due to the paucity of evidence. Additionally, opportunities for future research are identified.

41. Frassanito L, Filetici N, Piersanti A, Vassalli F, Van De Velde M, Tsen LC, Zanfini BA, Catarci S, Ciancia M, Scorzoni M, Olivieri C, Draisci G. **Sacral sensory blockade from 27-gauge pencil-point dural puncture epidural analgesia or epidural analgesia in laboring nulliparous parturients: a randomized controlled trial.** Int J Obstet Anesth. 2024 Nov;60:104217.

    Background: The dural puncture epidural (DPE) technique has been associated with better sacral analgesia compared with a traditional epidural (EPL) technique in laboring parturients. The aim of this study was to investigate whether DPE with a 27-gauge pencil-point needle compared with a traditional EPL technique produces more rapid bilateral sacral blockade in nulliparous parturients. **Methods:** Patients were randomized to a DPE or EPL technique. Epidural analgesia in both groups was initiated with ropivacaine 0.1% and sufentanil 0.5 μg/mL (15 mL) and maintained via programmed intermittent epidural boluses. Analgesic blockade was tested bilaterally beginning 10 min after initiation, and then at predefined intervals until delivery. The presence of an S2 blockade at 20 min was the primary outcome. **Results:** Among 108 (54 per group) patients enrolled, bilateral sacral (S2) blockade at 20 min was significantly more common in the DPE than in the EPL group [47 (87%) vs. 23 (43%), absolute risk reduction (ARR) 44%, 95% CI 28 to 60; P < 0.001]. Time to a numeric pain rating scale score (0-10 scale) ≤ 3 (20 [20,30] min in both groups, HR 1.15, 95% CI 0.77 to 1.15; P = 0.50), number of rescue doses [0 (0, 1) vs 0 (0, 1); P 0.08], and presence of bilateral S2 blockade at delivery were not significantly different between groups. **Conclusions:** The DPE technique with a 27-gauge pencil-point spinal needle more often provides bilateral sacral blockade at 20 min following block initiation compared with the EPL technique. The time to adequate analgesia and need for supplemental analgesia did not appear to differ between techniques.

42. Maeda A, Villela-Franyutti D, Lumbreras-Marquez MI, Murthy A, Fields KG, Justice S, Tsen LC. **Labor Analgesia Initiation With Dural Puncture Epidural Versus Conventional Epidural Techniques: A Randomized Biased-Coin Sequential Allocation Trial to Determine the Effective Dose for 90% of Patients of Bupivacaine.** Anesth Analg. 2024 Jun 1;138(6):1205-1214.

Background: The dural puncture epidural (DPE) technique has a faster onset, better sacral spread, and improved bilateral coverage when compared to the conventional epidural (EPL) technique. Whether these qualities translate into a lower bupivacaine dose to provide initial analgesia is unknown. We sought to determine the effective dose of bupivacaine to achieve initial (first 30 minutes) labor analgesia in 90% of patients (ED90) with the DPE and EPL techniques, using a biased-coin, sequential allocation method. **Methods:** A total of 100 women of mixed parity with term, singleton gestation at ≤5 cm dilation with no major comorbidities were randomized to receive a DPE or an EPL technique. An experienced anesthesiologist performed these techniques and administered an allocated dose of plain bupivacaine diluted with isotonic sterile 0.9% saline to a total volume of 20 mL via the EPL catheter. Bupivacaine doses for each subject were determined by the response of the previous subject, using a biased-coin sequential allocation method, with success defined by a numeric rating scale (NRS) < 3 at 30 minutes. Outcome assessments were performed by an investigator blinded to the technique and bupivacaine dose. Sensory and motor blockade and maternal or fetal side effects were recorded every 5 minutes for the first 30 minutes. The ED90 of bupivacaine with each technique was estimated using centered isotonic regression. **Results:** A total of 95 women were included in the final analysis. The ED90 of bupivacaine was estimated at 29.30 mg (90% confidence interval [CI], 28.55-31.56) with a DPE technique and 45.25 mg (90% CI, 42.80-52.03) with an EPL technique. **Conclusions:** Using a biased-coin, sequential allocation method, the DPE technique requires less bupivacaine to achieve effective initial analgesia (ED90) when compared to the EPL technique.



43. Howle R, Ragbourne S, Zolger D, Owolabi A, Onwochei D, Desai N. **Influence of different volumes and frequency of programmed intermittent epidural bolus in labor on maternal and neonatal outcomes: A systematic review and network meta-analysis**. J Clin Anesth. 2024 May;93:111364.

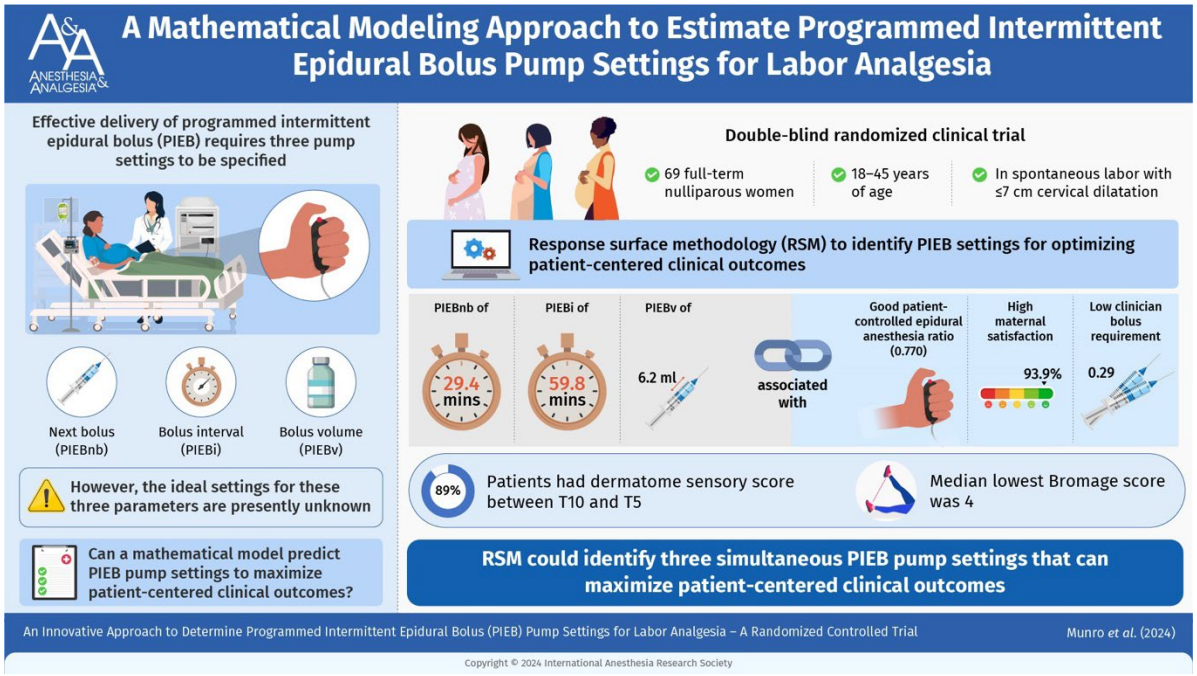
Study objective: In labor, programmed intermittent epidural bolus (PIEB) can be defined as the bolus administration of epidural solution at scheduled time intervals. Compared to continuous epidural infusion (CEI) with or without patient controlled epidural analgesia (PCEA), PIEB has been associated with decreased pain scores and need for rescue analgesia and increased maternal satisfaction. The optimal volume and dosing interval of PIEB, however, has still not been determined. **Design:** Systematic review and network meta-analysis registered with PROSPERO (CRD42022362708). **Settings:** Labor. **Patients:** Pregnant patients. **Interventions:** Central, CINAHL, Global Health, Ovid Embase, Ovid Medline and Web of Science were searched for randomized controlled trials that

examined pregnant patients in labor who received CEI or PIEB with or without a PCEA component. Network meta-analysis was performed with a frequentist method, facilitating the indirect comparison of PIEB with different volumes and dosing intervals through the common comparator of CEI and substituting or supplementing direct comparisons with these indirect ones. Continuous and dichotomous outcomes were presented as mean differences and odds ratios, respectively, with 95% confidence intervals. The risk of bias was evaluated using the Cochrane risk of bias 2 tool. **Main results:** Overall, 30 trials were included. For the first primary endpoint, need for rescue analgesia, PIEB delivered at a volume of 4 ml and frequency of 45 min (4/45) was inferior to PIEB 8/45 (OR 3.55; 95% CI 1.12-11.33), PIEB 10/60 was superior to PIEB 2.5/15 (OR 0.36; 95% CI 0.16-0.82), PIEB 4/45 (OR 0.14; 95% CI 0.03-0.71) and PIEB 5/60 (OR 0.23; 95% CI 0.08-0.70), and PIEB 5/30 was not inferior to PIEB 10/60 (OR 0.61; 95% CI 0.31-1.19). For the second primary endpoint, maternal satisfaction, no differences were present between the various PIEB regimens. The quality of evidence for these multiple primary endpoints was low owing to the presence of serious limitations and imprecision. Importantly, PIEB 5/30 decreased the pain score at 4 h compared to PIEB 2.5/15 (MD 2.45; 95% CI 0.13-4.76), PIEB 5/60 (MD -2.28; 95% CI -4.18--0.38) and PIEB 10/60 (MD 1.73; 95% CI 0.31-3.16). Mean ranking of interventions demonstrated PIEB 10/60 followed by PIEB 5/30 to be best placed to reduce the cumulative dose of local anesthetic, and this resulted in an improved incidence of lower limb motor blockade for PIEB 10/60 in comparison to CEI (OR 0.30; 95% CI 0.14-0.67). No differences in neonatal outcomes were found. Some concerns were present for the risk of bias in two thirds of trials and the risk of bias was shown to be high in the remaining one third of trials. **Conclusions:** Future research should focus on PIEB 5/30 and PIEB 10/60 and how the method of analgesia initiation, nature and concentration of local anesthetic, design of epidural catheter and rate of administration might influence outcomes related to the mother and neonate.

44. Munro A, George RB, Andreou P. **An Innovative Approach to Determine Programmed Intermittent Epidural Bolus Pump Settings for Labor Analgesia: A Randomized Controlled Trial.** Anesth Analg. 2024 Sep 1;139(3):545-554

BACKGROUND: Three settings are required on a programmed intermittent epidural bolus (PIEB) pump for labor analgesia: the PIEB next bolus (PIEBnb), PIEB interval (PIEBi), and PIEB volume (PIEBv). The ideal settings for these parameters are still unknown. We hypothesized a mathematical modeling tool, response surface methodology (RSM), could estimate 3 PIEB pump parameters while balancing 3 clinically important patient outcomes simultaneously. The study objective was to use RSM to estimate PIEB settings (PIEBnb, PIEBi, and PIEBv) while maximizing maternal satisfaction, minimizing the need for clinician-administered boluses, and optimizing the ratio of delivered/requested patient-controlled epidural analgesia (PCEA) boluses simultaneously. **METHODS:** With institutional ethics approval, a double-blind randomized trial was completed in a tertiary care labor and delivery center. Nulliparous, English-speaking American Society of Anesthesiologists (ASA) physical status II patients aged 18 to 45 years at full term, single gestation in vertex presentation, in spontaneous labor and ≤7 cm cervical dilation were included. Patients with comorbidities, contraindications to neuraxial analgesia, using chronic analgesics, <152 cm, or body mass index (BMI) >45 kg/m2 were excluded. After informed consent, labor analgesia was initiated using 10 mL ropivacaine 0.2% with 10 µg/mL fentanyl solution and PCEA (volume 6 mL every 10 minutes). Patients were randomized to predetermined PIEB settings. RSM identified 3 pump settings that represented a stationary point that best maximized or minimized 3 outcomes simultaneously: PCEA ratio (a ratio closest to 1), clinician bolus (optimal is 0), and maternal satisfaction (visual analog scale, 0–100, ideal response is ≥90). **RESULTS:** Of 287 potential

participants, 192 did not meet inclusion criteria or declined to participate, and 26 were withdrawn, leaving 69 patients for study inclusion. Using RSM, the suggested PIEB settings for all the primary study outcomes were as follows: PIEBnb = 29.4 minutes, PIEBi = 59.8 minutes, and PIEBv = 6.2 mL. These PIEB settings corresponded to the following clinical outcomes: maternal satisfaction at 93.9%, PCEA ratio at 0.77, and need for clinician bolus at 0.29. The dermatome sensory score was between T10 and T5 in 89% of the patients. The median lowest Bromage score was 4. **CONCLUSIONS:** This novel study used a mathematical model to estimate PIEB pump settings while simultaneously maximizing 3 clinical outcomes. Equally weighted clinical outcomes prevent maximal outcome optimization and may not reflect patient priorities. Future studies or quality improvement endeavors could use RSM methodology to estimate PIEB pump settings targeting optimal values for a single clinical outcome of determined importance to parturients.



45. Parameshwar P, Guo N, Bentley J, Main E, Singer SJ, Peden CJ, Morris T, Ansari J, Butwick AJ. **Variation in Hospital Neuraxial Labor Analgesia Rates in California.** Anesthesiology. 2024 Jun 1;140(6):1098-1110.

Background: Neuraxial analgesia provides effective pain relief during labor. However, it is unclear whether neuraxial analgesia prevalence differs across U.S. hospitals. The aim of this study was to assess hospital variation in neuraxial analgesia prevalence in California. **Methods:** A retrospective cross-sectional study analyzed birthing patients who underwent labor in 200 California hospitals from 2016 to 2020. The primary exposure was the delivery hospital. The outcomes were hospital neuraxial analgesia prevalence and between-hospital variability, before and after adjustment for patient and hospital factors. Median odds ratio and intraclass correlation coefficients quantified between-hospital variability. The median odds ratio estimated the odds of a patient receiving neuraxial analgesia when moving between hospitals. The intraclass correlation coefficients quantified the proportion of the total variance in neuraxial analgesia use due to variation between hospitals. **Results:** Among 1,510,750 patients who underwent labor, 1,040,483 (68.9%) received neuraxial

analgesia. Both unadjusted and adjusted hospital prevalence exhibited a skewed distribution characterized by a long left tail. The unadjusted and adjusted prevalences were 5.4% and 6.0% at the 1st percentile, 21.0% and 21.2% at the 5th percentile, 70.6% and 70.7% at the 50th percentile, 75.8% and 76.6% at the 95th percentile, and 75.9% and 78.6% at the 99th percentile, respectively. The adjusted median odds ratio (2.3; 95% CI, 2.1 to 2.5) indicated substantially increased odds of a patient receiving neuraxial analgesia if they moved from a hospital with a lower odds of neuraxial analgesia to one with higher odds. The hospital explained only a moderate portion of the overall variability in neuraxial analgesia (intraclass correlation coefficient, 19.1%; 95% CI, 18.8 to 20.5%). **Conclusions:** A long left tail in the distribution and wide variation exist in the neuraxial analgesia prevalence across California hospitals that is not explained by patient and hospital factors. Addressing the low prevalence among hospitals in the left tail requires exploration of the interplay between patient preferences, staffing availability, and care providers' attitudes toward neuraxial analgesia.

46. Benzon HT, Nelson AM, Patel AG, Chiang S, Agarwal D, Benzon HA, Rozental J, McCarthy RJ. **Literature review of spinal hematoma case reports: causes and outcomes in pediatric, obstetric, neuraxial and pain medicine cases.** Reg Anesth Pain Med. 2024 Dec 2;49(12):900-906.

    Background: The risk of spinal epidural hematoma (SEH) has been described in the literature but the impact in various patient populations has not been assessed in the same study. We identified the risk factors for SEH and calculated the OR for recovery in the pediatric, adult and obstetric (OB) patients based on the degree of neurological deficit before surgery. **Methods:** Adult non-OB cases were categorized whether they were on anticoagulants or not; SEH was related to neuraxial or pain procedure; or whether there was adherence to the American Society of Regional Anesthesia (ASRA) guidelines. Eligible cases were identified through PubMed and Embase searches in the English literature from 1954 to July 2022. **Results:** A total of 940 cases were evaluated. In the pediatric cases, SEH was typically spontaneous, related to coagulopathy or athletic trauma. OB cases were spontaneous or related to neuraxial injections. Among adults on anticoagulant(s), SEH was mostly spontaneous with no related etiology or related to neuraxial procedure. SEH occurred despite adherence to the ASRA guidelines. Among non-OB adults not on anticoagulants, SEH was due to trauma, neuraxial injections, surgery or other causes. Neurological recovery was related to the degree of neurological deficit before surgery. **Conclusions:** Our data show a preponderance of spontaneous SEH in all patient populations. SEH developed even though the ASRA guidelines were followed, especially in patients on multiple anticoagulants. Patients with less impairment prior to surgery had a higher likelihood of complete recovery, regardless of the interval between surgery and onset of symptoms.

47. Cornet MC, Kuzniewicz MW, Scheffler AW, Gaw SL, Yeh P, Newman TB, Wu YW. **Epidural Analgesia During Labor and Neonatal Hypoxic-Ischemic Encephalopathy.** JAMA Netw Open. 2024 Sep 3;7(9):e2433730.

    Importance: Epidural analgesia is used by approximately 70% of birthing persons in the US to alleviate labor pain and is a common cause of elevated temperature in the birthing parent during labor, which, in turn, is associated with adverse neonatal outcomes such as hypoxic-ischemic encephalopathy (HIE). **Objective:** To determine whether epidural analgesia is associated with increased risk of HIE after adjusting for the birthing person's maximal temperature before epidural placement and for the propensity to get an epidural. **Design, setting, and participants:** This

retrospective, population-based cohort study was conducted at 15 Kaiser Permanente Northern California hospitals. Participants included singleton neonates born at 35 weeks' or later gestational age between 2012 and 2019. Elective cesarean deliveries and deliveries within 2 hours of hospital admission were excluded. Data analysis was performed from November 2022 to June 2024. **Exposure:** The primary exposure was epidural analgesia during labor. **Main outcomes and measures:** The primary outcome was HIE, defined as the presence of both neonatal acidosis (ie, pH <7 or base deficit ≥10) and encephalopathy. The presence and timing of epidural analgesia and demographic, pregnancy, and labor characteristics were extracted from electronic medical records. A propensity score for receiving epidural analgesia was created including demographic variables and comorbidities predating epidural placement. Logistic regression was used to evaluate the association between epidural analgesia and HIE, adjusting for maximal birthing parent's temperature before epidural placement and the propensity for receiving an epidural. **Results:** Among 233 056 infants born at 35 weeks' or later gestational age by vaginal or unplanned cesarean delivery after at least 2 hours of in-hospital labor, 177 603 (76%) were exposed to epidural analgesia and 439 (0.19%) had HIE. On unadjusted analysis, epidural analgesia was associated with an increased risk of maximal temperature greater than 38 °C during labor (risk ratio [RR], 8.58; 95% CI, 8.06-9.14). Each degree increase in maximal temperature during labor was associated with nearly triple the odds of HIE (odds ratio [OR], 2.82; 95% CI, 2.51-3.17). However, there was no significant association between epidural analgesia and the risk of HIE either on crude (RR, 1.21; 95% CI, 0.96-1.53) or adjusted (adjusted OR, 0.93; 95% CI, 0.73-1.17) analyses. **Conclusions and relevance:** In this cohort study including more than 230 000 parent-infant dyads, epidural analgesia was associated with increased maximal temperature during labor, a known risk factor for HIE. However, epidural analgesia was not associated with increased odds of HIE.

48. McGarrigle C, Hartigan S, Duffy O, Tan T. **Perspectives on sustainable practices in the use of nitrous oxide for labour analgesia: A patient and staff survey.** Eur J Anaesthesiol. 2024 Jul 1;41(7):473-479.

Background: Climate change has emerged as the single biggest global health threat of the twenty-first century. Nitrous oxide accounts for the largest carbon footprint amongst our use of anaesthetic gas. It is a potent greenhouse gas possessing a global warming potential of approximately 265 times that of carbon dioxide. Despite recent curtailment of its use, it remains extensively employed as an analgesic for women in labour. **Objectives:** Assessment of the opinions of post-natal women and staff on nitrous oxide use and to investigate whether knowledge of its environmental harm would influence their choice of labour analgesia. **Design:** Postnatal women and healthcare staff were invited to participate in a survey of nitrous oxide use as a labour analgesic and knowledge of its effect of the environment. **Setting:** A single-centre study in a major obstetric tertiary referral centre in Ireland in 2021. **Main outcome measures:** To evaluate the awareness and perceptions of postnatal women and staff regarding the environmental impact of nitrous oxide and if it would affect their decision to use it in the future. **Results:** One hundred postnatal women and 50 healthcare staff completed the survey. One hundred and six post-natal women were invited to complete the survey, resulting in a response rate of 94%. Knowledge of nitrous oxide's environmental impact was low. After receiving information, 46% of patients were more inclined to seek epidural or request it earlier (54%) to limit their nitrous oxide use, while 51% would choose an alternative analgesia to avoid nitrous oxide altogether. Overwhelmingly, 99% believed they had the right to know about these harmful effects when choosing an analgesic option. **Conclusions:** Patients should be informed of the environmental impact of

nitrous oxide antenatally, empowering them to make informed decision on a climate friendly analgesic option if they wish.

49. Sharpe EE, Warner LL, Brakke BD, Davis PR, Finkel DM, Burkle CM, Hanson AC, Pompeian RJ, Arendt KW, Butler Tobah YS, Sviggum HP. **Impact of nitrous oxide use on parturient recall of neuraxial analgesia risks.** J Clin Anesth. 2024 Nov;98:111579.

Study objective: Nitrous oxide affects memory and recall. We aimed to determine if using nitrous oxide during labor affected patients' ability to learn and recall the risks and benefits of neuraxial analgesia. **Design:** Single-center, prospective cohort study. **Setting:** Labor and delivery unit in a large academic medical center. **Patients:** Nulliparous patients with spontaneous or planned induction of labor. **Interventions:** Parturients chose whether to use nitrous oxide during labor. At the discussion for epidural consent, 4 risks were described: headache, infection, nerve damage, bleeding. **Measurements:** Labor pain score, time from nitrous oxide discontinuation, and cervical dilation were documented at the discussion of epidural risks. Patients were assessed for unprompted recall and prompted recall of epidural risks on postpartum day 1 and unprompted recall at postpartum week 6. The number and proportion of patients who indicated each true risk (unprompted and prompted recall) or distractor (prompted recall only) were summarized by treatment group and results compared using Pearson $\chi 2$ tests. **Main results:** Of the 403 enrolled patients, 294 (73%) did not use nitrous oxide, and 109 (27%) did. The 2 groups were similar except women who used nitrous oxide were more likely to be cared for by midwives and had higher pain scores at their epidural request. Scores for unprompted or prompted recall of epidural risks were not different between women who received or did not receive nitrous oxide. All 4 risks were recalled unprompted by only 3% in the nitrous oxide group and by 6% in the group not receiving nitrous oxide ($P = .18$). **Conclusions:** The use of nitrous oxide for labor analgesia does not adversely influence a parturient's ability to recall the risks of epidural placement. Patients who receive nitrous oxide for labor analgesia should be considered eligible to provide consent for subsequent procedures.

Cesarean Delivery

50. Ansari JR, Yarmosh A, Michel G, Lyell D, Hedlin H, Cornfield DN, Carvalho B, Bateman BT. **Intravenous Calcium to Decrease Blood Loss During Intrapartum Cesarean Delivery: A Randomized Controlled Trial.** Obstet Gynecol. 2024 Jan 1;143(1):104-112.

Objective: To evaluate whether prophylactic administration of 1 g of intravenous calcium chloride after cord clamping reduces blood loss from uterine atony during intrapartum cesarean delivery. **Methods:** This single-center, block-randomized, placebo-controlled, double-blind superiority trial compared the effects of 1 g intravenous calcium chloride with those of saline placebo control on blood loss at cesarean delivery. Parturients at 34 or more weeks of gestation requiring intrapartum cesarean delivery after oxytocin exposure in labor were enrolled. Calcium or saline placebo was infused over 10 minutes beginning 1 minute after umbilical cord clamping in addition to standard care with oxytocin. The primary outcome was quantitative blood loss, analyzed by inverse Gaussian regression. Planned subgroup analysis excluded nonatonic bleeding, such as hysterotomy extension, arterial bleeding, and occult placenta accreta. We planned to enroll 120 patients to show a 200-mL reduction in quantitative blood loss in planned subgroup analysis, assuming up to 40% incidence of

nonatonic bleeding (80% power, α<0.05). **Results:** From April 2022 through March 2023, 828 laboring parturients provided consent and 120 participants were enrolled. Median blood loss was 840 mL in patients allocated to calcium chloride (n=60) and 1,051 mL in patients allocated to placebo (n=60), which was not statistically different (mean reduction 211 mL, 95% CI -33 to 410). In the planned subgroup analysis (n=39 calcium and n=40 placebo), excluding cases of surgeon-documented nonatonic bleeding, calcium reduced quantitative blood loss by 356 mL (95% CI 159-515). Rates of reported side effects were similar between the two groups (38% calcium vs 42% placebo). **Conclusion:** Prophylactic intravenous calcium chloride administered during intrapartum cesarean delivery after umbilical cord clamping did not significantly reduce blood loss in the primary analysis. However, in the planned subgroup analysis, calcium infusion significantly reduced blood loss by approximately 350 mL. These data suggest that this inexpensive and shelf-stable medication warrants future study as a novel treatment strategy to decrease postpartum hemorrhage, the leading global cause of maternal morbidity and mortality.

51. Cole NM, Kim JJ, Lumbreras-Marquez MI, Fields KG, Mendez-Pino L, Farber MK, Carusi DA, Toledo P, Bateman BT. **Second-Line Uterotonics for Uterine Atony: A Randomized Controlled Trial**. Obstet Gynecol. 2024 Dec 1;144(6):832-841.

    Objective: To evaluate the comparative efficacy of two of the most commonly used second-line uterotonics-methylergonovine maleate and carboprost tromethamine. **Methods:** We conducted a double-blind randomized trial at two large academic perinatal centers in patients undergoing nonemergency cesarean delivery with uterine atony refractory to oxytocin, as diagnosed by the operating obstetrician. The intervention included administration of a single dose of intramuscular methylergonovine or carboprost intraoperatively at diagnosis. The primary outcome, uterine tone on a 0-10 numeric rating scale 10 minutes after study drug administration, was rated by operating obstetricians blinded to the drug administered. Secondary outcomes included uterine tone score at 5 minutes, administration of additional uterotonic agents, other interventions for uterine atony or hemorrhage, quantitative blood loss, urine output, postpartum change in serum hematocrit, transfusion, length of hospital stay, adverse drug or transfusion reactions, and postpartum hemorrhage complications. A sample size of 50 participants per group was planned to detect a 1-point difference (with estimated within-group SD of 1.5) in the mean primary outcome with 80% power at a two-sided α level of 0.05 while accounting for potential protocol violations. **Results:** A total of 1,040 participants were enrolled, with 100 randomized to receive one of the study interventions. Mean±SD 10-minute uterine tone scores were 7.3±1.7 after methylergonovine and 7.6±2.1 after carboprost, with an adjusted difference in means of -0.1 (95% CI, -0.8 to 0.6, P =.76). Additional second-line uterotonics were required in 30.0% of the methylergonovine arm and 34.0% in the carboprost arm (adjusted odds ratio 0.72, 95% CI, 0.27-1.89, P =.505), and geometric mean quantitative blood loss was 756 mL (95% CI, 636-898) and 708 mL (95% CI, 619-810) (adjusted ratio of geometric means 1.06, 95% CI, 0.86-1.31, P =.588), respectively. No differences were detected in the occurrence of other interventions for uterine atony or postpartum hemorrhage. **Conclusion:** No difference was detected in uterine tone scores 10 minutes after administration of either methylergonovine or carboprost for refractory uterine atony, indicating that either agent is acceptable.

52. Boonstra L, Carvalho JCA, Turner W, Downey K, Ye XY, Thomas J, Balki M. **Maintenance infusion rate of oxytocin after initial 1-IU bolus for elective Cesarean delivery: a dose-finding study**. Can J Anaesth. 2024 Oct;71(10):1363-1371. English.

Purpose: The purpose of our study was to determine the minimum effective dose of oxytocin maintenance infusion required to maintain adequate uterine tone in 90% of patients (ED90) after administration of the initial bolus at elective Cesarean delivery (CD) under spinal anesthesia. **Methods:** We conducted a prospective, double-blind dose-finding study with biased coin up-down design. Immediately after delivery, a 1-IU oxytocin bolus was administered, followed by a maintenance infusion. The obstetrician assessed the uterine tone by palpation as satisfactory or unsatisfactory. In case of unsatisfactory response, the dose for the next patient was increased by 2 IU·hr-1. For satisfactory response, the dose for the next patient was either decreased by 2 IU·hr-1 with a probability of 1/9, or remained unchanged. The primary outcome was a satisfactory uterine tone from five minutes after delivery until discharge from postanesthesia care unit. The secondary outcomes were blood loss, need for additional uterotonics, and side effects. **Results:** We analyzed data for 40 patients. The ED90 of oxytocin maintenance infusion was 4.5 IU·hr-1 (95% confidence interval, 3.3 to 5.5) based on the isotonic regression estimator. The median [interquartile range] blood loss was 861 [553-1,181] mL; 18% received additional uterotonics, and 38% developed hypotension post delivery. **Conclusion:** Based on the results of this dose-finding study, we recommend a maintenance infusion rate of 4.5 IU·hr-1 following an oxytocin bolus of 1 IU for adequate uterine tone in pregnant patients undergoing elective CDs. This infusion rate is four-fold lower than that required without an initial bolus.

With an editorial by Sharpe EE and Sviggum HP. **Oxytocin protocols during Cesarean delivery: optimizing the tone zone.** Canadian Journal of Anaesthesia Sep 19 2024;19():19

53. Peska E, Balki M, Pfeifer W, Maxwell C, Ye XY, Downey K, Carvalho JCA. **Oxytocin at Elective Cesarean Delivery: A Dose-Finding Study in Pregnant People With Twin Pregnancy**. Anesth Analg. 2024 Apr 1;138(4):814-820.

Background: Multiple pregnancy is associated with higher risk of uterine atony, postpartum hemorrhage (PPH), blood transfusion, hysterectomy, and death. The optimal dose of oxytocin at cesarean delivery in people with twin pregnancy is unknown. We sought to determine the effective bolus dose of oxytocin required to initiate adequate uterine tone in 90% of people (ED90) with twin pregnancy undergoing elective cesarean delivery. Our hypothesis was that the dose of oxytocin would be higher than 0.5 international units (IU) but lower than 5 IU. **Methods:** A double-blind dose-finding study using the biased coin up-down method was undertaken in people with twin pregnancy ≥36 weeks gestational age undergoing elective cesarean delivery under neuraxial anesthesia. Those with additional risk factors for PPH, apart from twin pregnancy, were excluded. Oxytocin was administered as an intravenous bolus over 1 minute on delivery of the second fetus. The first patient received 0.5 IU, and subsequent oxytocin doses were administered according to a sequential allocation scheme. The actual doses administered were 0.5, 1, 2, 3, 4, and 5 IU of oxytocin. The primary outcome was the response defined as the satisfactory uterine tone at 2 minutes after completion of administration of the oxytocin bolus, as assessed by the operating obstetrician. Secondary outcomes included need for rescue uterotonic drugs, adverse effects, and estimated blood loss. The ED90 was estimated using the Dixon-Mood and the isotonic regression methods. **Results:** Thirty patients were included in study. The estimated ED90 of oxytocin was 4.38 IU (95% confidence interval [CI], 3.68-4.86 IU) and 3.41 IU (95% CI, 2.83-3.98 IU) by the isotonic regression and Dixon-Mood methods, respectively. Seven patients had inadequate tone at the 2-minute evaluation point and required rescue uterotonic drugs. The median (interquartile range [IQR]) estimated blood loss was 1031 mL (732-1462 mL) calculated by

the change in 24-hour hematocrit. Incidence of hypotension after oxytocin administration was 27%, nausea 30%, and vomiting 17%. **Conclusions:** Our results demonstrated that people with twin pregnancy require a much higher dose of oxytocin than those with singleton pregnancies. We recommended people with twin pregnancies should receive an initial 5 IU bolus over at least 1 minute when undergoing elective cesarean delivery under neuraxial anesthesia.

54. Tyagi A, Nigam C, Malhotra RK, Bodh P, Deep S, Singla A. **The minimum effective dose (ED90) of prophylactic oxytocin infusion during cesarean delivery in patients with and without obesity: an up-down sequential allocation dose-response study**. Int J Obstet Anesth. 2024 Feb;57:103962.

Background: Obesity is associated with greater oxytocin requirement during labor induction or augmentation. There are scant data exploring the intra-operative requirement during cesarean delivery in patients with obesity, and none comparing it with those without obesity. We evaluated the minimum effective dose (ED90) of an oxytocin infusion to achieve adequate uterine tone during cesarean delivery in patients with and without obesity. **Methods:** Patients (body mass index ≥30 kg/m2 represented patients with obesity) undergoing cesarean delivery using subarachnoid block were included. This prospective dual-arm dose-finding study used a 9:1 biased sequential allocation design. Oxytocin infusion was initiated at 13 IU/h at cord clamping in the first patient of each group. Uterine tone was graded as satisfactory or unsatisfactory by the obstetrician four minutes after initiation of the infusion. The dose of oxytocin infusion for subsequent patients was determined according to the response of the previous patient in the group. Oxytocin-associated side effects were evaluated. Dose-response data for the groups was evaluated using log-logistic function and ED90 estimates derived from fitted equations using the delta method. **Results:** The ED90 of oxytocin was significantly higher for patients with obesity (n = 40) compared with those without obesity (n = 40) [25.7 IU/h, 95% CI 18.6 to 32.9) vs. 16.6 IU/h, 95% CI 14.9 to 18.3)]; relative ratio 1.55 [95% CI 1.09 to 2.01] (P = 0.019). **Conclusions:** Patients with obesity require a higher intra-operative oxytocin infusion dose rate to achieve a satisfactorily contracted uterus after fetal delivery when compared with patients without obesity.

55. Girnius A, Snyder C, Czarny H, Minges T, Stacey M, Supinski T, Crowe J, Strong J, Josephs SA, Zafar MA. **Preoperative Multidisciplinary Team Huddle Improves Communication and Safety for Unscheduled Cesarean Deliveries: A System Redesign Using Improvement Science**. Anesth Analg. 2024 Dec 1;139(6):1199-1209.

Background: Optimal communication between care teams is a critical component in providing safe, timely, and appropriate patient care. Labor and delivery (L&D) units experience rapidly changing clinical scenarios often requiring escalation in care and unplanned cesarean deliveries (CDs). The University of Cincinnati Medical Center (UCMC) is a 550-bed academic level 4 maternal care center with a 13-bed L&D unit in Cincinnati, OH. There are approximately 2500 deliveries/y with a CD rate of 33%. The L&D unit is staffed with dedicated anesthesia personnel 24 hours a day. In our L&D unit, there was widespread dissatisfaction with multidisciplinary communication surrounding unscheduled CD. Near-miss safety events in our obstetric unit were attributed to preoperative communication failures. Initial surveys identified challenges in preoperative communication among nursing, anesthesiology, and obstetric teams leading to potential risk for compromised care. **Method:** Using the UC Health Performance Improvement Way, we first sought to understand the process leading up to unscheduled CD. Change ideas were developed based on observed failures in communication.

Interventions were tested and refined through iterative plan-do-study-act (PDSA) cycles. One key intervention was the introduction of a bedside, multidisciplinary, patient-centered, pre-CD huddle attended by nursing, anesthesia, and obstetrics representatives using a standard checklist for critical information. Qualitative patient feedback was elicited to inform change efforts. We compared patient and procedure characteristics from the baseline and huddle implementation phases. **Measures:** Our primary outcome measure was the satisfaction of care team members with communication around unscheduled CD. A secondary outcome was the general anesthesia (GA) rate for unscheduled CD. Our key process measure was adherence to the preoperative huddle. We tracked decision-to-incision interval (DTI) as a balancing measure. **Results:** Huddle adherence reached 96% for unscheduled CD within 6 months of testing and implementation. A combined survey of anesthesia, nursing, and obstetrics showed that satisfaction scores related to unscheduled CD communication improved from 3.3/5 to 4.7/5 after huddle implementation. The rate of GA use and the median DTI remained unchanged. Patients felt more engaged and reported positive experiences by being a part of the huddle discussion. **Conclusions:** In an academic obstetric unit, communication failures surrounding unscheduled CD were identified as a contributor to staff dissatisfaction and perception of safety risk. Implementation of a bedside multidisciplinary pre-CD huddle improved communication between teams and contributed to creating a culture of safety without causing significant delays in care.

56. Tan HS, Fuller ME, Barney EZ, Diomede OI, Landreth RA, Pham T, Rubright SM, Ernst L, Habib AS. **The 90% effective dose of intrathecal hyperbaric bupivacaine for Cesarean delivery under combined spinal-epidural anesthesia in parturients with super obesity: an up-down sequential allocation study.** Can J Anaesth. 2024 May;71(5):570-578.

Purpose: To determine the 90% effective dose (ED90) of intrathecal hyperbaric bupivacaine for Cesarean delivery under combined spinal-epidural anesthesia (CSE) in parturients with super obesity (body mass index [BMI] ≥ 50 kg·m-2). **Methods:** We enrolled parturients with BMI ≥ 50 kg·m-2 with term, singleton vertex pregnancies undergoing elective Cesarean delivery under CSE. An independent statistician generated the 0.75% hyperbaric bupivacaine dosing regimen in increments of 0.75 mg using a biased-coin up-down sequential allocation technique. This was combined with 15 µg fentanyl, 150 µg morphine, and normal saline to a volume of 2.05 mL. The initial and maximum doses were 9.75 mg and 12 mg, respectively. Participants, clinical team, and outcome assessors were blinded to the dose. The primary outcome was block success, defined as T6 block to pinprick within ten minutes and no intraoperative analgesic supplementation within 90 min of spinal injection. We determined the ED90 using logistic regression. **Results:** We enrolled 45 parturients and included 42 in the analysis. All doses achieved a T6 level within ten minutes, and the primary outcome occurred in 0/1 (0%) of the 9.75-mg doses, 2/3 (67%) of the 10.5-mg doses, 21/27 (78%) of the 11.25-mg doses, and 11/11 (100%) of the 12-mg doses. The ED90 of hyperbaric bupivacaine was 11.56 mg (95% confidence interval, 11.16 to 11.99). Four parturients (9.5%) had sensory level higher than T2, but none was symptomatic or required general anesthesia. **Conclusion:** The estimated ED90 of hyperbaric bupivacaine with fentanyl and morphine in parturients with super obesity undergoing Cesarean delivery under CSE was approximately 11.5 mg.

57. Jin SY, Munro A, Aidemouni M, McKeen DM, Uppal V. **The Incidence and Predictors of Failed Spinal Anesthesia After Intrathecal Injection of Local Anesthetic for Cesarean Delivery: A Single-Center, 9-Year Retrospective Review**. Anesth Analg. 2024 Feb 1;138(2):430-437.

Background: The incidence of failed spinal anesthesia varies widely in the obstetric literature. Although many risk factors have been suggested, their relative predictive value is unknown. The primary objective of this retrospective cohort study was to determine the incidence of failed spinal anesthesia for cesarean deliveries at a tertiary care obstetric hospital, and its secondary objectives were to identify predictors of failed spinal anesthesia in the obstetrics population and quantify their relative importance in a predictive model for failure. **Methods:** With local institutional ethics committee approval, a retrospective review of our hospital database identified the incidence of failed spinal anesthesia for 5361 cesarean deliveries between 2010 and 2019. We performed a multivariable analysis to assess the association of predictors with failure and a dominance analysis to assess the importance of each predictor. **Results:** The incidence of failed spinal anesthesia requiring an alternative anesthetic was 2.1%, with conversion to general anesthesia occurring in 0.7% of surgeries. Supplemental analgesia or sedation was provided to an additional 2.0% of women. The most important predictors of a failed spinal anesthetic were previous cesarean delivery (odds ratio [OR], 11.33; 95% confidence interval [CI], 7.09-18.20; P < .001), concomitant tubal ligation (OR, 8.23; 95% CI, 3.12-19.20; P < .001), lower body mass index (BMI) (kg·m -2 , OR, 0.94; 95% CI, 0.90-0.98; P = .005), and longer surgery duration (minutes, OR, 1.02; 95% CI, 1.01-1.03; P = .006). Previous cesarean delivery was the most significant risk factor, contributing to 9.6% of the total 17% variance predicted by all predictors examined. **Conclusions:** Spinal anesthesia failed to provide a pain-free surgery in 4.1% of our cesarean deliveries. Previous cesarean delivery was the most important predictor of spinal failure. Other important predictors included tubal ligation, lower BMI, and longer surgery duration.

58. Xu Y, Shou Y, Li Y, Chen D, Wen Y, Huang X, Li Y. **Virtual reality treatment could reduce anxiety for women undergoing cesarean section with spinal anesthesia: a randomized controlled trial**. Arch Gynecol Obstet. 2024 Sep;310(3):1509-1516.

Purpose: Cesarean section may result in adverse psychosocial and behavioral outcomes because women put considerable emphasis on the process of birth. Virtual reality treatment has been shown by many studies to reduce anxiety and improve patient satisfaction. Therefore, we designed a randomized controlled trial to investigate whether the application of virtual reality technology during cesarean section can reduce maternal anxiety and improve satisfaction. **Methods:** We recruited 128 women undergoing elective cesarean delivery with proposed spinal anesthesia and randomly assigned them to either virtual reality or routine care. The virtual reality intervention was a virtual reality program tailored specifically for women undergoing cesarean section. Primary outcome was the change in anxiety score (change = preoperative-intraoperative score). Secondary outcomes included patient satisfaction score, requirement of intraoperative sedative and analgesic drugs, and respiratory rate. **Results:** The change in anxiety score in the virtual reality group was significantly higher than that in the routine care group (30 [20, 47.5] vs 10 [- 10, 23.8], respectively; P < 0.001, with Hodges-Lehmann median difference estimate of 20 (95% confidence interval CI, 15-30)). There were no significant differences between the two groups in patient satisfaction scores, the requirement of intraoperative sedative and analgesic drugs, and respiratory rate and side effects. **Conclusion:** Virtual reality treatment could reduce the anxiety of women undergoing elective cesarean section, which is beneficial to the mother and baby.

59. Jiang A, Perry T, Walker K, Burfoot A, Patterson L. **Surgical sensation during caesarean section: a qualitative analysis**. Int J Obstet Anesth. 2024 Feb;57:103935.

Background: Caesarean section (CS) is a major abdominal surgery performed usually on a young and healthy population under neuraxial anesthesia with little to no sedation. This creates a distinct surgical experience whereby patients are aware of the surgical process, physical sensations, and their environment. This study aimed to provide an in-depth descriptive assessment of subjective surgical experience during CS under regional anaesthesia. We expected the information gained would enhance our current understanding and better alleviate patient anxiety through informed counselling. **Methods:** This qualitative descriptive study was conducted at a Canadian academic centre. Twenty patients participated in semi-structured interviews within a week of CS, using an interview guide developed for this study. Patient medical records were reviewed to collect demographic and surgical information. Thematic analysis was conducted using an inductive approach to determine common themes. **Results:** Nine themes were identified. Five themes were identified in the category of surgical sensation and four themes were identified in the category of peri-operative education. **Conclusions:** Patients commonly experienced pressure and movement sensations at varying intensity, and most did not experience pain. Environmental factors, including sounds and distraction by the newborn, affected perception of surgical sensation. Patients wish to receive pre-operative counselling regarding potential surgical sensations, as well as ongoing communication from their anaesthesiologist. These results can be used to guide informed discussions with patients and direct further investigation in this area.

60. Sanchez J, Prabhu R, Guglielminotti J, Landau R. **Pain during cesarean delivery: A patient-related prospective observational study assessing the incidence and risk factors for intraoperative pain and intravenous medication administration.** Anaesth Crit Care Pain Med. 2024 Feb;43(1):101310.

Introduction: The incidence of pain during cesarean delivery (PDCD) remains unclear. Most studies evaluated PDCD using interventions suggesting inadequate analgesia: neuraxial replacement, unplanned intravenous medication (IVM), or conversion to general anesthesia. Few assess self-reported pain. This study evaluates the incidence of and risk factors for self-reported PDCD and IVM administration. **Methods:** Between May and September 2022, English-speaking women undergoing cesarean delivery under neuraxial anesthesia were approached within the first 48 h. Participants answered a 16-question survey about intraoperative anesthesia care. Clinical characteristics were extracted from electronic medical records. The primary outcome was PDCD. Secondary outcomes were analgesic IVM (opioids alone or in combination with ketamine, midazolam, or dexmedetomidine) and conversion to general anesthesia. Risk factors for PDCD and analgesic IVM were identified using multivariable logistic regression models. **Results:** Pain was reported by 46/399 (11.5%; 95% CI: 8.6, 15.1) participants. Analgesic IVM was administered to 16 (34.8%) women with PDCD and 45 (12.6%) without. Conversion to general anesthesia occurred in 3 (6.5%) women with and 4 (1.1%) without PDCD. Risk factors associated with PDCD were substance use disorder and intrapartum epidural extension. Risk factors associated with analgesic IVM were PDCD, intrapartum epidural extension when ≥2 epidural top-ups were given for labor analgesia, and longer surgical duration. **Discussion:** In our cohort of scheduled and unplanned cesarean deliveries, the incidence of PDCD was 11.5%. A significant proportion of women (15.1%) received analgesic IVM, of which some but not all reported pain, which requires further evaluation to identify triggers for IVM administration and strategies optimizing shared decision-making.

61. Sanchez J, Prabhu R, Guglielminotti J, Landau R. **Racial and Ethnic Concordance Between the Patient and Anesthesia Team and Patients' Satisfaction With Pain Management During Cesarean Delivery.** Anesth Analg. 2024 Nov 1;139(5):921-930.

Background: Racial and ethnic concordance between patients and health care providers increases patient satisfaction but has not been examined in obstetric anesthesia care. This study evaluated the association between racial and ethnic concordance and satisfaction with management of pain during cesarean delivery (PDCD). **Methods:** This was a secondary analysis on a cohort of patients undergoing cesarean deliveries under neuraxial anesthesia that examined PDCD. The outcome was satisfaction, recorded within 48 hours after delivery using the survey question, "Overall, how satisfied are you with the anesthesia care during the C-section as it relates to pain management?" Using a 5-point Likert scale, satisfaction was defined with the answer "very satisfied." Participants were also asked, "If you have another C-section, would you want the same anesthesia team?" The exposure was racial and ethnic concordance between the patient and anesthesia team members (attending with a resident, nurse anesthetist, or fellow) categorized into full concordance, partial concordance, discordance, and missing. Risk factors for satisfaction were identified using a multivariable analysis. **Results:** Among 403 participants, 305 (78.2%; 95% confidence interval [CI], 73.8-82.1) were "very satisfied," and 358 of 399 (89.7%; 95% CI, 86.3-92.5) "would want the same anesthesia team." Full concordance occurred in 18 (4.5%) cases, partial concordance in 117 (29.0%), discordance in 175 (43.4%), and missing in 93 (23.1%). Satisfaction rate was 88.9% for full concordance, 71.8% for partial concordance, 81.1% for discordance, and 78.5% for missing (P value = .202). In the multivariable analysis, there was insufficient evidence for an association of concordance with satisfaction. Compared to full concordance, partial concordance was associated with a nonsignificant 57% (95% CI, -113 to 91) decrease in the odds of being satisfied, discordance with a 29% (95% CI, -251 to 85) decrease, and missing with a 39% (95% CI, -210 to 88) decrease. Risk factors for not being "very satisfied" were PDCD, anxiety disorders, pregnancy resulting from in vitro fertilization, intravenous medication administration, intrapartum cesarean with extension of labor epidural, having 3 anesthesia team members (instead of 2), and a higher intraoperative blood loss. **Conclusions:** Our inability to identify an association between concordance and satisfaction is likely due to the high satisfaction rate in our cohort (78.2%), combined with low proportion of full concordance (4.5%). Addressing elements such as PDCD, anxiety, intravenous medication administration, and use of epidural anesthesia for cesarean delivery, and a better understanding of the interplay between concordance and satisfaction are warranted.

62. Stav MY, Fein S, Matatov Y, Hoffman D, Heesen P, Binyamin Y, Iluz-Freundlich D, Eidelman L, Orbach-Zinger S. **Conversion to general anesthesia and intravenous supplementation during intrapartum cesarean delivery with an indwelling epidural catheter: a retrospective study.** Reg Anesth Pain Med. 2024 Jul 14:rapm-2024-105388.

Background: Intraoperative pain during cesarean delivery with or without conversion to general anesthesia has been shown to negatively impact maternal and perinatal morbidity. Efforts to reduce these adverse events are a recent focus of obstetric anesthesia care. We aimed to assess rates of and risk factors for conversion to general anesthesia and intraoperative pain during intrapartum cesarean delivery with an indwelling epidural catheter in our academic center. **Methods:** In this retrospective cohort study, all women undergoing cesarean delivery with an indwelling epidural catheter between January 2017 and June 2022 were included. Labor epidural analgesia was provided according to a

standardized protocol, and conversion to epidural anesthesia was achieved in the operating room before surgery. We determined the conversion rate to general anesthesia and associated risk factors. Second, we examined the rate of administration of analgesics/sedatives and related risk factors in cesarean cases that were not converted to general anesthesia. **Results:** Among the 1192 women undergoing intrapartum cesarean delivery with epidural anesthesia, there were 97 cases with conversion to general anesthesia (8.1%), of which 87 (89.7%) were due to a failed epidural. Higher age, higher weight, and higher gestational age were associated with decreased odds of conversion to general anesthesia. Higher gravidity and longer surgical time were associated with increased odds. An emergent indication was not associated with conversion to general anesthesia. Intravenous analgesic/sedative supplementation occurred in 141 cases (12.9%). Higher age was associated with decreased odds of supplementation, and longer surgical time was associated with increased odds. **Conclusion:** In our tertiary academic center, the rate of intraoperative conversion to general anesthesia and administration of analgesic/sedative medication among women undergoing intrapartum cesarean delivery with epidural anesthesia was relatively high. Emergency cesarean delivery was not associated with either of the above endpoints.

63. Harnett C, Connors J, Kelly S, Tan T, Howle R. **Evaluation of the 'Sip Til Send' regimen before elective caesarean delivery using bedside gastric ultrasound: A paired cohort pragmatic study**. Eur J Anaesthesiol. 2024 Feb 1;41(2):129-135.

Background: Pre-operative fasting is routinely advocated to avoid pulmonary aspiration. The European Society of Anaesthesiology and Intensive Care (ESAIC) recommends a fasting period of 2 h for liquids before surgery. Liberal drinking policies such as the 'Sip Til Send' are a suggested alternative to maintain hydration before surgery. **Objectives:** To compare residual gastric volumes in fully fasted nonlabouring parturients before elective caesarean delivery with the 'Sip Til Send' with water liberal drinking protocol. Our hypothesis was the 'Sip Til Send' would be noninferior to standard fasting at minimising the residual gastric volume immediately before surgery. **Design:** A paired cohort prospective observational pragmatic study using gastric ultrasound, analysed by an operator blinded to the fasting status of each scan. **Setting:** A tertiary maternity hospital in Dublin, Ireland. The study was conducted between January and June 2023. **Participants:** Pregnant women about to undergo elective caesarean delivery who had followed ESAIC fasting guidelines before admission. **Interventions:** Each participant underwent two pairs (semi-recumbent and the semi-recumbent right lateral positions) of standardised ultrasound examinations of the gastric antrum: the order of these scans was randomised. The first pair of scans occurred on admission before the 'Sip Til Send' protocol commenced, the other pair just before spinal anaesthesia for caesarean delivery, after a variable time following the 'Sip Til Send' protocol. **Main outcome measure:** The primary outcome was the difference in antral cross-sectional area (CSA) between the fully fasted women on admission and the same women after following the 'Sip Til Send' protocol until just before spinal anaesthesia. **Results:** Fifty-eight women were randomised for the study: 55 and 54 scans in the semi-recumbent position on admission, and 55 and 54 scans in the right lateral position just before spinal anaesthesia. The mean differences (95% CI) in CSA in the semi-recumbent and RL positions were 0.07 (-0.39 to 0.53) cm 2 and 0.04 (-0.60 to 0.68) cm 2 , respectively. Since the of 95% CIs did not cross the predefined noninferiority margin of 0.88 cm 2 , 'Sip Til Send' was noninferior to fully fasting in in terms of the antral CSA. **Conclusion:** The 'Sip Til Send' protocol of liberal hydration with water was noninferior to standard fasting prior to elective caesarean delivery.

64. Zhao S, Chen Q, Qin P, Liu L, Wei K. **Comparison of vasopressors for management of hypotension in high-risk caesarean section under neuraxial anesthesia: a systematic review and network meta-analysis.** BMC Anesthesiol. 2024 Dec 4;24(1):447.

Background: Vasopressors are effective in managing perioperative hypotension in high-risk parturients undergoing Caesarean section (CS). Nevertheless, the optimal vasopressor for addressing hypotension induced by neuraxial anesthesia remains a subject of investigation. **Methods:** We compared hypotension episodes among high-risk parturients who received ephedrine, noradrenaline, or phenylephrine by searching four electronic databases and reviewing the relevant references. Inclusion criteria encompassed randomized controlled trials directly comparing two or more vasopressors in the context of managing hypotension in high-risk parturients undergoing neuraxial anesthesia for CS. A network meta-analysis was performed using fixed-effects and Bayesian random-effects models. **Results:** We analyzed 13 trials involving 1,262 patients. While our direct and indirect comparisons revealed no reveal statistically significant differences in the number of hypotensive episodes among patients treated with different vasopressors, vasopressors were hierarchically ranked. Phenylephrine (Rank of the best choice = 0.81) exhibited the highest effectiveness in preventing hypotension, followed by ephedrine (Rank of the best choice = 0.10) and noradrenaline (Rank of the best choice = 0.09). Bradycardia occurrence was higher in patients administered phenylephrine compared to those given noradrenaline (risk ratio [RR]: 0.23; 95% confidence interval [CI]: 0.03 to 0.85) or ephedrine (RR: 0.01; 95% CI: 0.00 to 0.12). Notably, patients treated with phenylephrine or noradrenaline experienced reduced occurrences of nausea or vomiting compared to those who received ephedrine (RR: 0.37; 95% CI: 0.19 to 0.59 for phenylephrine and RR: 0.28; 95% CI: 0.10 to 0.75 for noradrenaline). Regarding fetal outcomes, no significant differences were noted between noradrenaline and phenylephrine. Overall norepinephrine in maternal outcomes may be more favorable. **Conclusions:** Our findings suggest the potential advantages of phenylephrine for reducing hypotensive episodes in high-risk parturients undergoing CS. Noradrenalin may emerge as an alternative, particularly for women at high risk of caesarean delivery.

65. Duttala SV, Kumari K, Kumari V, Meshram TM, Sharma A, Sethi P, Rathod D, Bhatia PK, Goyal S. **Dexamethasone for prevention of spinal hypotension during caesarean delivery: a randomised controlled trial.** Int J Obstet Anesth. 2024 Oct 15;61:104286.

Background: Spinal anaesthesia is commonly associated with maternal hypotension, which can be deleterious to mother and fetus. Dexamethasone increases peripheral vascular resistance and may be effective in preventing spinal hypotension. We hypothesized that a single preoperative dose of intravenous dexamethasone will prevent spinal hypotension in women undergoing elective caesarean delivery. **Methods:** A total of 170 participants planned for elective caesarean delivery were randomised to receive a single preoperative intravenous dose of dexamethasone 8 mg (Group D, n=85) or normal saline (Group C, n=85). Following spinal anaesthesia, blood pressure and heart rate were recorded every 1 minute up to 20 minutes and every 5 minutes thereafter. The primary outcome was the incidence of spinal hypotension. The secondary outcomes were maternal blood pressure, phenylephrine requirement, the incidence of post-delivery hypotension, nausea and/or vomiting, shivering, maternal bradycardia, and neonatal outcomes. **Results:** The incidence of spinal hypotension was significantly lower in group D (18.8%) compared to group C (38.8%) [difference 20% (95%CI 6.72, 33.28)] (P=0.007). The incidence of post-delivery hypotension and maternal bradycardia were not different between the groups. Phenylephrine requirement, the incidence of nausea and/or

vomiting and shivering were significantly less in Group D (all P <0.05). There was no significant difference among the study groups in maternal random blood sugar, neonatal Apgar scores, and umbilical arterial pH. **Conclusion:** A single preoperative intravenous dose of dexamethasone 8 mg significantly reduced the incidence of spinal hypotension in patients undergoing caesarean delivery

66. Wang L, Huang J, Hu H, Chang X, Xia F. **Commonly used antiemetics for prophylaxis of postoperative nausea and vomiting after Caesarean delivery with neuraxial morphine: a network meta-analysis.** Br J Anaesth. 2024 Jun;132(6):1274-1284.

Background: Dopamine antagonists, 5-HT3 antagonists, and dexamethasone are frequently used in obstetrics to prevent postoperative nausea and vomiting (PONV). However, the superiority of any drug class is yet to be established. This network meta-analysis aimed to compare the efficacy of these antiemetics for PONV prophylaxis in women receiving neuraxial morphine for Caesarean delivery. **Methods:** We searched PubMed, Embase, CENTRAL, Web of Science, and Wanfang Data for eligible randomised controlled trials. Primary outcomes were the incidences of postoperative nausea (PON) and postoperative vomiting (POV) within 24 h after surgery. We used a Bayesian random-effects model and calculated odds ratios with 95% credible intervals for dichotomous data. We performed sensitivity and subgroup analyses for primary outcomes. **Results:** A total of 33 studies with 4238 women were included. In the primary analyses of all women, 5-HT3 antagonists, dopamine antagonists, dexamethasone, and 5-HT3 antagonists plus dexamethasone significantly reduced PON and POV compared with placebo, and 5-HT3 antagonists plus dexamethasone were more effective than monotherapy. In the subgroup analyses, similar results were seen in women receiving epidural morphine or intrathecal morphine alone but not in women receiving intrathecal morphine with fentanyl or sufentanil. However, most included studies had some concerns or a high risk of bias, and the overall certainty of the evidence was low or very low. **Conclusions:** Combined 5-HT3 antagonists plus dexamethasone are more effective than monotherapy in preventing PONV associated with neuraxial morphine after Caesarean delivery. Future studies are needed to determine the role of prophylactic antiemetics in women receiving intrathecal morphine and lipophilic opioids.

67. Shippam W, Massey S, Clark K, Saulnier L, Chau A. **Time to motor block regression after neuraxial anaesthesia for caesarean delivery: a retrospective, cohort study.** Anaesthesia. 2024 Oct;79(10):1125-1127.

We conducted a retrospective cohort study to characterize the duration of sensory and motor block regression following neuraxial anaesthesia for caesarean delivery. Data from 200 patients receiving intrathecal (n = 100, 0.75% hyperbaric bupivacaine with fentanyl 10–15 mcg and morphine 100 mcg) and epidural (n = 100, lidocaine 2% with adrenaline 1:200,000, fentanyl 50–100 mcg and morphine 1.5–2 mg) anaesthesia for elective or emergency caesarean deliveries were retrospectively collected from patient records between December 2021 and February 2022. The primary outcome was median time to motor block regression, defined as time of intrathecal injection or epidural top-up, to time of recovery of straight leg raising, analysed using Kaplan–Meier curves with hazard ratio obtained via the Mantel–Haenszel method. The maximum time to straight leg raising in outliers was greater with increasing intrathecal dose used, although this study was not powered to examine differences between groups. For sensory block regression, there were significant outliers; four patients in the intrathecal group took 15–21 h for complete motor block regression and four patients in the epidural group took 16–27 h for complete sensory block regression.

68. Walia A, Friedman AM, Sobhani NC, Wen T. **Readmission Rates After Expedited Postpartum Discharge**. Obstet Gynecol. 2024 Sep 1;144(3):421-429.

Objective: To characterize national trends in expedited postpartum discharge and, secondarily, to identify predictors of expedited postpartum discharge and assess whether expedited postpartum discharge was associated with postpartum readmissions within 60 days of delivery hospitalization discharge. **Methods:** Birth hospitalizations and subsequent 60-day postpartum readmissions were extracted from the 2016-2020 Nationwide Readmissions Database for this retrospective cohort study. Postpartum discharge was categorized as expedited (less than 2 days after vaginal birth or less than 3 days after cesarean birth), routine (2 days after vaginal birth or 3 days after cesarean birth), or prolonged (more than 2 days after vaginal birth or more than 3 days after cesarean birth). Trends in expedited discharge were assessed over the study period with joinpoint regression. Unadjusted and adjusted logistic regression models were performed to assess clinical, hospital, and demographic predictors of expedited postpartum discharge. Sixty-day postpartum readmission risk was calculated, and adjusted regression models were performed to evaluate the association between expedited postpartum discharge and readmission. **Results:** Of 17.9 million birth hospitalizations, 32.9% had expedited postpartum discharge. The overall 60-day postpartum readmission rate after delivery hospitalization discharge was 1.7% for all patients, 1.4% for expedited postpartum discharge, 1.6% for routine discharge, and 3.3% for prolonged discharge. Rates of expedited postpartum increased from 29.1% in 2016 to 31.4% in 2019 and to 43.8% in 2020. This trend was not significant (average annual percent change: 9.9%, 95% CI, -1.6% to 23.7%), although rates of expedited discharge were significantly higher in 2020 than in 2016-2019 (P <.01). Younger and older age, chronic comorbid conditions, mental health conditions, and obstetric complications (eg, transfusion, chorioamnionitis or endometritis) were associated with lower likelihood of expedited postpartum discharge. Expedited postpartum discharge was associated with 14% lower adjusted odds of 60-day postpartum readmission compared with routine discharge (adjusted odds ratio 0.86, 95% CI, 0.85-0.88). **Conclusion:** Rates of expedited postpartum discharge increased significantly in 2020 compared with 2016-2019 and were not associated with 60-day postpartum readmission. These findings suggest that broader use of expedited postpartum discharge has not resulted in increased risk of postpartum readmissions.

Airway Management

69. Binyamin Y, Orbach-Zinger S, Ioscovich A, Reina YY, Bichovsky Y, Gruzman I, Zlotnik A, Brotfain E. **Incidence and clinical impact of aspiration during cesarean delivery: A multi-center retrospective study**. Anaesth Crit Care Pain Med. 2024 Apr;43(2):101347.

Background: The risk of aspiration during general anesthesia for cesarean delivery has long been thought to be increased due to factors such as increased intra-abdominal pressures and delayed gastric emptying in pregnant patients. However, recent studies have reported normal gastric emptying in pregnant patients, suggesting that the risk of aspiration may not be as high as previously believed. **Methods:** We conducted a retrospective study of 48,609 cesarean deliveries, of which 22,690 (46.7%) were performed under general anesthesia at two large tertiary medical centers in Israel. The study aimed to examine the incidence of potentially severe aspiration during cesarean delivery, both under general and neuraxial anesthesia. **Results:** Among the patients included in the study, three were admitted to the intensive care unit due to suspected pulmonary aspiration. Two of these cases

occurred during induction of general anesthesia for emergency cesarean delivery associated with difficult intubation and one under deep sedation during spinal anesthesia. The incidence of aspiration during cesarean delivery during general anesthesia in our study was 1 in 11,345 patients, and the incidence of aspiration during neuraxial anesthesia was 1 in 25,929 patients. No deaths due to aspiration were reported during the study period. **Conclusions:** Our findings provide another contemporary analysis of aspiration rates in obstetric patients, highlighting increased risks during the management of difficult airways during general anesthesia and deep sedation associated with neuraxial anesthesia.

With an editorial by Le Guen M, Zeidan A, and Thourel P. **Incidence and Clinical Impact of Aspiration during Cesarean Delivery: A Multi-Center Retrospective Study: Addressing the Hidden Risk: Aspiration during Cesarean Delivery.** Anaesthesia Critical Care & Pain Medicine Oct 11 2024;():101437

70. Tan PCF, Peyton PJ, Deane A, Unterscheider J, Dennis AT. **Pre-oxygenation using high flow humidified nasal oxygen or face mask oxygen in pregnant people - a prospective randomised controlled crossover non-inferiority study (The HINOP2 study)**. Int J Obstet Anesth. 2024 Nov;60:104236.

Background: Airway guidelines recommend pre-oxygenation of obstetric patients to an end tidal oxygen concentration (etO2) ≥90%. High flow nasal oxygen (HFNO) achieves this in 60% of pregnant people. However face mask (FM) pre-oxygenation also may not achieve this target in all patients. In this study we determined whether HFNO pre-oxygenation is non-inferior to FM pre-oxygenation. **Methods:** This randomised controlled crossover non-inferiority trial was conducted on healthy participants of gestational age ≥37 weeks in a simulated environment. Participants underwent pre-oxygenation for three minutes with HFNO and FM oxygen in randomised order. HFNO was delivered at a maximal flow of 70 l.min-1 and FM oxygen at 10 l.min-1. The primary outcome was etO2 on first expired breath after pre-oxygenation. Non-inferiority was defined as a mean difference in first etO2 between groups of ≤5%. **Results:** Seventy participants were randomised with 62 analysed. Age (mean (SD)), gestation (median (IQR)), and body mass index (median (IQR)), were 34.7 (4.6) years, 39 (38.4, 39.4) weeks, 29 (26.6, 32.4) kg.m-2 respectively. First etO2 after HFNO pre-oxygenation was greater than after FM pre-oxygenation (HFNO pre-oxygenation mean (SD) 90.2 (3.9)% versus FM pre-oxygenation 88.7 (3.0)%; mean difference = 1.45%, 95% CI 0.19 to 2.72%; p = 0.025. Forty-four (71%) participants achieved ≥90% first etO2 concentration after HFNO pre-oxygenation versus 27 (44%) after FM pre-oxygenation (p = 0.002). **Conclusions:** In this cohort of pregnant people at term in a simulated environment, pre-oxygenation with HFNO was not inferior to FM pre-oxygenation. FM pre-oxygenation did not achieve pre-oxygenation targets in over 50% of participants.

71. Maxwell S, Rajala B, Schechtman SA, Kountanis JA, Singh S, Klumpner TT, Cassidy R, Zisblatt L, Healy DW, Engoren M, Cooke JM, Pancaro C. **Development of the obstetric unanticipated difficult video-laryngoscopy algorithm through a quality improvement randomized open-label in situ simulation study.** Int J Obstet Anesth. 2024 Nov;60:104245.

Background: Video-laryngoscopy is increasingly used during general anesthesia for emergency cesarean deliveries. Given the heightened risk of difficult tracheal intubation in obstetrics, addressing challenges in airway management is crucial. In this simulation study, we hypothesized that using a

flexible bronchoscope would lead to securing the airway faster than the Eschmann introducer when either device is used in addition to video-laryngoscopy. **Methods:** Twenty-eight anesthesia trainees (n=14/group) were randomized to use either one of the rescue devices and video-recorded in a simulated scenario of emergency cesarean delivery. The primary outcome was the time difference in establishing intubation; secondary outcomes were the differences in incidence of hypoxemia, need for bag and mask ventilation, and failed intubation between the two rescue devices. **Results:** Mean (±SD) time to intubation using flexible bronchoscopy was shorter compared to using an Eschmann introducer (24 ± 10 vs 86 ± 35 s; P<0.0001; difference in mean 62 seconds, 95% CI 42 to 82 seconds). In the fiberoptic bronchoscopy group, there were no episodes of hypoxemia or need for bag and mask ventilation; in contrast both such events occurred frequently in the Eschmann introducer group (71%, 10/14); P=0.0002). All flexible bronchoscopy-aided intubations were established on the first attempt. The incidence of failed intubation was similar in both groups. **Conclusions:** Our data from simulated emergency tracheal intubation suggest that flexible bronchoscopy combined with video-laryngoscopy results in faster intubation time than using an Eschmann introducer combined with video-laryngoscopy.

72. Sanganee U, Jansen K, Lucas N, Van de Velde M. **The role of supraglottic airway devices for caesarean section under general anaesthesia. A scoping literature review with a proposed algorithm for the appropriate use of supraglottic airway devices for caesarean sections.** Eur J Anaesthesiol. 2024 Sep 1;41(9):668-676.

This review aims to assess the published evidence on airway management with a supraglottic airway device (SGA) for general anaesthesia in patients requiring a caesarean section. Physiological changes during pregnancy can make airway management in parturients challenging. At the same time, pregnant patients are at risk of pulmonary aspiration due to hormonal and mechanical alterations. The standard airway management for parturients undergoing caesarean section is rapid sequence induction followed by tracheal intubation. Evidence exists that using second-generation SGA devices is well tolerated and effective in selected patients. In this review, we provide an overview of the existing evidence and provide an algorithm to make an evidence-based clinical decision on the use of SGA devices. An online literature search was performed in Medline, Embase, PubMed, Emcare, Cochrane Library and CINAHL. The search terms used were 'supraglottic airway', 'supraglottic airway device', 'supraglottic airway management', 'supraglottic tube', 'i-gel', laryngeal mask', 'laryngeal mask airway', 'LMA', 'SGA', 'Proseal', 'Supreme', 'obstetric surgery', 'obstetric operation', 'general anaesthesia', 'caesarean' or 'caesarean section', 'abdominal delivery'. Full-text articles in English, Dutch and French were included. Case reports and studies in which the surgery was not a caesarean section were excluded. The initial search yielded 815 results. Following screening, deduplication and removal of publications that were unrelated to the topic or did not fit the inclusion criteria, 13 manuscripts were included in our analysis. A total of 7722 patients were described in the articles included. In the majority of manuscripts, second-generation SGA devices were used. There were seven cases of failed insertion and a need for conversion to tracheal intubation; first-generation SGA devices were used in these cases. There were no cases of pulmonary aspiration, and only one case of gastric regurgitation was described. Growing evidence suggests that the use of second-generation SGA devices might be well tolerated as the primary method for securing the airway for caesarean sections requiring general anaesthesia, in selected patients with a low risk for aspiration and difficult intubation.

73. Guglielminotti J, Monk C, Russell MT, Li G. **Association of General Anesthesia for Cesarean Delivery with Postpartum Depression and Suicidality.** Anesth Analg. 2024 Dec 4.

Background: Compared to neuraxial anesthesia, general anesthesia (GA) for cesarean delivery is associated with an increased risk of postpartum depression (PPD) requiring hospitalization. However, obstetric complications occurring during childbirth (eg, stillbirth) are associated with both increased use of GA and increased risk of PPD, and may account for the reported association between GA and PPD. This study assessed the association of GA for cesarean delivery with PPD requiring hospitalization, outpatient visit, or emergency department (ED) visit, accounting for obstetric complications. **Methods:** This retrospective cohort study included women who underwent a cesarean delivery in New York State between January 2009 and December 2017. Women were followed for 1 year after discharge for readmission, outpatient visit, or ED visit. The primary outcome was PPD requiring readmission, outpatient visit, or ED visit. The 2 secondary outcomes were (1) PPD requiring readmission, and (2) suicidality. Obstetric complications included severe maternal morbidity, blood transfusion, postpartum hemorrhage, preterm birth, and stillbirth. Adjusted hazard ratios (aHRs) and 95% confidence intervals (CIs) of PPD, PPD requiring readmission, and suicidality associated with GA were estimated using the propensity score matching and the overlap propensity score weighting methods. **Results:** Of the 325,840 women included, 19,513 received GA (6.0%; 95% CI, 5.9-6.1). Complications occurred in 43,432 women (13.3%) and the GA rate for these women was 9.7% (95% CI, 9.4-10.0). The incidence rate of PPD was 12.8 per 1000 person-years, with 24.5% requiring hospital readmission, and was higher when an obstetric complication occurred (17.1 per 1000 person-years). After matching, the incidence rate of PPD was 15.5 per 1000 person-years for women who received neuraxial anesthesia and 17.5 per 1000 person-years for women who received GA, yielding an aHR of 1.12 (95% CI, 0.97-1.30). Use of GA was associated with a 38% increased risk of PPD requiring hospitalization (aHR: 1.38; 95% CI, 1.07-1.77) and with a 45% increased risk of suicidality (aHR 1.45; 95% CI, 1.02-2.05). Results were consistent when using the overlap propensity score weighting. **Conclusions:** Use of GA for cesarean delivery is independently associated with a significantly increased risk of PPD requiring hospitalization and suicidality. It underscores the need to avoid using GA whenever appropriate and to address the potential mental health issues of patients after GA use, specifically by screening for PPD and providing referrals to accessible mental health providers as needed.

Postpartum Analgesia

74. Borrelli MC, Sprowell AJ, Moldysz A, Idris M, Armstrong SL, Kowalczyk JJ, Li Y, Hess PE. **A randomized controlled trial of spinal morphine with an enhanced recovery pathway and its effect on duration of analgesia after cesarean delivery.** Anaesth Crit Care Pain Med. 2024 Feb;43(1):101309.

Background: Intrathecal morphine is frequently administered after cesarean delivery to provide pain relief lasting up to 24 h. An enhanced recovery after cesarean pathways reduces the amount of postoperative opioids needed. The ideal dose of intrathecal morphine when combined with a pathway has not been determined. **Methods:** This was a non-inferiority trial in 72 healthy women undergoing a scheduled cesarean delivery. Women were randomized to receive either 50 mcg, 150 mcg, or 250 mcg of intrathecal morphine during spinal anesthesia, with a standardized postoperative enhanced

recovery pathway. The time to request supplemental opioids was the primary outcome. Secondary outcomes included pain scores, side effects, and quality of recovery at 24 h. **Results:** The duration of analgesia with 50 mcg of morphine (median 24.5 h [IQR: 3.5-34.4]) was inferior to 150 mcg (29.4 h [24.5-72]), and both doses were inferior to 250 mcg (32 h [30.5-72]). Women who received 50 mcg morphine had higher pain scores than the other doses, received more supplemental opioids, and had lower quality recovery scores. The secondary outcomes between 150 mcg and 250 mcg were similar. Side effects were similar among all groups. 63% of women who received 250 mcg remained opioid-free at 72 h, compared to 150 mcg (52%) and 50 mcg (30%). **Conclusions:** The duration of analgesia using intrathecal morphine with an enhanced recovery pathway was longer with 250 mcg than with lower doses, and side effects were similar. 50 mcg provided inferior pain relief over 24 h. More than half of our patients avoided additional opioids for up to 72 h with either 150 mcg or 250 mcg doses.

75. Ciechanowicz S, Kim J, Mak K, Blake L, Carvalho B, Sultan P. **Outcomes and outcome measures utilised in randomised controlled trials of postoperative caesarean delivery pain: a scoping review.** Int J Obstet Anesth. 2024 Feb;57:103927.

    Background: Inadequately treated postoperative pain following caesarean delivery can delay recovery and the ability to care for a newborn. Effectiveness studies of interventions to treat postoperative caesarean delivery pain measure different outcomes, limiting data pooling for meta-analysis. We performed a comprehensive review of existing outcomes with the aim of recommending core outcomes for future research. **Methods:** A scoping review to identify all outcomes reported in randomised controlled trials (RCTs) and clinical trial registries of interventions to treat or prevent postoperative caesarean delivery pain, with postoperative pain as a primary outcome measure. We searched PubMed, Web of Science, CINAHL, LILACS, Embase, CDSR and CRCT for studies from May 2016 to 2021. Outcomes were extracted and frequencies tabulated. **Results:** Ninety RCTs and 11 trial registries were included. In total, 392 outcomes (375 inpatient and 17 outpatient) were identified and categorised. The most reported outcome domain was analgesia (n = 242/375, 64.5%), reported in 96% of inpatient studies, with analgesic consumption accounting for 108/375, 28.8% of analgesia outcomes. The second most common domain was pain intensity (n = 120/375, 32%), reported in 97% of inpatient studies, using the visual analogue scale (68/120, 59%) and the numerical reporting scale (37/120, 25%). Maternal and neonatal adverse effects accounted for 65/375 (17.3%) and 19/375 (5.1%) of inpatient outcomes, respectively. **Conclusions:** Outcomes reported in RCTs for postoperative caesarean delivery pain vary widely. The results of this review suggest that standardisation is needed to promote research efficiency and aid future meta-analyses to identify optimal postoperative caesarean delivery pain management.

76. Baghirzada L, Walker A, Yu HC, Endersby R. **The analgesic effect of transversalis fascia plane block after caesarean section under spinal anaesthesia with intrathecal morphine: a randomised controlled trial.** Anaesthesia. 2024 Jan;79(1):63-70.

    We aimed to test whether bilateral injection of bupivacaine 0.25% in the transversalis fascia plane reduced 24 h opioid dose after singleton caesarean section, under spinal anaesthesia with intrathecal morphine, compared with saline 0.9% injectate. We allocated randomly 52 women to bilateral injection of 20 ml saline 0.9% on arrival in the post-anaesthesia care unit and 54 women to bilateral injection of 20 ml bupivacaine 0.25% (with adrenaline 2.5 μg.ml-1). Mean (SD) cumulative morphine equivalent opioid dose 24 h after saline injection was 32.3 (28.3) mg and 18.7 (20.2) mg after bupivacaine injection, a mean (95%CI) difference of 13.7 (4.1-23.2) mg (p = 0.006). Median (IQR

[range]) time to first postoperative opioid dose was 3.0 (1.5-10.3 [0.0-57.4]) h after saline 0.9% and 8.2 (2.7-29.6 [0.2-55.4]) h after bupivacaine 0.25% (p = 0.054). Transversalis fascia plane with bupivacaine 0.25% with adrenaline reduced postoperative pain at rest during 48 h (0-10-point scale) by a mean (95%CI) of 0.9 (0.2-1.6) points (p = 0.013) and on movement by 1.2 (0.4-2.1) points (p = 0.004). We conclude that transversalis fascia plane bupivacaine 0.25% with adrenaline reduces pain and opioid dose after caesarean section compared with saline 0.9%.

77. Katz D, Song J, Carangelo M, Bergsma T, Winston R, Landau R. **Simulated bupivacaine pharmacokinetics after labor epidural analgesia followed by transversus abdominis plane block with liposomal bupivacaine for intrapartum cesarean delivery**. J Clin Anesth. 2024 Dec;99:111589.

Study objective: To simulate bupivacaine pharmacokinetics in scenarios of labor epidural analgesia (LEA) extended for intrapartum cesarean delivery (CD) with epidural or intrathecal boluses, followed by transversus abdominis plane (TAP) block with liposomal bupivacaine (LB) for postcesarean analgesia. **Design:** Bupivacaine plasma concentrations were simulated using a 2-compartment distribution model fit to previous study data. **Setting:** Virtual pharmacokinetic simulations. **Patients:** Virtual individuals (1000, each scenario) had uniform weight (80 kg) but varying absorption parameters. **Interventions:** The 6 scenarios varied in LEA infusion duration (6 or 24 h), local anesthetic used for bolus to extend LEA (epidural lidocaine or intrathecal bupivacaine), TAP block regimen, and time between bolus and TAP block. **Measurements:** Scenario outcomes included geometric mean (GM) peak bupivacaine plasma concentration (Cmax) with 95% prediction interval (PI), median (range) Cmax, and number of virtual individuals (per 1000) with Cmax reaching estimated toxicity thresholds (neurotoxicity: 2000 μg/L; cardiotoxicity: 4000 μg/L). **Main results:** In simulated scenarios of LEA infusion for 24 h with an epidural bolus of lidocaine 400 mg for CD followed 1 h later by TAP block, the GM Cmax for the scenarios with TAP blocks including either LB 266 mg plus bupivacaine hydrochloride 52 mg or bupivacaine hydrochloride 104 mg was 1860 (95% PI, 1107-3124) and 1851 (95% PI, 1085-3157) μg/L, respectively. Among 1000 virtual individuals for each scenario, 404 and 401 had Cmax reaching 2000 μg/L, respectively; 1 and 0 had Cmax reaching 4000 μg/L, respectively. For other scenarios, GM Cmax remained <1000 μg/L. **Conclusions:** Across 6 different simulations of TAP blocks for intrapartum CD analgesia, LEA with bupivacaine (with or without boluses for extension and including a conservative modeling of lidocaine without epinephrine), followed by TAP block with LB and/or bupivacaine hydrochloride 0, 1, or 2 h after CD, is unlikely to result in bupivacaine plasma concentrations reaching local anesthetic systemic toxicity thresholds in healthy patients.

78. He J, Wilson JM, Fields KG, Zachos KMF, Franqueiro AR, Reale SC, Farber MK, Bateman BT, Edwards RR, Rathmell JP, Soens M, Schreiber KL. **Brief Assessment of Patient Phenotype to Explain Variability in Postsurgical Pain and Opioid Consumption after Cesarean Delivery: Performance of a Novel Brief Questionnaire Compared to Long Questionnaires**. Anesthesiology. 2024 Apr 1;140(4):701-714.

Background: Understanding factors that explain why some women experience greater postoperative pain and consume more opioids after cesarean delivery is crucial to building an evidence base for personalized prevention. Comprehensive psychosocial assessment with validated questionnaires in the preoperative period can be time-consuming. A three-item questionnaire has shown promise as a simpler tool to be integrated into clinical practice, but its brevity may limit the ability to explain heterogeneity in psychosocial pain modulators among individuals. This study compared the

explanatory ability of three models: (1) the 3-item questionnaire, (2) a 58-item questionnaire (long) including validated questionnaires (e.g., Brief Pain Inventory, Patient Reported Outcome Measurement Information System [PROMIS]) plus the 3-item questionnaire, and (3) a novel 19-item questionnaire (brief) assessing several psychosocial factors plus the 3-item questionnaire. Additionally, this study explored the utility of adding a pragmatic quantitative sensory test to models. **Methods:** In this prospective, observational study, 545 women undergoing cesarean delivery completed questionnaires presurgery. Pain during local anesthetic skin wheal before spinal placement served as a pragmatic quantitative sensory test. Postoperatively, pain and opioid consumption were assessed. Linear regression analysis assessed model fit and the association of model items with pain and opioid consumption during the 48 h after surgery. **Results:** A modest amount of variability was explained by each of the three models for postoperative pain and opioid consumption. Both the brief and long questionnaire models performed better than the three-item questionnaire but were themselves statistically indistinguishable. Items that were independently associated with pain and opioid consumption included anticipated postsurgical pain medication requirement, surgical anxiety, poor sleep, pre-existing pain, and catastrophic thinking about pain. The quantitative sensory test was itself independently associated with pain across models but only modestly improved models for postoperative pain. **Conclusions:** The brief questionnaire may be more clinically feasible than longer validated questionnaires, while still performing better and integrating a more comprehensive psychosocial assessment than the three-item questionnaire.

79. Stone AL, Pham A, Osmundson SS, Pedowitz A, Kingsley PJ, Marnett LJ, Patel S, Wickersham N, Sorabella LL, Bruehl S. **Interactions Between Endocannabinoid and Endogenous Opioid Systems Prospectively Influence Postoperative Opioid Use in Pregnant Patients Undergoing Cesarean Delivery**. J Pain. 2024 Sep;25(9):104548.
Both endocannabinoid (EC) and endogenous opioid systems are involved in nociceptive processing and may work together synergistically based on preclinical models. This study evaluated the interactive effects of preoperative beta-endorphin (BE) concentrations (a key analgesic endogenous opioid) in cerebrospinal fluid (CSF) and ECs (CSF and plasma 2-arachidonoylglycerol and plasma anandamide) on postoperative opioid use and pain intensity in a prospective cohort of n = 112 pregnant patients undergoing scheduled cesarean delivery. Maternal blood and CSF samples were collected preoperatively for BE and EC assays. Patients completed measures of outpatient opioid use (number of tablets used and days of use) and average pain intensity at 2 weeks postoperatively. Results of general linear model analyses controlling for maternal age, body mass index at time of delivery, and race revealed significant multiplicative interactions between EC and BE concentrations on number of opioid tablets used (based on pill count), days of opioid use, and total milligram morphine equivalents used in the 2-week follow-up period. Elevated preoperative plasma and CSF 2-arachidonoylglycerol predicted reduced outpatient opioid analgesic use, particularly for patients low in CSF BE. Similar analyses for pain intensity at 2-week follow-up indicated a significant interaction ($P < .02$) characterized by higher preoperative BE concentrations being associated with lower subsequent pain only for individuals with low preoperative plasma anandamide concentrations. Further exploration of interactions between EC and endogenous opioid inhibitory systems as they influence responses to opioid analgesics in other clinical pain populations may help guide the development of precision pain management approaches. PERSPECTIVE: In the postoperative setting of patients undergoing cesarean delivery, elevated ECs were linked to reduced outpatient opioid analgesic use in individuals who had low endogenous opioid concentrations in CSF. Further

exploration of interactions between these 2 inhibitory systems as they impact responses to pain management interventions appears warranted.

80. Luxey X, Lemoine A, Dewinter G, Joshi GP, Le Ray C, Raeder J, Van de Velde M, Bonnet MP. **Acute pain management after vaginal delivery with perineal tears or episiotomy.** Reg Anesth Pain Med. 2024 Jun 14:rapm-2024-105478.
Background: A vaginal delivery may be associated with acute postpartum pain, particularly after perineal trauma. However, pain management in this setting remains poorly explored. **Objective:** The aim of this systematic review was to evaluate the literature and to develop recommendations for pain management after a vaginal delivery with perineal trauma.
Evidence review: MEDLINE, Embase, and Cochrane databases were searched for randomized controlled trials (RCTs) and systematic reviews assessing pain after a vaginal delivery with perineal tears or episiotomy until March 2023. Cochrane Covidence quality assessment generic tool and the RoB Vis 2 tool were used to grade the quality of evidence. **Findings:** Overall, 79 studies (69 RCTs and 10 systematic reviews and meta-analyses) of good quality of evidence were included. Acetaminophen and non-steroidal anti-inflammatory drugs (NSAIDs) are recommended as first-line treatment. Epidural morphine (≤2 mg) is recommended among women with labor epidural analgesia and severe perineal tears, with adequate respiratory monitoring. Local anesthetic infiltration, topical local anesthetic, ointment application, and pudendal nerve block are not recommended due to insufficient or lack of evidence. Ice or chemical cold packs are recommended for postpartum pain first-line treatment due to their simplicity of use. Transcutaneous nerve stimulation and acupuncture are recommended as adjuvants. When a perineal suture is indicated, a continuous suture compared with an interrupted suture for the repair of episiotomy or second-degree perineal tears is recommended for the outcome of pain. For women with first-degree or second-degree perineal tears, no suturing or glue compared with suturing is recommended for the outcome of pain.**Conclusions:** Postpartum pain management after a vaginal delivery with perineal trauma should include acetaminophen, NSAIDs, and ice or chemical cold packs. Epidural morphine should be reserved for severe perineal tears. A surgical repair technique should depend on perineal tear severity.

81. Katz D, Hyers B, Siddiqui S, Ouyang Y, Hamburger J, Knibbs N, Beilin Y. **Impact of Neuraxial Preservative-Free Morphine in Vaginal Delivery on Opiate Consumption and Recovery: A Randomized Control Trial**. Anesth Analg. 2024 Jul 19.
Background: Neuraxial opioids are commonly used after cesarean delivery (CD). However, they are not commonly used after vaginal delivery (VD) though some studies have suggested they may be beneficial from a pain perspective. However, they did not evaluate other potential benefits including patient satisfaction, impact on postpartum depression and breastfeeding (BF) success, or side effects such as pruritus. **Methods:** Parturients who delivered vaginally with epidural analgesia were randomized to receive either 2 mg of preservative-free morphine (4 mL) or saline (4 mL) via the epidural catheter within 1 hour of VD. Routine analgesics were unchanged and included q 6-hour dosing of acetaminophen 975 mg orally and ketorolac 30 mg intravenous (IV). Hydromorphone 2 mg or oxycodone 10 mg were offered for breakthrough pain. Our primary outcome was opiate consumption in the first 24 hours after drug administration. Secondary outcomes included pain scores at 24 hours and 1 week postpartum as well as opiate consumption up to 1 week postpartum. Additional end points such as obstetric quality of recovery score (OBS-QOR10) breast feeding success, and an Edinburgh Postnatal Depression Score (EPDS) were also obtained. **Results:** Data were analyzed for

157 parturients, 80 in the morphine group and 77 in the saline group. No difference was observed in the EDPS score predelivery or intention to BF. We found a statistically significant difference in the use of opioids in the first 24 hours, 3.8% (95% confidence interval [CI], 0.9%-11.3%) vs 14.3% (7.7%-24.5%) in the morphine and saline groups, respectively; and in total opioid dose, median (interquartile range, IQR [range]) of morphine milligram equivalent vs 0 (0-0 [0-47.5]) vs 0 (0-0 [0-72]), P = .023, in the morphine and saline groups, respectively. Verbal pain scores (0-10) at 24 hours were lower in the morphine group (median (IQR [range): 2.0 (1-4 [0-10]) vs 3.0 (1.5-5.0 [0-10]), P = .043. There was a greater incidence of pruritus in the morphine group versus saline group, 37.5% (95% CI, 27.1%-49.1%) vs 18.2% (95% CI, 10.6%-29.0%), P = .008. We did not find any differences in the OBS-QOR10, BF success, or EPDS at 6 weeks PP (P < .05). **Conclusions:** A single epidural dose of 2 mg preservative-free morphine after VD was effective at decreasing pain and opioid use at 24 hours after VD but came at the cost of increased pruritus. We did not detect any differences in BF, recovery scores, or PPD. Future studies should focus on elucidating the role of neuraxial preservative-free morphine after VD.

Obstetric Hemorrhage

82. **The effect of tranexamic acid on postpartum bleeding in women with moderate and severe anaemia (WOMAN-2): an international, randomised, double-blind, placebo-controlled trial.** Lancet. 2024 Oct 26;404(10463):1645-1656.

Background: Tranexamic acid, given within 3 h of birth, reduces bleeding deaths in women with postpartum haemorrhage. We examined whether giving tranexamic acid shortly after birth can prevent postpartum haemorrhage in women with moderate or severe anaemia. **Methods:** This international, randomised, double-blind, placebo-controlled trial was done in 34 hospitals across four countries (Nigeria, Pakistan, Tanzania, and Zambia). We recruited women of any age in active labour with moderate or severe anaemia (haemoglobin <100 g/L). We randomly assigned women (1:1) who had given birth vaginally to receive 1 g of tranexamic acid or matching placebo by slow intravenous injection (over 10 min) within 15 min of the umbilical cord being cut or clamped. Women were randomly assigned by selection of the lowest numbered treatment pack from a box containing 20 packs that were identical apart from the pack number. Participants, care givers, and those assessing outcomes were masked to group assignment. The primary outcome was a clinical diagnosis of primary postpartum haemorrhage, which might be an estimated blood loss of more than 500 mL or any blood loss sufficient to compromise haemodynamic stability within 24 h of randomisation, analysed on an intention-to-treat basis. Safety analyses were performed in all participants included in the intention-to-treat population. This trial was registered on ISRCTN (ISRCTN62396133), ClinicalTrials.gov (NCT03475342), and the Pan African Clinical Trial Registry (PACTR201909735842379) and is closed to recruitment. **Findings:** From Aug 24, 2019, to Sept 19, 2023, 16 586 women aged 14-50 years were invited to take part and 1518 were excluded. 7580 women were randomly assigned to receive tranexamic acid and 7488 to receive placebo. Primary outcome data were unavailable for one woman in each group. The median time interval from the start of the administration of the trial treatment to the diagnosis of postpartum haemorrhage was 18·5 min (IQR 5-58); 20 min (8-64) in women with moderate anaemia and 13 min (7-44) in women with severe anaemia. 358 (35%) of 1024 with postpartum haemorrhage for whom time data were available were diagnosed before the trial treatment had been fully administered. Clinically diagnosed postpartum haemorrhage occurred in 530 (7·0%) of 7579 in the tranexamic acid group and in 497 (6·6%) of 7487 in the placebo

group (risk ratio [RR] 1·05, 95% CI 0·94-1·19). There was no strong evidence against the null hypothesis of homogeneity of effects for any of the prespecified subgroup analyses: severity of anaemia (p=0·44), antepartum haemorrhage (p=0·044), birth canal trauma (p=0·37), use of pain control (p=0·37), and baseline risk of postpartum haemorrhage (p=0·31). There were no vascular occlusive events (pulmonary embolism, deep vein thrombosis, stroke, and myocardial infarction) reported in either group. There were no adverse events related to the treatment and no treatment-related deaths. **Interpretation:** In women with moderate and severe anaemia, giving tranexamic acid within 15 min of the umbilical cord being clamped did not reduce the risk of clinically diagnosed postpartum haemorrhage.

83. Rohwer C, Rohwer A, Cluver C, Ker K, Hofmeyr GJ. **Tranexamic acid for preventing postpartum haemorrhage after caesarean section.** Cochrane Database Syst Rev. 2024 Nov 13;11(11):CD016278.

Objectives: To assess the effects of TXA for preventing PPH compared to placebo or no treatment (with or without uterotonic co-treatment) in women during caesarean birth. **Search methods:** We searched CENTRAL, MEDLINE, Embase, and WHO ICTRP to 20 February 2024 and searched reference lists of retrieved studies. **Eligibility criteria:** We included randomised controlled trials (RCTs) evaluating the use of TXA alone or plus uterotonics during caesarean birth for preventing PPH. **Outcomes:** The critical outcome was blood loss ≥ 1000 mL, measured using estimated or calculated methods. Important outcomes included maternal death, severe morbidity, blood transfusion, the use of additional surgical interventions to control PPH, thromboembolic events, use of additional uterotonics, hysterectomy, maternal satisfaction, and breastfeeding at discharge. **Included studies:** We included six RCTs with 15,981 participants. All 12 trials in the previous version of this review were not included after review of trial registrations and trustworthiness checklists. Most included studies involved women at low risk of PPH and were conducted in high-resource settings. **Synthesis of results:** Prophylactic TXA in addition to standard care compared to placebo in addition to standard care or standard care alone TXA results in little to no difference in estimated blood loss ≥ 1000 mL (risk ratio (RR) 0.94, 95% confidence interval (CI) 0.79 to 1.11; 4 RCTs; n = 13,042; high certainty evidence), resulting in 8 fewer per 1000 women having estimated blood loss ≥ 1000 mL (from 30 fewer to 16 more). TXA likely results in a slight reduction in calculated blood loss ≥ 1000 mL (RR 0.83, 95% CI 0.76 to 0.92; 2 RCTs; n = 4327; moderate certainty evidence), resulting in 53 fewer per 1000 having calculated blood loss ≥ 1000 mL (from 75 fewer to 25 fewer). TXA likely results in little to no difference in blood transfusion (RR 0.88, 95% CI 0.72 to 1.08; 5 RCTs; n = 15,740; moderate certainty evidence), resulting in 4 fewer per 1000 women requiring a blood transfusion (from 10 fewer to 3 more). The evidence is very uncertain about the effect of TXA on thromboembolic events (RR 1.40, 95% CI 0.22 to 8.90; 4 RCTs; n = 14,480; very low certainty evidence), resulting in 1 more per 1000 women having a thromboembolic event (from 2 fewer to 17 more). Overall, studies had low risk of bias. We downgraded the certainty of evidence mainly for imprecision. **Authors' conclusions:** Prophylactic TXA in addition to standard care during caesarean birth results in little to no difference in estimated blood loss ≥ 1000 mL and likely results in a slight reduction in calculated blood loss ≥ 1000 mL compared to placebo. There were no data for severe morbidity due to PPH. Event rates for further interventions to control PPH were low and similar across groups. Prophylactic TXA thus results in little to no difference between groups for additional surgical interventions (32 versus 31 per 1000), and likely results in little to no difference between groups for blood transfusions (31 versus 36 per 1000) and use of additional uterotonics (107 versus 121 per 1000). There were very few events for the outcomes maternal death (1

in placebo group), thromboembolic events (2 versus 3 per 1000), and hysterectomy (1 per 1000 in each group). Evidence for these serious adverse events is therefore very uncertain. Decisions about implementing routine prophylactic TXA during caesarean birth should not only consider outcomes related to blood loss, but also the relatively low rates of PPH morbidity and uncertainty of serious adverse events. Most studies included women at low risk of PPH, thereby precluding any conclusions about women at high risk of PPH. Cost associated with routine use of an additional drug for all caesarean births needs to be considered.

84. Ker K, Sentilhes L, Shakur-Still H, Madar H, Deneux-Tharaux C, Saade G, Pacheco LD, Ageron FX, Mansukhani R, Balogun E, Brenner A, Prowse D, Arribas M, Ahmadzia H, Chaudhri R, Olayemi O, Roberts I. **Tranexamic acid for postpartum bleeding: a systematic review and individual patient data meta-analysis of randomised controlled trials**. Lancet. 2024 Oct 26;404(10463):1657-1667.

Background: Tranexamic acid is a recommended treatment for women with a clinical diagnosis of postpartum haemorrhage, but whether it can prevent bleeding is unclear. We conducted a systematic review and individual patient data (IPD) meta-analysis of randomised controlled trials to assess the effects of tranexamic acid in women giving birth. **Methods:** In this systematic review and IPD meta-analysis, we searched the WHO International Clinical Trials Registry Platform from database inception to Aug 4, 2024 for randomised trials that assessed the effects of tranexamic acid in women giving birth. Trials were eligible if they were prospectively registered, placebo-controlled, included more than 500 women, and had a low risk of bias for random sequence generation and allocation concealment. IPD were requested from the trial investigators. The primary outcomes were the numbers of women with life-threatening bleeding and thromboembolic events. We used a one-stage model to analyse the data and explored whether the effect of tranexamic acid varied by the underlying risk of life-threatening bleeding, type of birth, presence of moderate or severe anaemia, or timing of administration (before or after a diagnosis of postpartum haemorrhage). This study is registered with PROSPERO, CRD42022345775. **Findings:** We analysed data on 54 404 women from five trials. We obtained IPD for 43 409 women from four trials and aggregate data on 10 995 women from one trial. All trials had a low risk of bias. Life-threatening bleeding occurred in 178 (0·65%) of 27 300 women in the tranexamic acid group versus 230 (0·85%) of 27 093 women in the placebo group (pooled odds ratio [OR] 0·77 [95% CI 0·63-0·93]; p=0·008). There was no evidence that the effect of tranexamic acid varied by the underlying risk of life-threatening bleeding, type of birth, presence of moderate or severe anaemia or timing of administration. No significant difference was identified between tranexamic acid and placebo groups with regard to thromboembolic events: 50 (0·2%) of 26 571 women in the tranexamic acid group had fatal or non-fatal thromboembolic events versus 52 (0·2%) of 26 373 women in the placebo group (pooled OR 0·96 [0·65-1·41]; p=0·82) with no significant heterogeneity identified in the subgroup analyses. **Interpretation:** Tranexamic acid reduces the risk of life-threatening postpartum bleeding. We found no evidence that tranexamic acid increases the risk of thrombosis. Although we do not recommend the use of tranexamic acid in all women giving birth, consideration should be given to its use before a diagnosis of postpartum haemorrhage in women at high risk of death.

85. Ende HB, Domenico HJ, Polic A, Wesoloski A, Zuckerwise LC, Mccoy AB, Woytash AR, Moore RP, Byrne DW. **Development and Validation of an Automated, Real-Time Predictive Model for Postpartum Hemorrhage**. Obstet Gynecol. 2024 Jul 1;144(1):109-117.

Objective: To develop and validate a predictive model for postpartum hemorrhage that can be deployed in clinical care using automated, real-time electronic health record (EHR) data and to compare performance of the model with a nationally published risk prediction tool. **Methods:** A multivariable logistic regression model was developed from retrospective EHR data from 21,108 patients delivering at a quaternary medical center between January 1, 2018, and April 30, 2022. Deliveries were divided into derivation and validation sets based on an 80/20 split by date of delivery. Postpartum hemorrhage was defined as blood loss of 1,000 mL or more in addition to postpartum transfusion of 1 or more units of packed red blood cells. Model performance was evaluated by the area under the receiver operating characteristic curve (AUC) and was compared with a postpartum hemorrhage risk assessment tool published by the CMQCC (California Maternal Quality Care Collaborative). The model was then programmed into the EHR and again validated with prospectively collected data from 928 patients between November 7, 2023, and January 31, 2024. **Results:** Postpartum hemorrhage occurred in 235 of 16,862 patients (1.4%) in the derivation cohort. The predictive model included 21 risk factors and demonstrated an AUC of 0.81 (95% CI, 0.79-0.84) and calibration slope of 1.0 (Brier score 0.013). During external temporal validation, the model maintained discrimination (AUC 0.80, 95% CI, 0.72-0.84) and calibration (calibration slope 0.95, Brier score 0.014). This was superior to the CMQCC tool (AUC 0.69 [95% CI, 0.67-0.70], P <.001). The model maintained performance in prospective, automated data collected with the predictive model in real time (AUC 0.82 [95% CI, 0.73-0.91]). **Conclusion:** We created and temporally validated a postpartum hemorrhage prediction model, demonstrated its superior performance over a commonly used risk prediction tool, successfully coded the model into the EHR, and prospectively validated the model using risk factor data collected in real time. Future work should evaluate external generalizability and effects on patient outcomes; to facilitate this work, we have included the model coefficients and examples of EHR integration in the article.

86. Papadopoulou A, Tournas G, Georgiopoulos G, Antsaklis P, Daskalakis G, Coomarasamy A, Devall AJ. **Preventing postpartum hemorrhage: A network meta-analysis on routes of administration of uterotonics.** Eur J Obstet Gynecol Reprod Biol. 2024 Apr;295:172-180.

Objective: To perform a network meta-analysis to specify the route of administration that maximises the effectiveness of each of the available prophylactic uterotonics without increasing the risk for side effects. **Data sources:** Literature searches on 12th September 2022 included: CENTRAL, MEDLINE, Embase, CINAHL, ClinicalTrials.gov and the WHO International Clinical Trials Registry Platform. The reference lists of the retrieved study records were also searched. **Study eligibility criteria:** Population: Randomized controlled trials involving women in the third stage of labour after a vaginal or caesarean delivery in hospital or community settings. **Interventions:** Systemically administered prophylactic uterotonics of any route and dose for primary postpartum hemorrhage prevention. Comparison: Any other prophylactic uterotonic, or a different route or dose of a given uterotonic, or placebo, or no treatment. Outcomes (primary): postpartum hemorrhage ≥ 500 mL and ≥ 1000 mL. **Study appraisal and synthesis methods:** Risk of bias and trustworthiness assessments were performed, according to Cochrane's guidance. Direct, indirect and network meta-analyses were conducted, and results were summarized either as risk ratio or mean difference with 95% confidence intervals for dichotomous and continuous outcomes, respectively. The certainty of generated evidence was assessed according to the GRADE approach. Cumulative probabilities were calculated and the surface under the cumulative ranking curve was used to create a ranking of the available drugs. **Results:** One hundred eighty-one studies involving 122,867 randomised women were

included. Most studies were conducted in hospital settings in lower-middle income countries and involved women delivering vaginally. When compared with intramuscular oxytocin, carbetocin (RR 0.58, 95 % CI 0.40-0.84) and oxytocin (RR 0.75, 95 % CI 0.59-0.97) by an intravenous bolus, and intramuscular ergometrine plus oxytocin combination (RR 0.71, 95 % CI 0.56-0.91) are probably more effective in preventing primary postpartum hemorrhage. Intramuscularly administered oxytocin and carbetocin by an intravenous bolus have a favourable side effects profile. **Conclusions:** Generated evidence was generally moderate and global inconsistency was low. Carbetocin and oxytocin by an intravenous bolus, and intramuscular ergometrine plus oxytocin combination are probably the top uterotonics for primary postpartum hemorrhage prevention. Large scale studies exploring different routes of administration for available prophylactic uterotonics, and women's views should be conducted.

87. Dey T, Brown D, Cole MG, Hill RA, Chaplin M, Huffstetler HE, Curtis F. **Cell salvage for the management of postpartum haemorrhage**. Cochrane Database Syst Rev. 2024 Dec 20;12(12):CD016120.

Objectives: To assess the benefits and harms of cell salvage when used during birth. **Search methods:** We searched the CENTRAL, MEDLINE, Ovid Embase, and Global Index Medicus databases and the ICTRP and ClinicalTrials.gov trials registers. We also carried out reference checking and citation searching, and contacted study authors to identify all relevant studies. The latest search date was 8 February 2024. **Eligibility criteria:** We included randomised controlled trials (RCTs) in pregnant women (24 weeks or more gestation) comparing use of cell salvage following caesarean or vaginal birth with routine care (defined as no cell salvage). We did not place any restrictions on mode of birth, ethnicity, race, socioeconomic status, education level, or place of residence. **Outcomes:** Critical outcomes for this review were risk of allogenic blood transfusion, risk of transfusion-related adverse reactions, risk of haemorrhage, transfer to higher level of care, length of hospitalisation, length of operation, and risk of sepsis. Important outcomes were estimated blood loss, blood loss ≥ 500 mL, blood loss ≥ 1000 mL, use of additional uterotonics or tranexamic acid, maternal death, postpartum haemoglobin concentration, change in haemoglobin, major surgery including hysterectomy, future major surgery, end-organ dysfunction or failure, amniotic fluid embolism, side effects, clotting abnormalities, maternal experience/satisfaction, maternal well-being, and breastfeeding. **Synthesis methods:** We conducted a meta-analysis for each outcome where data were available from more than one study using a random-effects model. If data could not be analysed using meta-analysis, we synthesised results narratively using the Synthesis Without Meta-analysis (SWiM) guidance. We used GRADE to assess the certainty of evidence for each outcome. **Included studies:** We included six RCTs with 3476 participants. All trials involved pregnant women having a caesarean birth. Three trials were conducted in high-income countries, and three were conducted in an upper-middle-income country. **Synthesis of results:** Intraoperative cell salvage at caesarean birth may reduce the need for allogenic transfusions received by participants, although the 95% confidence interval (CI) includes the possibility of an increase in effect. Low-certainty evidence from three studies found the risk of donor transfusions was possibly lower in participants with cell salvage (risk ratio (RR) 0.45, 95% CI 0.15 to 1.33; P = 0.15, I2 = 33%; 3 RCTs, 3115 women; low-certainty evidence). The absolute risk of transfusion was very low in the studies (4% in women not treated with cell salvage and 2% in women treated with cell salvage). The evidence is very uncertain about the risk of transfusion-related adverse reactions in participants with intraoperative cell salvage (RR 0.48, 95% CI 0.09 to 2.62; P = 0.39; 4 RCTs, 3304 women; very low-certainty evidence). Cell salvage at caesarean birth may increase day

one postpartum haemoglobin. Three studies reported day one postpartum haemoglobin levels (MD 6.14 g/L, 95% CI 1.62 to 10.65; P = 0.008, I2 = 97%; 3 RCTs, 3070 women; low-certainty evidence). Three trials reported risk of amniotic fluid embolism and no cases were observed (n = 3226 women). **Authors' conclusions:** Cell salvage may reduce the need for allogenic blood transfusion, may reduce blood loss, and may increase day one postpartum haemoglobin in pregnant women having caesarean birth (low certainty). Cell salvage may make little to no difference to the risk of sepsis (low certainty) and probably makes little to no difference to the risk of haemorrhage (moderate certainty). The effect of cell salvage on risk of transfusion-related adverse reactions is very uncertain. The effect of cell salvage on the length of hospital stay was both clinically and statistically heterogenous, with a very low certainty of evidence. No cases of amniotic fluid embolism were reported among the included trials. Studies in low- and middle-income settings are needed.

88. Caulfield KC, McMahon O, Dennis AT. **Baseline haemoglobin variability by measurement technique in pregnant people on the day of childbirth.** Anaesthesia. 2024 Feb;79(2):178-185.

Point-of-care haemoglobin measurement devices may play an important role in the antenatal detection of anaemia in pregnant people and may be useful in guiding blood transfusion during resuscitation in obstetric haemorrhage. We compared baseline haemoglobin variability of venous and capillary HemoCue® haemoglobin, and Masimo® Rad-67 Pulse CO-Oximeter haemoglobin with laboratory haemoglobin in people on the day of their planned vaginal birth. A total of 180 people undergoing planned vaginal birth were enrolled in this prospective observational study. Laboratory haemoglobin was compared with HemoCue and Masimo Rad-67 Pulse CO-Oximeter measurements using Bland-Altman analysis, calculating mean difference (bias) and limits of agreement. Five (2.8%) people had anaemia (haemoglobin < 110 g.l-1). Laboratory haemoglobin and HemoCue venous haemoglobin comparison showed an acceptable bias (SD) 0.7 (7.54) g.l-1 (95%CI -0.43-1.79), with limits of agreement -14.10-15.46 g.l-1 and acceptable agreement range of 29.6 g.l-1 . Laboratory and HemoCue capillary haemoglobin comparison showed an unacceptable bias (SD) 13.3 (14.12) g.l-1 (95%CI 11.17-15.34), with limits of agreement - 14.42-40.93 g.l-1 and unacceptable agreement range of 55.3 g.l-1 . Laboratory and Masimo haemoglobin comparison showed an unacceptable bias (SD) -14.0 (11.15) g.l-1 (95%CI -15.63 to -12.34), with limits of agreement to -35.85 to 7.87 g.l-1 and acceptable agreement range of 43.7 g.l-1 . Venous HemoCue, with its acceptable bias and limits of agreement, should be applied more widely in the antenatal setting to detect, manage and risk stratify pregnant people with anaemia. HemoCue capillary measurement under-estimated haemoglobin and Masimo haemoglobin measurement over-estimated, limiting their clinical use. Serial studies are needed to determine if the accuracy of venous HemoCue haemoglobin measurement is sustained in other obstetric settings.

89. de Lloyd LJ, Bell SF, Roberts T, Freyer Martins Pereira J, Bray M, Kitchen T, James D, Collins PW, Collis RE. **Early viscoelastometric guided fibrinogen replacement combined with escalation of clinical care reduces progression in postpartum haemorrhage: a comparison of outcomes from two prospective observational studies.** Int J Obstet Anesth. 2024 Aug;59:104209.

Background: Viscoelastometric haemostatic assays (VHA) give rapid information on coagulation status, allowing individualised resuscitation. **Methods:** This paper compares outcomes from two observational studies of postpartum haemorrhage (PPH) in the same institution, before and after practice changed from fixed ratio empirical transfusion of coagulation products with laboratory

coagulation testing to VHA-guided fibrinogen replacement incorporated into an enhanced PPH care bundle. In both studies, all blood samples were taken near 1000 mL qualitative blood loss (QBL). In Study One, QBL started once PPH was identified, and resuscitation with coagulation blood products was empirical or based on laboratory tests of coagulation. In Study Two, QBL started at delivery and VHA was used to guide fibrinogen replacement if FIBTEM A5 was <12 mm (Claus fibrinogen ≤2 g/L) or to withhold coagulation products if FIBTEM A5 was >12 mm. **Results:** Improved PPH outcomes were observed in Study Two, with rates of measured blood loss ≥2500 mL, ≥4 units red blood cell (RBC) transfusion, fresh frozen plasma transfusion and ≥8 units of any blood product transfusion all reduced ($P < 0.01$). Clinically significant improvements occurred in women with fibrinogen ≤2 g/L at study entry, where the proportion of women who received ≥4 units RBC transfusion fell from 67% in Study One to 0% in Study Two ($P = 0.0007$). **Conclusions:** These results suggest that use of VHA as part of an early bundle of PPH care targeting fibrinogen ≤2 g/L with fibrinogen concentrate reduces PPH progression. The greatest benefit was seen when fibrinogen levels were ≤2 g/L at first testing.

90. Deniau B, Ricbourg A, Weiss E, Paugam-Burtz C, Bonnet MP, Goffinet F, Mignon A, Morel O, Le Guen M, Binczak M, Carbonnel M, Michelet D, Dahmani S, Pili-Floury S, Ducloy Bouthors AS, Mebazaa A, Gayat E. **Association of severe postpartum hemorrhage and development of psychological disorders: Results from the prospective and multicentre HELP MOM study.** Anaesth Crit Care Pain Med. 2024 Apr;43(2):101340.

Objective: Post-partum hemorrhage (PPH) is the leading preventable cause of worldwide maternal morbidity and mortality. Risk factors for psychological disorders following PPH are currently unknown. HELP-MOM study aimed to determine the incidence and identify risk factors for psychological disorders following PPH. **Methods:** HELP-MOM study was a prospective, observational, national, and multicentre study including patients who experienced severe PPH requiring sulprostone. The primary endpoint was the occurrence of psychological disorders (anxiety and/or post-traumatic disorder and/or depression) following PPH, assessed at 1, 3, and 6 months after delivery using HADS, IES-R, and EPDS scales. **Results:** Between November 2014 and November 2016, 332 patients experienced a severe PPH and 236 (72%) answered self-questionnaires at 1, 3, and 6 months. A total of 161 (68%) patients declared a psychological disorder following severe PPH (146 (90.1%) were screened positive for anxiety, 96 (58.9%) were screened positive for post-traumatic stress disorder, and 94 (57.7%) were screened positive for post-partum depression). In multivariable analysis, the use of intra-uterine tamponnement balloon was associated with a lower risk to be screened positive for psychological disorder after severe PPH (OR = 0.33 [IC95% 0.15-0.69], p = 0.004, and after propensity score matching (OR=0.34 [IC95% 0.12-0.94], p = 0.04)). Low hemoglobin values during severe PPH management were associated with a higher risk of being screened positive for psychological disorders. Finally, we did not find differences in desire or pregnancy between patients without or with psychological disorders occurring in the year after severe PPH. **Discussion:** Severe PPH was associated with significant psychosocial morbidity including anxiety, post-traumatic disorder, and depression. This should engage a psychological follow-up. Large cohorts are urgently needed to confirm our results.

91. Ansari T, Wani S, Hofmann A, Shetty N, Sangani K, Stamp CJ, Murray K, Trentino KM. **Outcomes Associated with a Patient Blood Management Program in Major Obstetric Hemorrhage: A Retrospective Cohort Study.** Anesth Analg. 2024 Nov 21.

Background: Obstetric patient blood management (PBM) strategies were used at Corniche Hospital in 2018, initially focusing on minimizing bleeding, with other clinical strategies implemented incrementally. This study assesses program outcomes in patients with major obstetric hemorrhage of 2000 mL or greater. **Methods:** A retrospective study of 353 women admitted to The Corniche Hospital between 2018 and 2023 who experienced major obstetric hemorrhage of 2000 mL or greater. The primary outcome measure was units of red blood cell (RBC), fresh-frozen plasma (FFP), and platelet units transfused. Secondary outcomes included pretransfusion hemoglobin in patients with no active bleeding, hemoglobin levels 3 weeks postdischarge, anemia predelivery, blood product-acquisition cost savings, mortality, composite morbidity (transfusion reaction, acute lung injury, thrombosis, sepsis, postpartum hysterectomy), hospital and high-dependency unit length of stay, and all-cause emergency readmissions within 28 days. **Results:** Comparing baseline (2018) with the final year (2023), the mean units of RBCs, FFP, and platelets transfused per admission decreased from 4.18 to 0.67 (P -trend <.001), resulting in blood acquisition savings of US$ 175,705. Over the same period the percentage of women anemic predelivery decreased from 40.3% to 23.8% (P -trend = 0.015) and the mean pretransfusion hemoglobin level in nonactively bleeding patients decreased from 7.54 g/dL to 6.35 g/dL (P -trend < .001). The mean hemoglobin rise 3 weeks postdischarge increased from 2.41 g/dL in 2018 to 4.26 g/dL in 2023. There were no changes in adjusted composite morbidity, hospital, or high-dependency unit length of stay. **Conclusions:** In women with a major obstetric hemorrhage of 2000 mL or greater, the implementation of an obstetric PBM program was associated with reduced blood product utilization, reduced costs, reduced anemia, and increased hemoglobin rise postdischarge.

92. Sugrue RP, Olsen J, Abi Antoun ME, Skalla LA, Cate J, James AH, Stonehill A, Watkins V, Telen MJ, Federspiel JJ. **Standard Compared With Extended Red Blood Cell Antigen Matching for Prevention of Subsequent Hemolytic Disease of the Fetus and Newborn: A Systematic Review**. Obstet Gynecol. 2024 Oct 1;144(4):444-453.

Objective: To systematically review and meta-analyze alloimmunization among recipients of red blood cells (RBCs) matched for ABO blood type and Rhesus D (ABO+D) antigen compared with those also matched for c, E, and Kell (cEK). **Data sources:** Four online databases (Medline, Scopus, EMBASE, ClinicalTrials.gov) were searched from March 28, 2023, to April 1, 2024. The search protocol was peer reviewed and published on PROSPERO (CRD42023411620). **Methods of study selection:** Studies reporting alloimmunization as the primary outcome among recipients of RBCs matched for ABO+D or additional cEK matching were included. Patients transfused with unmatched RBCs or a mixture of matching regimens were excluded. Risk of bias was assessed with Cochrane Tool to Assess Risk of Bias in Cohort Studies and Tool for Risk of Bias. Random-effects meta-analysis was used to combine effect estimates. **Tabulation, integration, and results:** Ten studies met criteria. Risk of bias was low. Overall, 91,221 patients were transfused, of whom 40,220 (44.1%) received additional cEK-matched RBCs. The overall rate of alloimmunization was 6.2% (95% CI, 2.5-14.9%) for ABO+D-only matching and 1.9% (95% CI, 0.7-5.1%) when cEK was added. Time of follow-up antibody testing ranged from 6 to 18 months after transfusion. Additional cEK match was associated with significantly less alloimmunization compared with standard ABO+D match (odds ratio [OR] 0.37, 95% CI, 0.20-

0.69). This association remained when chronically transfused patients were excluded (OR 0.65, 95% CI, 0.54-0.79) and for alloimmunization to c, E, or K antigens only (OR 0.29, 95% CI, 0.18-0.47). **Conclusion:** Additional cEK RBC matching protocols were associated with lower odds of recipient alloimmunization. Given severe sequelae of alloimmunization in pregnancy, routine cEK matching for transfusion in people with pregnancy potential younger than age 50 years in the United States merits consideration.

93. Phillips JM, Larkin J, Waters JH, Tamura T, Sakamoto S. **Maternal outcomes following postpartum autotransfusion of blood lost during vaginal obstetric hemorrhage**. Transfusion. 2024 Jan;64(1):77-84. doi: 10.1111/trf.17603. Epub 2023 Nov 24.

Background: Autotransfusion following vaginal delivery has not been as widely adopted and existing data on this topic are limited to small case series. **Methods:** This is a single-center retrospective matched cohort study. Deliveries exposed to autotransfusion during obstetric hemorrhage were matched to unexposed controls with obstetric hemorrhage who did not receive autotransfusion. The primary outcome was allogeneic transfusion of packed red blood cells. Planned secondary analyses included change in hemoglobin following delivery, composite maternal safety outcomes, and unplanned postpartum health care utilization. **Results:** Thirty-six deliveries exposed to autotransfusion were matched to 144 unexposed controls. There was no significant difference in allogenic transfusion of packed red blood cells in the patients exposed to autotransfusion red with unexposed controls (adjusted OR 1.1; 95% CI 0.5-2.4). Deliveries that received autotransfusion had a less severe pre- to post-delivery decline in hemoglobin compared with unexposed controls across all values of QBL (p = .003). There were no significant differences in maternal morbidity outcomes evaluated in exposed versus unexposed deliveries. **Conclusion:** Autotransfusion in cases of vaginal obstetric hemorrhage did not attenuate rates of allogenic packed red blood cell transfusion but did result in a less severe pre- to postdelivery decline in hemoglobin at discharge. Autotransfusion cases did not have any markers of increased maternal morbidity when compared with a control group. These findings support emerging evidence indicating that autotransfusion of blood lost during vaginal obstetric hemorrhage is a safe and potentially effective tool for use in the management of obstetric hemorrhage.

94. Einerson BD, Healy AJ, Lee A, Warrick C, Combs CA, Hameed AB. **Society for Maternal-Fetal Medicine Special Statement: Emergency checklist, planning worksheet, and system preparedness bundle for placenta accreta spectrum.** Am J Obstet Gynecol. 2024 Jan;230(1):B2-B11.

Placenta accreta spectrum is a life-threatening complication of pregnancy that is underdiagnosed and can result in massive hemorrhage, disseminated intravascular coagulation, massive transfusion, surgical injury, multisystem organ failure, and even death. Given the rarity and complexity, most obstetrical hospitals and providers do not have comprehensive expertise in the diagnosis and management of placenta accreta spectrum. Emergency management, antenatal interdisciplinary planning, and system preparedness are key pillars of care for this life-threatening disorder. We present an updated sample checklist for emergent and unplanned cases, an antenatal planning worksheet for known or suspected cases, and a bundle of activities to improve system and team preparedness for placenta accreta spectrum.

95. Bonsen LR, Sleijpen K, Hendriks J, Urlings TAJ, Dekkers OM, le Cessie S, van de Velde M, Gurung P, van den Akker T, van der Bom JG, Henriquez DDCA. **Prophylactic Radiologic Interventions for Postpartum Hemorrhage Control in Women With Placenta Accreta Spectrum Disorder: A Systematic Review and Meta-analysis.** Obstet Gynecol. 2024 Sep 1;144(3):315-327.

Objective: To quantify the association between prophylactic radiologic interventions and perioperative blood loss during cesarean delivery in women with placenta accreta spectrum disorder through a systematic review and network meta-analysis.

Data sources: On January 3, 2023, a literature search was conducted in PubMed, EMBASE, Cochrane Library, and Web of Science. We also checked ClinicalTrials.gov retrospectively. Prophylactic radiologic interventions to reduce bleeding during cesarean delivery involved preoperative placement of balloon catheters, distal (internal or common iliac arteries) or proximal (abdominal aorta), or sheaths (uterine arteries). The primary outcome was volume of blood loss; secondary outcomes were the number of red blood cell units transfused and adverse events. Studies including women who received an emergency cesarean delivery were excluded.

Methods of study selection: Two authors independently screened citations for relevance, extracted data, and assessed the risk of bias of individual studies with the Cochrane Risk of Bias in Non-randomized Studies of Interventions tool.

Tabultation, integration, and results: From a total of 1,332 screened studies, 50 were included in the final analysis, comprising 5,962 women. These studies consisted of two randomized controlled trials and 48 observational studies. Thirty studies compared distal balloon occlusion with a control group, with a mean difference in blood loss of -406 mL (95% CI, -645 to -167). Fourteen studies compared proximal balloon occlusion with a control group, with a mean difference of -1,041 mL (95% CI, -1,371 to -710). Sensitivity analysis excluding studies with serious or critical risk of bias provided similar results. Five studies compared uterine artery embolization with a control group, all with serious or critical risk of bias; the mean difference was -936 mL (95% CI, -1,522 to -350). Reported information on adverse events was limited.

Conclusion: Although the predominance of observational studies in the included literature warrants caution in interpreting the findings of this meta-analysis, our findings suggest that prophylactic placement of balloon catheters or sheaths before planned cesarean delivery in women with placenta accreta spectrum disorder may, in some cases, substantially reduce perioperative blood loss. Further study is required to quantify the efficacy according to various severities of placenta accreta spectrum disorder and the associated safety of these radiologic interventions.

96. Holland E, Richards JL, Langlois WO, Zhu J, Achu-Lopes RA, Brook K. **Ethical and Medicolegal Issues: When Obstetric Patients Who Refuse Blood Products Change Their Minds**. Anesth Analg. 2024 Jan 1;138(1):89-95.

While most Jehovah's Witnesses (JW) will reject major blood components (red cells, plasma, and platelets), some may accept minor components such as albumin, while others accept cell salvage. During postpartum hemorrhage, the authors argue that to respect the core principle of patient autonomy, clinicians should reassess a patient's wishes midcrisis with consideration of (1) the patient's decision-making capacity and (2) the patient's identity and values. The authors provide suggestions for how physicians should assess a JW patient's decision-making capacity and attempt to

assess the alignment of her wishes with her values midcrisis, while minimizing coercion. The variability in legal rulings highlights the legal and moral ambiguity that exists around the care of JW patients and underscores the need for guidance when physicians encounter a JW obstetric patient in crisis. While these challenging scenarios may be rare, this practical approach offers actionable steps to optimize the care of hemorrhaging JW pregnant patients.

Postpartum Recovery/Patient Experience

97. Ansari J, Sheikh M, Riley E, Guo N, Traynor A, Carvalho B. **A retrospective cohort study of the anesthetic management of postpartum tubal ligation. Int J Obstet Anesth**. 2024 May;58:103974.

    Background: Neuraxial anesthesia with reactivation of a labor epidural catheter is commonly utilized for postpartum tubal ligations (PPTL), although the optimal anesthetic approach is unknown. We assessed institutional anesthesia practices for PPTL, and evaluated the failure rates of reactivation of labor epidural catheters, de novo spinal anesthesia, and spinal anesthesia after failed blocks. **Methods:** We conducted a single-center retrospective cohort analysis of 300 consecutive patients who underwent a PPTL and 100 having spinal anesthesia for cesarean delivery. Anesthetic management data (existing labor epidural catheter reactivation, de novo spinal anesthesia or general anesthesia) were collected from electronic medical records. Anesthetic block failure rates were determined for each anesthetic technique. **Results:** The failure rate was 15% for de novo spinal anesthesia and 23% after failed reactivation of a labor epidural catheter or spinal anesthesia. The epidural catheter reactivation failure rate was 35%. The failure rate of spinal anesthesia for cesarean delivery was 4%. Drug dosage, epidural catheter use in labor, time since epidural catheter placement or delivery, labor neuraxial technique (combined spinal-epidural, epidural), supplemental top-up doses during labor, and anesthesiologist experience did not predict neuraxial anesthesia failures. **Conclusions:** Our analysis revealed an unexpectedly high neuraxial anesthesia failure rate even when de novo spinal anesthesia was used for PPTL. The results are consistent with other institutions' recent findings, and are higher than spinal anesthesia failure rates associated with cesarean delivery. Further studies are required to determine optimal anesthesia dosing strategies, and to understand the mechanisms behind high neuraxial anesthesia failures for PPTL.

98. Kountanis JA, Vogel TM. **Unveiling the Anesthesiologist's Impact on Childbirth-Related Posttraumatic Stress Disorder**. Anesth Analg. 2024 Dec 1;139(6):1156-1158.

    This review raises awareness of childbirth-related posttraumatic stress disorder (CB-PTSD) to anesthesiologists that may not be as familiar with the condition. There is a relatively high prevalence of CB-PTSD, which translates to a high likelihood that anesthesiologists practicing in obstetrics will care for a patient with this condition over the course of their career and should educate themselves about CB-PTSD. Implementing trauma informed care and promptly addressing patients' pain during cesarean delivery are important quality improvement initiatives that can positively affect patient outcomes.

99. Burgart A, Sutton C. **Chemical Restraints for Obstetric Violence: Anesthesiology Professionals, Moral Courage, and the Prevention of Forced and Coerced Surgeries.** Am J Bioeth. 2024 Feb;24(2):4-7.

This editorial discusses the unique position anesthesiologists are in to prevent and mitigate obstetric violence. In the case of forced interventions, chemical restraint both directly harms patients and facilitates surgical harm to patients. This practice is clearly in violation of our core responsibilities to respect patient self-determination and prevent harm. To use anesthesia to force patients with capacity to undergo unwanted surgery is a reprehensible liberty violation. Anesthesiology professionals must demonstrate moral courage, elevate patients' autonomy, and serve as protectors against forced surgeries rather than complicit participants.

100. Dekel S, Papadakis JE, Quagliarini B, Pham CT, Pacheco-Barrios K, Hughes F, Jagodnik KM, Nandru R. **Preventing posttraumatic stress disorder following childbirth: a systematic review and meta-analysis**. Am J Obstet Gynecol. 2024 Jun;230(6):610-641.e14.

Objective: Women can develop posttraumatic stress disorder in response to experienced or perceived traumatic, often medically complicated, childbirth; the prevalence of these events remains high in the United States. Currently, no recommended treatment exists in routine care to prevent or mitigate maternal childbirth-related posttraumatic stress disorder. We conducted a systematic review and meta-analysis of clinical trials that evaluated any therapy to prevent or treat childbirth-related posttraumatic stress disorder. **Data sources:** PsycInfo, PsycArticles, PubMed (MEDLINE), ClinicalTrials.gov, CINAHL, ProQuest, Sociological Abstracts, Google Scholar, Embase, Web of Science, ScienceDirect, Scopus, and the Cochrane Central Register of Controlled Trials (CENTRAL) were searched for eligible trials published through September 2023. **Study eligibility criteria:** Trials were included if they were interventional, if they evaluated any therapy for childbirth-related posttraumatic stress disorder for the indication of symptoms or before posttraumatic stress disorder onset, and if they were written in English. **Methods:** Independent coders extracted the sample characteristics and intervention information of the eligible studies and evaluated the trials using the Downs and Black's quality checklist and Cochrane's method for risk of bias evaluation. Meta-analysis was conducted to evaluate pooled effect sizes of secondary and tertiary prevention trials. **Results:** A total of 41 studies (32 randomized controlled trials, 9 nonrandomized trials) were reviewed. They evaluated brief psychological therapies including debriefing, trauma-focused therapies (including cognitive behavioral therapy and expressive writing), memory consolidation and reconsolidation blockage, mother-infant-focused therapies, and educational interventions. The trials targeted secondary preventions aimed at buffering childbirth-related posttraumatic stress disorder usually after traumatic childbirth (n=24), tertiary preventions among women with probable childbirth-related posttraumatic stress disorder (n=14), and primary prevention during pregnancy (n=3). A meta-analysis of the combined randomized secondary preventions showed moderate effects in reducing childbirth-related posttraumatic stress disorder symptoms when compared with usual treatment (standardized mean difference, -0.67; 95% confidence interval, -0.92 to -0.42). Single-session therapy within 96 hours of birth was helpful (standardized mean difference, -0.55). Brief, structured, trauma-focused therapies and semi-structured, midwife-led, dialogue-based psychological counseling showed the largest effects (standardized mean difference, -0.95 and -0.91, respectively). Other treatment approaches (e.g., the Tetris game, mindfulness, mother-infant-focused treatment) warrant more research. Tertiary preventions produced smaller effects than secondary prevention but are potentially clinically meaningful (standardized mean difference, -0.37; -0.60 to -0.14). Antepartum educational approaches may help, but insufficient empirical evidence exists. **Conclusion:** Brief trauma-focused and non-trauma-focused psychological therapies delivered early in the period following traumatic childbirth offer a critical and feasible opportunity to buffer the symptoms of childbirth-related

posttraumatic stress disorder. Future research that integrates diagnostic and biological measures can inform treatment use and the mechanisms at work.

101. Arora IH, Woscoboinik GG, Mokhtar S, Quagliarini B, Bartal A, Jagodnik KM, Barry RL, Edlow AG, Orr SP, Dekel S. **A diagnostic questionnaire for childbirth related posttraumatic stress disorder: a validation study**. Am J Obstet Gynecol. 2024 Jul;231(1):134.e1-134.e13.

Background: Labor and delivery can entail complications and severe maternal morbidities that threaten a woman's life or cause her to believe that her life is in danger. Women with these experiences are at risk for developing posttraumatic stress disorder. Postpartum posttraumatic stress disorder, or childbirth-related posttraumatic stress disorder, can become an enduring and debilitating condition. At present, validated tools for a rapid and efficient screen for childbirth-related posttraumatic stress disorder are lacking. **Objective:** We examined the diagnostic validity of the Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, for detecting posttraumatic stress disorder among women who have had a traumatic childbirth. This Checklist assesses the 20 Diagnostic and Statistical Manual of Mental Disorders, posttraumatic stress disorder symptoms and is a commonly used patient-administrated screening instrument. Its diagnostic accuracy for detecting childbirth-related posttraumatic stress disorder is unknown. **Study design:** The sample included 59 patients who reported a traumatic childbirth experience determined in accordance with the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, posttraumatic stress disorder criterion A for exposure involving a threat or potential threat to the life of the mother or infant, experienced or perceived, or physical injury. The majority (66%) of the participants were less than 1 year postpartum (for full sample: median, 4.67 months; mean, 1.5 years) and were recruited via the Mass General Brigham's online platform, during the postpartum unit hospitalization or after discharge. Patients were instructed to complete the Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, concerning posttraumatic stress disorder symptoms related to childbirth. Other comorbid conditions (ie, depression and anxiety) were also assessed. They also underwent a clinician interview for posttraumatic stress disorder using the gold-standard Clinician-Administered PTSD Scale for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. A second administration of the Checklist was performed in a subgroup (n=43), altogether allowing an assessment of internal consistency, test-retest reliability, and convergent and diagnostic validity of the Checklist. The diagnostic accuracy of the Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, in reference to the Clinician-Administered PTSD Scale for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, was determined using the area under the receiver operating characteristic curve; an optimal cutoff score was identified using the Youden's J index. **Results:** One-third of the sample (35.59%) met the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, criteria for a posttraumatic stress disorder diagnosis stemming from childbirth. The Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, symptom severity score was strongly correlated with the Clinician-Administered PTSD Scale for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, total score (ρ=0.82; P<.001). The area under the receiver operating characteristic curve was 0.93 (95% confidence interval, 0.87-0.99), indicating excellent diagnostic performance of the Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. A cutoff value of 28 optimized the sensitivity (0.81) and specificity (0.90) and correctly diagnosed 86% of women. A higher value (32) identified individuals with more severe posttraumatic

stress disorder symptoms (specificity, 0.95), but with lower sensitivity (0.62). Checklist scores were also stable over time (intraclass correlation coefficient, 0.73), indicating good test-retest reliability. Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, scores were moderately correlated with the depression and anxiety symptom scores (Edinburgh Postnatal Depression Scale: ρ=0.58; P<.001 and the Brief Symptom Inventory, anxiety subscale: ρ=0.51; P<.001). **Conclusion:** This study demonstrates the validity of the Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, as a screening tool for posttraumatic stress disorder among women who had a traumatic childbirth experience. The instrument may facilitate screening for childbirth-related posttraumatic stress disorder on a large scale and help identify women who might benefit from further diagnostics and services. Replication of the findings in larger, postpartum samples is needed.

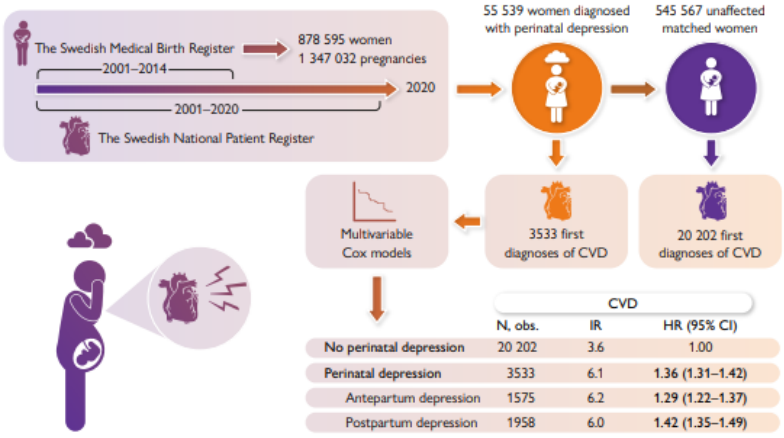
102. Horsch A, Garthus-Niegel S, Ayers S, Chandra P, Hartmann K, Vaisbuch E, Lalor J. **Childbirth-related posttraumatic stress disorder: definition, risk factors, pathophysiology, diagnosis, prevention, and treatment**. Am J Obstet Gynecol. 2024 Mar;230(3S):S1116-S1127.

Psychological birth trauma and childbirth-related posttraumatic stress disorder represent a substantial burden of disease with 6.6 million mothers and 1.7 million fathers or co-parents affected by childbirth-related posttraumatic stress disorder worldwide each year. There is mounting evidence to indicate that parents who develop childbirth-related posttraumatic stress disorder do so as a direct consequence of a traumatic childbirth experience. High-risk groups, such as those who experience preterm birth, stillbirth, or preeclampsia, have higher prevalence rates. The main risks include antenatal factors (eg, depression in pregnancy, fear of childbirth, poor health or complications in pregnancy, history of trauma or sexual abuse, or mental health problems), perinatal factors (eg, negative subjective birth experience, operative birth, obstetrical complications, and severe maternal morbidity, as well as maternal near misses, lack of support, dissociation), and postpartum factors (eg, depression, postpartum physical complications, and poor coping and stress). The link between birth events and childbirth-related posttraumatic stress disorder provides a valuable opportunity to prevent traumatic childbirths and childbirth-related posttraumatic stress disorder from occurring in the first place. Childbirth-related posttraumatic stress disorder is an extremely distressing mental disorder and has a substantial negative impact on those who give birth, fathers or co-parents, and, potentially, the whole family. Still, a traumatic childbirth experience and childbirth-related posttraumatic stress disorder remain largely unrecognized in maternity services and are not routinely screened for during pregnancy and the postpartum period. In fact, there are gaps in the evidence on how, when, and who to screen. Similarly, there is a lack of evidence on how best to treat those affected. Primary prevention efforts (eg, screening for antenatal risk factors, use of trauma-informed care) are aimed at preventing a traumatic childbirth experience and childbirth-related posttraumatic stress disorder in the first place by eliminating or reducing risk factors for childbirth-related posttraumatic stress disorder. Secondary prevention approaches (eg, trauma-focused psychological therapies, early psychological interventions) aim to identify those who have had a traumatic childbirth experience and to intervene to prevent the development of childbirth-related posttraumatic stress disorder. Tertiary prevention (eg, trauma-focused cognitive behavioural therapy and eye movement desensitization and reprocessing) seeks to ensure that people with childbirth-related posttraumatic stress disorder are identified and treated to recovery so that childbirth-related posttraumatic stress disorder does not become chronic. Adequate prevention, screening, and intervention could alleviate a considerable amount of suffering in affected families. In light of the available research on the impact of childbirth-related posttraumatic

stress disorder on families, it is important to develop and evaluate assessment, prevention, and treatment interventions that target the birthing person, the couple dyad, the parent-infant dyad, and the family as a whole. Further research should focus on the inclusion of couples in different constellations and, more generally, on the inclusion of more diverse populations in diverse settings. The paucity of national and international policy guidance on the prevention, care, and treatment of psychological birth trauma and the lack of formal psychological birth trauma services and training, highlight the need to engage with service managers and policy makers.

103. Hagatulah N, Bränn E, Oberg AS, Valdimarsdóttir UA, Shen Q, Lu D. **Perinatal depression and risk of mortality: nationwide, register based study in Sweden**. BMJ. 2024 Jan 10;384:e075462.

Objective: To determine whether women with perinatal depression are at an increased risk of death compared with women who did not develop the disorder, and compared with full sisters. **Design:** Nationwide, register based study. **Setting**: Swedish national registers, 1 January 2001 to 31 December 2018.**Participants:** 86 551 women with a first ever diagnosis of perinatal depression ascertained through specialised care and use of antidepressants, and 865 510 women who did not have perinatal depression were identified and matched based on age and calendar year at delivery. To address familial confounding factors, comparisons were made between 270 586 full sisters (women with perinatal depression (n=24 473) and full sisters who did not have this disorder (n=246 113)), who gave at least one singleton birth during the study period. **Main outcome measures:** Primary outcome was death due to any cause. Secondary outcome was cause specific deaths (ie, unnatural and natural causes). Multivariable Cox regression was used to estimate hazard ratios of mortality comparing women with perinatal depression to unaffected women and sisters, taking into account several confounders. The temporal patterns of perinatal depression and differences between antepartum and postpartum onset of perinatal depression were also studied. **Results:** 522 deaths (0.82 per 1000 person years) were reported among women with perinatal depression diagnosed at a median age of 31.0 years (interquartile range 27.0 to 35.0) over up to 18 years of follow-up. Compared with women who did not have perinatal depression, women with perinatal depression were associated with an increased risk of death (adjusted hazard ratio 2.11 (95% confidence interval 1.86 to 2.40)); similar associations were reported among women who had and did not have pre-existing psychiatric disorder. Risk of death seemed to be increased for postpartum than for antepartum depression (hazard ratio 2.71 (95% confidence interval 2.26 to 3.26) v 1.62 (1.34 to 1.94)). A similar association was noted for perinatal depression in the sibling comparison (2.12 (1.16 to 3.88)). The association was most pronounced within the first year after perinatal depression but remained up to 18 years after start of follow up. An increased risk was associated with both unnatural and natural causes of death among women with perinatal depression (4.28 (3.44 to 5.32) v (1.38 (1.16



to 1.64)), with the strongest association noted for suicide (6.34 (4.62 to 8.71)), although suicide was rare (0.23 per 1000 person years).**Conclusions:** Even when accounting for familial factors, women with clinically diagnosed perinatal depression were associated with an increased risk of death, particularly during the first year after diagnosis and because of suicide. Women who are affected, their families, and health professionals should be aware of these severe health hazards after perinatal depression.

104. Zivin K, Zhong C, Rodríguez-Putnam A, Spring E, Cai Q, Miller A, Johns L, Kalesnikava VA, Courant A, Mezuk B. **Suicide Mortality During the Perinatal Period.** JAMA Netw Open. 2024 Jun 3;7(6):e2418887.

Importance: The US has the highest maternal mortality rate among developed countries. The Centers for Disease Control and Prevention deems nearly all of these deaths preventable, especially those attributable to mental health conditions. Coordination between US health care and social service systems could help further characterize circumstances and risks associated with perinatal suicide mortality. **Objective:** To examine contextual and individual precipitating circumstances and risks associated with perinatal suicide. **Design, setting, and participants:** This cross-sectional observational study used a convergent mixed methods design to explore factors contributing to maternal suicides and deaths of undetermined intent (hereinafter, undetermined deaths) identified in National Violent Death Reporting System (NVDRS) data for January 1, 2003, to December 31, 2021. Analyses included decedents who were aged 10 to 50 years and pregnant or post partum at death (collectively, the perinatal group) and demographically matched female decedents who were not pregnant or recently pregnant (nonperinatal group) at death. Analyses were performed between December 2022 and December 2023. **Exposures:** Pregnancy status at death (perinatal or nonperinatal). **Main outcomes and measures:** The main outcomes included contributing circumstances associated with suicides and undetermined deaths cited in coroner, medical examiner, or law enforcement case narratives. The study examined quantitative differences between groups using a matched analysis and characterized key themes of salient suicide circumstances using qualitative content analysis. **Results:** This study included 1150 perinatal decedents identified in the NVDRS: 456 (39.6%) were pregnant at death, 203 (17.7%) were pregnant within 42 days of death, and 491 (42.7%) were pregnant within 43 to 365 days before death, yielding 694 postpartum decedents. The nonperinatal comparison group included 17 655 female decedents aged 10 to 50 years. The mean (SD) age was 29.1 (7.4) years for perinatal decedents and 35.8 (10.8) years for nonperinatal decedents. Compared with matched nonperinatal decedents, perinatal decedents had higher odds of the following identified contributing circumstances: intimate partner problems (IPPs) (odds ratio [OR], 1.45 [95% CI, 1.23-1.72]), recent argument (OR, 1.33 [95% CI, 1.09-1.61]), depressed mood (OR, 1.39 [95% CI, 1.19-1.63]), substance abuse or other abuse (OR, 1.21 [95% CI, 1.03-1.42]), physical health problems (OR, 1.37 [95% CI, 1.09-1.72]), and death of a family member or friend (OR, 1.47 [95% CI, 1.06-2.02]). The findings of the qualitative analysis emphasized the importance of mental health and identified 128 decedents (12.4%) with postpartum depression. **Conclusions and relevance:** This study provides insights into complex factors surrounding maternal suicide, and it highlights opportunities for further research to understand long-term consequences of perinatal mental health. These findings also underscore the need for targeted evidence-based interventions and effective policies targeting mental health, substance use, and IPPs to prevent maternal suicide and enhance maternal health outcomes.

105. Lu D, Valdimarsdóttir UA, Wei D, Chen Y, Andreassen OA, Fang F, László KD, Bränn E. **Perinatal depression and risk of maternal cardiovascular disease: a Swedish nationwide study.** Eur Heart J. 2024 Aug 16;45(31):2865-2875.

Background and aims: Increasing evidence suggests that some reproductive factors/hazards are associated with a future risk of cardiovascular disease (CVD) in women. While major (non-perinatal) depression has consistently been associated with CVD, the long-term risk of CVD after perinatal depression (PND) is largely unknown. **Methods:** A nationwide population-based matched cohort study involving 55 539 women diagnosed with PND during 2001-14 in Sweden and 545 567 unaffected women individually matched on age and year of conception/delivery was conducted. All women were followed up to 2020. Perinatal depression and CVD were identified from Swedish national health registers. Using multivariable Cox models, hazard ratios (HR) of any and type-specific CVD according to PND were estimated. **Results:** The mean age at the PND diagnosis was 30.8 [standard deviation (SD) 5.6] years. During the follow-up of up to 20 years (mean 10.4, SD 3.6), 3533 (6.4%) women with PND (expected number 2077) and 20 202 (3.7%) unaffected women developed CVD. Compared with matched unaffected women, women with PND had a 36% higher risk of developing CVD [adjusted HR = 1.36, 95% confidence interval (CI): 1.31-1.42], while compared with their sisters, women with PND had a 20% higher risk of CVD (adjusted HR = 1.20, 95% CI 1.07-1.34). The results were most pronounced in women without a history of psychiatric disorder (P for interaction < .001). The association was observed for all CVD subtypes, with the highest HR in the case of hypertensive disease (HR = 1.50, 95% CI: 1.41-1.60), ischaemic heart disease (HR = 1.37, 95% CI: 1.13-1.65), and heart failure (HR 1.36, 95% CI: 1.06-1.74). **Conclusions:** Women with PND are at higher risk of CVD in middle adulthood. Reproductive history, including PND, should be considered in CVD risk assessments of women.

106. Perry MF, Bui L, Yee LM, Feinglass J. **Association Between State Paid Family and Medical Leave and Breastfeeding, Depression, and Postpartum Visits**. Obstet Gynecol. 2024 Jan 1;143(1):14-22.

Objective: To evaluate the association of state paid family and medical leave policies with the likelihood of breastfeeding, postpartum depression symptoms, and attendance of the postpartum visit. **Methods:** This was a cross-sectional study that used 2016-2019 data from PRAMS (Pregnancy Risk Assessment Monitoring System) for 43 states and Washington, DC. We describe the association of state paid family and medical leave generosity with rates of breastfeeding, postpartum depression symptoms, and attendance of the postpartum visit. Logistic and Poisson regression models tested the significance of state paid family and medical leave coverage generosity after controlling for individual respondent sociodemographic characteristics, with sensitivity analyses for respondents with deliveries covered by Medicaid insurance. **Results:** Of the 143,131 respondents, representative of an estimated 7,426,725 population, 26.2% lived in eight states and DC with the most generous paid family and medical leave, 20.5% lived in nine states with some paid family and medical leave, and 53.3% lived in 26 states with little or no paid family and medical leave. Overall, 54.8% reported breastfeeding at 6 months or at time of the survey, ranging from 59.5% in the most generous paid family and medical leave states to 51.0% in states with the least paid family and medical leave coverage. Postpartum depression symptoms varied from 11.7% in the most generous states to 13.3% in the least generous states (both P <.001). State differences in postpartum visit attendance rates (90.9% overall) did not differ significantly. After adjusting for respondent characteristics, compared with states with the least paid family and medical leave, breastfeeding was 9% more likely (adjusted

incidence rate ratio [aIRR] 1.09, 95% CI, 1.07-1.11) in states with the strongest paid family and medical leave coverage and 32% more likely (aIRR 1.32, 95% CI, 1.25-1.39) in analyses limited to respondents with deliveries covered by Medicaid insurance. A more generous state paid family and medical leave policy was significantly associated with a lower likelihood of postpartum depression symptoms compared with states with the least paid family and medical leave (adjusted odds ratio 0.85, 95% CI, 0.76-0.94) and a modest but significant increase in postpartum visit attendance (aIRR 1.03, 95% CI, 1.01-1.04) among respondents with deliveries covered by Medicaid insurance. **Conclusion:** Respondents from states with strong paid family and medical leave had a greater likelihood of breastfeeding and had lower odds of postpartum depression symptoms, with stronger associations among respondents with deliveries covered by Medicaid insurance. Despite major potential health benefits of paid family and medical leave, the United States remains one of the few countries without federally mandated paid parental leave.

107. Xu S, Zhou Y, Wang S, Li Q, Feng Y, Chen L, Duan K. **Perioperative intravenous infusion of dexmedetomidine for alleviating postpartum depression after cesarean section: A meta-analysis and systematic review.** Eur J Obstet Gynecol Reprod Biol. 2024 May;296:333-341.

The efficacy of perioperative dexmedetomidine (DEX) infusion as a precaution against postpartum depression (PPD) in women undergoing cesarean section has not been substantiated systematically. A literature search for RCTs on DEX against PPD was retrieved in the following databases from inception to January 3, 2024: PubMed, Embase, Web of Science, the Cochrane Library, CNKI, Wanfang, CBM, VIP, etc. A total of 13 RCTs with 1711 participants were included. Meta-analysis was performed by RevMan5.3 and Stata16 using a random-effects model. EPDS scores were significantly decreased in the DEX group within one week or over one week postpartum compared to the control group (SMD = -1.25, 95 %CI: -1.73 to -0.77; SMD = -1.08, 95 %CI: -1.43 to -0.73). The prevalence of PPD was significantly inferior to the control at both time points (RR = 0.36, 95 %CI: 0.24 to 0.54; RR = 0.39, 95 %CI: 0.26 to 0.57). Univariate meta-regression suggested that age influenced the heterogeneity of the EPDS scores (P = 0.039), and DEX infusion dose was a potential moderator (P = 0.074). The subgroup analysis results of PPD scores at both time points were consistent, showing that: ① Mothers younger than 30 years old had better sensitivity to DEX for treating PPD. ② The anti-PPD efficacy of continuous infusion of DEX by PCIA was superior to both single infusion and combined infusion. ③ DEX showed a better anti-PPD effect when the total infusion dose was ≤ 2 μg/kg. Moreover, DEX improved analgesia and sleep quality, provided appropriate sedation, and reduced the incidence of nausea, vomiting, and chills. The current evidence confirmed the prophylaxis and superiority of DEX for PPD. More high-quality, large-scale RCTs are required for verifying the reliability and formulating administration methods.

108. Esalatmanesh S, Kashani L, Khooshideh M, Moghaddam HS, Ansari S, Akhondzadeh S. **Efficacy and safety of celecoxib for treatment of mild to moderate postpartum depression: a randomized, double-blind, placebo-controlled trial.** Arch Gynecol Obstet. 2024 Apr;309(4):1429-1439.

Purpose: Evidence has demonstrated the roles of inflammatory processes in pathogenesis of depression. We aim to assess the effects of adjunctive celecoxib with cognitive behavioral therapy (CBT), an anti-inflammatory agent, in treatment of postpartum depression and on levels of Brain-derived neurotrophic factor (BDNF) and inflammatory cytokines. **Methods:** This was a randomized, double-blind, placebo-controlled trial to investigate the effects of adjunctive celecoxib with CBT on

postpartum depression. Fifty outpatient women with postpartum depression, participated in this study. Patients randomly received either a celecoxib capsule twice a day or a placebo capsule twice a day for 6 weeks. Patients were assessed using the Hamilton Depression Rating Scale (HDRS) and the adverse event checklist at baseline and weeks 2, 4, and 6. **Results:** Patients in the celecoxib group showed a greater decline in HDRS scores from baseline to all three study time points compared to the placebo group ($p = 0.12$ for week 2, $p = 0.001$ for week 4, $p < 0.001$ for week 6). Rate of response to treatment was significantly higher in the celecoxib group compared to the placebo group at week 4 (60 vs 24%, $p = 0.010$) and week 6 (96 vs 44%, $p < 0.001$). Rate of remission was significantly higher in the celecoxib group compared to the placebo group at week 4 (52 vs 20%, $p = 0.018$) and week 6 (96 vs 36%, $p < 0.001$). Levels of most inflammatory markers were significantly lower in the celecoxib group compared to the placebo group at week 6. Levels of BDNF were significantly higher in the celecoxib group compared to the placebo group at week 6 ($p < 0.001$). **Conclusions:** Findings suggest adjunctive celecoxib is an effective treatment for the improvement of postpartum depressive symptoms.

109. Hung KC, Kao CL, Lai YC, Chen JY, Lin CH, Ko CC, Lin CM, Chen IW. **Perioperative administration of sub-anesthetic ketamine/esketamine for preventing postpartum depression symptoms: A trial sequential meta-analysis**. PLoS One. 2024 Nov 18;19(11):e0310751.

Objective: Postpartum depression (PPD) is a major mental health issue affecting 10%-15% of women globally. This meta-analysis synthesized updated evidence on sub-anesthetic ketamine/esketamine's efficacy in preventing PPD. **Methods:** Randomized controlled trials (RCTs) comparing ketamine/esketamine to a placebo for PPD prevention were searched without language restriction. Primary outcomes were PPD risk at 1- and 4-6-week postpartum. Secondary outcomes included the difference in depression scores and risk of adverse events. Trial sequential analysis (TSA) was conducted to validate the reliability. **Results:** A meta-analysis of 22 RCTs (n = 3,463) showed that ketamine/esketamine significantly decreased PPD risk at 1- (risk ratio [RR], 0.41; 95% confidence interval [CI], 0.3-0.57) and 4-6-week (RR, 0.47; 95%CI, 0.35-0.63) follow-ups. Consistently, participants receiving ketamine/esketamine had lower depression-related scores at 1- (standardized mean difference [SMD], -0.94; 95%CI, -1.26 to -0.62) and 4-6-week (SMD, -0.89; 95%CI, -1.25 to -0.53) follow-ups. Despite potential publication bias, TSA confirmed the evidence's reliability. Subgroup analysis showed that ketamine/esketamine's preventive effect on 1-week PPD was consistent, regardless of administration timing, type of agents, or total dosage (<0.5 vs. ≥0.5 mg/kg). For the 4-6-week period, PPD risk was favorably reduced only with postoperative administration or the use of esketamine, with the total dosage having no observed influence. Participants on ketamine/esketamine experienced more frequency of hallucinations (RR, 4.77; 95%CI, 1.39-16.44) and dizziness (RR, 1.36; 95%CI, 1.02-1.81). **Conclusion:** Our findings advocate for the postoperative administration of low-dose ketamine/esketamine to avert PPD, which needed additional research for confirmation.

110. Wang S, Deng CM, Zeng Y, Chen XZ, Li AY, Feng SW, Xu LL, Chen L, Yuan HM, Hu H, Yang T, Han T, Zhang HY, Jiang M, Sun XY, Guo HN, Sessler DI, Wang DX. **Efficacy of a single low dose of esketamine after childbirth for mothers with symptoms of prenatal depression: randomised clinical trial.** BMJ. 2024 Apr 10;385:e078218.

Objective: To determine whether a single low dose of esketamine administered after childbirth reduces postpartum depression in mothers with prenatal depression. **Design:** Randomised, double

blind, placebo controlled trial with two parallel arms. **Setting**: Five tertiary care hospitals in China, 19 June 2020 to 3 August 2022. **Participants:** 364 mothers aged ≥18 years who had at least mild prenatal depression as indicated by Edinburgh postnatal depression scale scores of ≥10 (range 0-30, with higher scores indicating worse depression) and who were admitted to hospital for delivery. **Interventions:** Participants were randomly assigned 1:1 to receive either 0.2 mg/kg esketamine or placebo infused intravenously over 40 minutes after childbirth once the umbilical cord had been clamped. **Main outcome measures:** The primary outcome was prevalence of a major depressive episode at 42 days post partum, diagnosed using the mini-international neuropsychiatric interview. Secondary outcomes included the Edinburgh postnatal depression scale score at seven and 42 days post partum and the 17 item Hamilton depression rating scale score at 42 days post partum (range 0-52, with higher scores indicating worse depression). Adverse events were monitored until 24 hours after childbirth. **Results:** A total of 364 mothers (mean age 31.8 (standard deviation 4.1) years) were enrolled and randomised. At 42 days post partum, a major depressive episode was observed in 6.7% (12/180) of participants in the esketamine group compared with 25.4% (46/181) in the placebo group (relative risk 0.26, 95% confidence interval (CI) 0.14 to 0.48; P<0.001). Edinburgh postnatal depression scale scores were lower in the esketamine group at seven days (median difference -3, 95% CI -4 to -2; P<0.001) and 42 days (-3, -4 to -2; P<0.001). Hamilton depression rating scale scores at 42 days post partum were also lower in the esketamine group (-4, -6 to -3; P<0.001). The overall incidence of neuropsychiatric adverse events was higher in the esketamine group (45.1% (82/182) v 22.0% (40/182); P<0.001); however, symptoms lasted less than a day and none required drug treatment. **Conclusions:** For mothers with prenatal depression, a single low dose of esketamine after childbirth decreases major depressive episodes at 42 days post partum by about three quarters. Neuropsychiatric symptoms were more frequent but transient and did not require drug intervention.

111. Lewkowitz AK, Whelan AR, Ayala NK, Hardi A, Stoll C, Battle CL, Tuuli MG, Ranney ML, Miller ES. **The effect of digital health interventions on postpartum depression or anxiety: a systematic review and meta-analysis of randomized controlled trials.** Am J Obstet Gynecol. 2024 Jan;230(1):12-43.

Objective: This study aimed to examine the effect of digital health interventions compared with treatment as usual on preventing and treating postpartum depression and postpartum anxiety. **Data sources:** Searches were conducted in Ovid MEDLINE, Embase, Scopus, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and ClinicalTrials.gov. **Study eligibility requirements:** The systematic review included full-text randomized controlled trials comparing digital health interventions with treatment as usual for preventing or treating postpartum depression and postpartum anxiety.**Study appraisal and synthesis methods:** Two authors independently screened all abstracts for eligibility and independently reviewed all potentially eligible full-text articles for inclusion. A third author screened abstracts and full-text articles as needed to determine eligibility in cases of discrepancy. The primary outcome was the score on the first ascertainment of postpartum depression or postpartum anxiety symptoms after the intervention. Secondary outcomes included screening positive for postpartum depression or postpartum anxiety -- as defined in the primary study --and loss to follow-up, defined as the proportion of participants who completed the final study assessment compared with the number of initially randomized participants. For continuous outcomes, the Hedges method was used to obtain standardized mean differences when the studies used different psychometric scales, and weighted mean differences were calculated when studies used the same psychometric scales. For categorical outcomes, pooled relative risks were estimated. **Results:** Of 921 studies originally identified, 31 randomized controlled trials-

corresponding to 5532 participants randomized to digital health intervention and 5492 participants randomized to treatment as usual-were included. Compared with treatment as usual, digital health interventions significantly reduced mean scores ascertaining postpartum depression symptoms (29 studies: standardized mean difference, -0.64 [95% confidence interval, -0.88 to -0.40]; I2=94.4%) and postpartum anxiety symptoms (17 studies: standardized mean difference, -0.49 [95% confidence interval, -0.72 to -0.25]; I2=84.6%). In the few studies that assessed screen-positive rates for postpartum depression (n=4) or postpartum anxiety (n=1), there were no significant differences between those randomized to digital health intervention and treatment as usual. Overall, those randomized to digital health intervention had 38% increased risk of not completing the final study assessment compared with those randomized to treatment as usual (pooled relative risk, 1.38 [95% confidence interval, 1.18-1.62]), but those randomized to app-based digital health intervention had similar loss-to-follow-up rates as those randomized to treatment as usual (relative risk, 1.04 [95% confidence interval, 0.91-1.19]). **Conclusion:** Digital health interventions modestly, but significantly, reduced scores assessing postpartum depression and postpartum anxiety symptoms. More research is needed to identify digital health interventions that effectively prevent or treat postpartum depression and postpartum anxiety but encourage ongoing engagement throughout the study period.

112. Surkan PJ, Malik A, Perin J, Atif N, Rowther A, Zaidi A, Rahman A. **Anxiety-focused cognitive behavioral therapy delivered by non-specialists to prevent postnatal depression: a randomized, phase 3 trial.** Nat Med. 2024 Mar;30(3):675-682.

    Anxiety experienced by women during pregnancy is highly prevalent, especially in resource-poor settings and strongly predicts postnatal common mental disorders (CMDs), anxiety and depression. We evaluated the effectiveness of an anxiety-focused early prenatal intervention on preventing postnatal CMDs. This study was a phase 3, two-arm, single-blind, randomized controlled trial conducted in Pakistan with women who were ≤22 weeks pregnant and had at least mild anxiety without clinical depression. Participants were randomized to the Happy Mother-Healthy Baby program, based on cognitive behavioral therapy, consisting of six one-on-one intervention sessions in pregnancy delivered by non-specialist providers, or to enhanced care alone. The primary outcome was major depression, generalized anxiety disorder or both at 6 weeks after delivery. Overall, 755 women completed postnatal assessments (380 (50.3%), intervention arm; 375 (49.7%) enhanced-care arm). The primary outcomes were met. Examined jointly, we found 81% reduced odds of having either a major depressive episode (MDE) or moderate-to-severe anxiety for women randomized to the intervention (adjusted odds ratio (aOR) = 0.19, 95% CI 0.14-0.28). Overall, 12% of women in the intervention group developed MDE at 6 weeks postpartum, versus 41% in the control group. We found reductions of 81% and 74% in the odds of postnatal MDE (aOR = 0.19, 95% CI 0.13-0.28) and of moderate-to-severe anxiety (aOR = 0.26, 95% CI 0.17-0.40), respectively. The Happy Mother-Healthy Baby program early prenatal intervention focusing on anxiety symptoms reduced postpartum CMDs.

113. Ackerman A, Afzal N, Lautarescu A, Wilson CA, Nadkarni A. **Non-specialist delivered psycho-social interventions for women with perinatal depression living in rural communities: A systematic review.** PLOS Glob Public Health. 2024 Jul 8;4(7):e0003031.

    Evidence from low- and middle-income countries suggests that non-specialist-delivered interventions effectively improve access to perinatal mental health care. However, there have been no systematic attempts to synthesize the evidence on effectiveness, relevance, and application of this strategy to

resource-limited settings such as rural areas. The aim of this review is to synthesize the evidence about the effectiveness of non-specialist delivered interventions in improving depression and related outcomes in women with perinatal depression living in rural communities. Seven electronic databases were searched using the following search concepts: perinatal depression (e.g., puerperal depression, antenatal depression), rural areas (e.g., remote, nonmetropolitan, underserved), and non-specialist workers (e.g., lay worker, volunteer aide, informal caretaker. The risk of bias was assessed using RoB-2 and ROBINS-I tools. A narrative synthesis was performed as the high degree of study heterogeneity precluded a meta-analysis. Nine unique studies were eligible for inclusion. Psychoeducation and problem-solving techniques were the most used intervention elements. Two interventions significantly reduced the prevalence of perinatal depression compared to usual care, and three interventions reported effectiveness in reducing depression symptom severity. There was little to no consistent evidence for other outcomes, including but not limited to maternal health care utilization, breastfeeding behaviors, and child health. This review provides limited evidence to suggest that non-specialist delivered interventions effectively improved outcomes among women with perinatal depression living in rural communities. The paucity of high-quality studies included in this review demonstrates that this rural demographic is frequently neglected in the context of maternal mental health research.

114. O'Carroll JE, Zucco L, Warwick E, Radcliffe G, Moonesinghe SR, El-Boghdadly K, Guo N, Carvalho B, Sultan P. **Ethnicity, socio-economic deprivation and postpartum outcomes following caesarean delivery: a multicentre cohort study.** Anaesthesia. 2024 May;79(5):486-497.

Disparities relating to postpartum recovery outcomes in different socio-economic and racial ethnic groups are underexplored. We conducted a planned analysis of a large prospective caesarean delivery cohort to explore the relationship between ethnicity, socio-economic status and postpartum recovery. Eligible patients were enrolled and baseline demographic, obstetric and medical history data were collected 18 h and 30 h following delivery. Patients completed postpartum quality of life and recovery measures in person on day 1 (EuroQoL EQ-5D-5L, including global health visual analogue scale; Obstetric Quality of Recovery-10 item score; and pain scores) and by telephone between day 28 and day 32 postpartum (EQ-5D-5L and pain scores). Socio-economic group was determined according to the Index of Multiple Deprivation quintile of each patient's usual place of residence. Data from 1000 patients who underwent caesarean delivery were included. There were more patients of Asian, Black and mixed ethnicity in the more deprived quintiles. Patients of White ethnicities had shorter postpartum duration of hospital stay compared with patients of Asian and Black ethnicities (35 (28-56 [18-513]) h vs. 44 (31-71 [19-465]) h vs. 49 (33-75 [23-189]) h, respectively. In adjusted models at day 30, patients of Asian ethnicity had a significantly greater risk of moderate to severe pain (numerical rating scale ≥ 4) at rest and on movement (odds ratio (95%CI) 2.42 (1.24-4.74) and 2.32 (1.40-3.87)), respectively). There were no differences in readmission rates or incidence of complications between groups. Patients from White ethnic backgrounds experience shorter postpartum duration of stay compared with patients from Asian and Black ethnic groups. Ethnic background impacts pain scores and recovery at day 1 postpartum and following hospital discharge, even after adjusting for socio-economic group. Further work is required to understand the underlying factors driving differences in pain and recovery and to develop strategies to reduce disparities in obstetric patients.

115. Morales JF, Gomez A, Carvalho J, Ye XY, Downey K, Siddiqui N. **Quality of Recovery After Unplanned and Planned Cesarean Deliveries: A Prospective Observational Study Using the Obstetric Quality of Recovery-10 Tool.** Anesth Analg. 2024 Oct 1;139(4):754-760.

Background: There is a paucity of literature examining the differences between patient-reported outcome measures after planned and unplanned cesarean delivery using a validated quality of recovery tool. The Obstetric Quality of Recovery-10 (ObsQoR-10) scoring tool has been validated to quantify functional recovery after cesarean delivery. We aimed to use the ObsQoR-10 to compare the postoperative recovery characteristics of patients undergoing planned and unplanned cesarean deliveries. **Methods:** We conducted a prospective single-center observational study. Patients undergoing planned and unplanned cesarean deliveries under neuraxial anesthesia were asked to complete the ObsQoR-10 questionnaire 24 hours, 48 hours, and 1 week postpartum. We collected information on total in-hospital postoperative opioid consumption and patients ´ perception of readiness for discharge at 24 and 48 hours postpartum. Additionally, patient characteristics were collected to assess their correlation with our findings. **Results:** We included 112 patients (56 in each group). No statistical differences in ObsQoR-10 scores at 24 hours, 48 hours, and 1 week postpartum were observed between the planned and unplanned cesarean deliveries. Additionally, there was no difference between the groups in patients' perception of readiness for hospital discharge at 24 and 48 hours and opioid consumption in the first 2 days after surgery. Most patients in both groups did not think they would be ready for discharge at 24 hours postpartum. Analysis of the individual components of ObsQoR-10 at 24 hours showed a difference in the responses assessing the severity of shivering (higher in unplanned cesarean deliveries) and the ability to look after personal hygiene (lower in unplanned cesarean deliveries). **Conclusions:** As assessed by the ObsQoR-10, no significant difference in the quality of recovery was observed between patients undergoing planned and unplanned cesarean delivery.

Disparities in Maternal Outcomes/ Global Health

Global Health

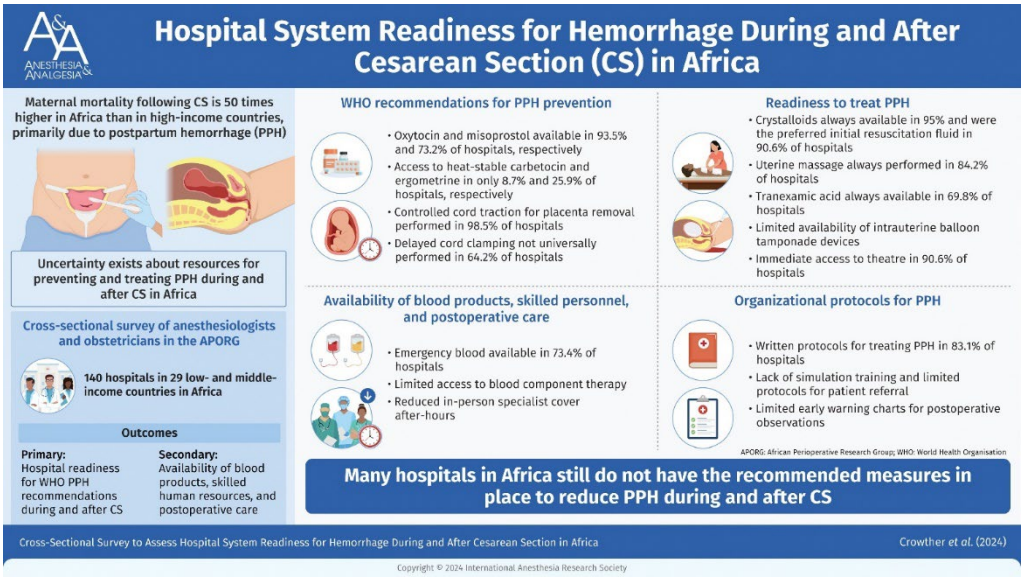
116. Gerber C, Bishop DG, Dyer RA, Maswime S, Rodseth RN, van Dyk D, Kluyts HL, Mbwele B, Tumukunde JT, Madzimbamuto FD, Elkhogia AM, Ndonga AK, Ngumi ZWW, Omigbodun AO, Amanor-Boadu SD, Zoumenou E, Basenero A, Munlemvo DM, Coulibaly Y, Ndayisaba G, Antwi-Kusi A, Gobin V, Forget P, Rakotoarison S, Samateh AL, Mehyaoui R, Patel-Mujajati U, Sani CM, Madiba TE, Pearse RM, Biccard BM. **Method of Anesthesia and Perioperative Risk Factors, Maternal Anesthesia Complications, and Neonatal Mortality Following Cesarean Delivery in Africa: A Substudy of a 7-Day Prospective Observational Cohort Study**. Anesth Analg. 2024 Jun 1;138(6):1275-1284.

Background: The African Surgical Outcomes Study (ASOS) found that maternal mortality following cesarean delivery in Africa is 50 times higher than in high-income countries, and associated with obstetric hemorrhage and anesthesia complications. Mothers who died were more likely to receive general anesthesia (GA). The associations between GA versus spinal anesthesia (SA) and preoperative risk factors, maternal anesthesia complications, and neonatal outcomes following cesarean delivery in Africa are unknown. **Methods:** This is a secondary explanatory analysis of 3792 patients undergoing

cesarean delivery in ASOS, a prospective observational cohort study, across 22 African countries. The primary aim was to estimate the association between preoperative risk factors and the outcome of the method of anesthesia delivered. Secondary aims were to estimate the association between the method of anesthesia and the outcomes (1) maternal intraoperative hypotension, (2) severe maternal anesthesia complications, and (3) neonatal mortality. Generalized linear mixed models adjusting for obstetric gravidity and gestation, American Society of Anesthesiologists (ASA) category, urgency of surgery, maternal comorbidities, fetal distress, and level of anesthesia provider were used. **Results:** Of 3709 patients, SA was performed in 2968 (80%) and GA in 741 (20%). Preoperative factors independently associated with GA for cesarean delivery were gestational age (adjusted odds ratio [aOR], 1.093; 95% confidence interval [CI], 1.052-1.135), ASA categories III (aOR, 11.84; 95% CI, 2.93-46.31) and IV (aOR, 11.48; 95% CI, 2.93-44.93), eclampsia (aOR, 3.92; 95% CI, 2.18-7.06), placental abruption (aOR, 6.23; 95% CI, 3.36-11.54), and ruptured uterus (aOR, 3.61; 95% CI, 1.36-9.63). SA was administered to 48 of 94 (51.1%) patients with eclampsia, 12 of 28 (42.9%) with cardiac disease, 14 of 19 (73.7%) with preoperative sepsis, 48 of 76 (63.2%) with antepartum hemorrhage, 30 of 55 (54.5%) with placenta previa, 33 of 78 (42.3%) with placental abruption, and 12 of 29 (41.4%) with a ruptured uterus. The composite maternal outcome "all anesthesia complications" was more frequent in GA than SA (9/741 [1.2%] vs 3/2968 [0.1%], P < .001). The unadjusted neonatal mortality was higher with GA than SA (65/662 [9.8%] vs 73/2669 [2.7%], P < .001). The adjusted analyses demonstrated no association between method of anesthesia and (1) intraoperative maternal hypotension and (2) neonatal mortality. **Conclusions:** Analysis of patients undergoing anesthesia for cesarean delivery in Africa indicated patients more likely to receive GA. Anesthesia complications and neonatal mortality were more frequent following GA. SA was often administered to high-risk patients, including those with eclampsia or obstetric hemorrhage. Training in the principles of selection of method of anesthesia, and the skills of safe GA and neonatal resuscitation, is recommended.

117. Crowther M, Dyer RA, Bishop DG, Bulamba F, Maswime S, Pearse RM, Biccard BM. **Cross-Sectional Survey to Assess Hospital System Readiness for Hemorrhage During and After Cesarean Delivery in Africa**. Anesth Analg. 2024 Nov 6.

Background: Mothers in Africa are 50 times more likely to die after cesarean delivery (CD) than in high-income countries, largely due to hemorrhage. It is unclear whether countries across Africa are adequately equipped to prevent and treat postpartum hemorrhage (PPH) during and after CD. **Methods:** This was a cross-sectional survey of anesthesiologists and obstetricians across the African Perioperative Research Group (APORG). The primary objective was to determine readiness of the hospital system to implement the World



Health Organization (WHO) recommendations for prevention and treatment of PPH during and after CD. The secondary objectives were to evaluate the availability of blood products, skilled human resources and establish available postoperative care after CD. Survey question format was close-ended or Likert scale, with options "always," "sometimes," or "never." **Results:** Responses were analyzed from 1 respondent from each of 140 hospitals from 29 low- and middle-income countries across Africa. Most respondents completed every data field on the case report form. Regarding WHO recommendations on prevention of PPH, oxytocin and misoprostol were available in 130/139 (93.5%) and 101/138 (73.2%) hospitals, respectively. There was limited access to heat-stable carbetocin (12/138 [8.7%]) and ergometrine (35/135, [25.9%]). Controlled cord traction for removal of placenta was always performed in 133/135 (98.5%) hospitals. Delayed cord clamping when neonatal resuscitation was not indicated, was not performed universally (86/134 [64.2%]). Regarding the treatment of PPH, crystalloids were always available in 133/139 (95.7%) hospitals, and the preferred initial resuscitation fluid (125/138 [90.6%]). Uterine massage was always performed in 117/139 (84.2%) hospitals. Tranexamic acid was always available in 97/139 (69.8%) hospitals. The availability of intrauterine balloon tamponade devices was limited. Most had immediate access to theater (126/139 [90.6%]). Responses concerning organizational recommendations showed that 113/136 (83.1%) hospitals had written protocols for the treatment of PPH. Protocols for patient referral and simulation training were limited. Most hospitals had access to emergency blood (102/139 [73.4%]). There was limited access to blood component therapy, with platelets available at 32/138 (23.2%), cryoprecipitate at 21/138 (15.2%) and fibrinogen at 11/139 (7.9%) hospitals. In-person specialist cover was reduced after-hours. **Conclusions:** Important WHO-recommended measures to reduce hemorrhage during and after CD, are not currently available in many hospitals across Africa. It is likely that the lack of a combination of factors leads to failure to rescue mothers in Africa from postoperative complications. These findings should facilitate codesign of quality improvement initiatives to reduce hemorrhage related to CD.

118. Gazeley U, Polizzi A, Prieto JR, Aburto JM, Reniers G, Filippi V. **The lifetime risk of maternal near miss morbidity in Asia, Africa, the Middle East, and Latin America: a cross-country systematic analysis.** Lancet Glob Health. 2024 Nov;12(11):e1775-e1784.

Background: Life-threatening maternal near miss (MNM) morbidity can have long-term consequences for the physical, psychological, sexual, social, and economic wellbeing of female individuals. The lifetime risk of MNM (LTR-MNM) quantifies the probability that a female individual aged 15 years will have an MNM before age 50 years, given current mortality and fertility rates. We compare the LTR-MNM globally to reveal inequities in the cumulative burden of severe maternal morbidity across the reproductive life course. **Methods:** We estimated the LTR-MNM for 40 countries with multifacility, regional, or national data on the prevalence of MNM morbidity measured using WHO or modified WHO criteria of organ dysfunction from 2010 onwards (Central and Southern Asia=6, Eastern and Southeastern Asia=9, Latin America and the Caribbean=10, Northern Africa and Western Asia=2, sub-Saharan Africa=13). We also calculated the lifetime risk of severe maternal outcome (LTR-SMO) as the lifetime risk of maternal death or MNM. **Findings:** The LTR-MNM ranges from a 1 in 269 risk in Viet Nam (2010) to 1 in 6 in Guatemala (2016), whereas the LTR-SMO ranges from a 1 in 201 risk in Malaysia (2014) to 1 in 5 in Guatemala (2016). The LTR-MNM is a 1 in 20 risk or higher in nine countries, seven of which are in sub-Saharan Africa. The LTR-SMO is a 1 in 20 risk or higher in 11 countries, eight of which

are in sub-Saharan Africa. The relative contribution of the LTR-MNM to the LTR-SMO ranges from 42% in Angola to 99% in Japan. **Interpretation:** There exist substantial global and regional disparities in the cumulative burden of severe maternal morbidity across the reproductive life course. The LTR-MNM is an important indicator to highlight the magnitude of inequalities in MNM morbidity, once accounting for obstetric risk, fertility rates, and mortality rates. The LTR-SMO can be used to highlight variation in the relative importance of morbidity to the overall burden of maternal ill-health across the female reproductive life course, given countries' stage in the obstetric transition. Both the LTR-MNM and LTR-SMO can serve as important indicators to advocate for further global commitment to end preventable maternal morbidity and mortality.

Disparities

119. Janevic T, Tomalin LE, Glazer KB, Boychuk N, Kern-Goldberger A, Burdick M, Howell F, Suarez-Farinas M, Egorova N, Zeitlin J, Hebert P, Howell EA. **Development of a prediction model of postpartum hospital use using an equity-focused approach**. Am J Obstet Gynecol. 2024 Jun;230(6):671.e1-671.e10.

Background: Racial inequities in maternal morbidity and mortality persist into the postpartum period, leading to a higher rate of postpartum hospital use among Black and Hispanic people. Delivery hospitalizations provide an opportunity to screen and identify people at high risk to prevent adverse postpartum outcomes. Current models do not adequately incorporate social and structural determinants of health, and some include race, which may result in biased risk stratification. **Objective:** This study aimed to develop a risk prediction model of postpartum hospital use while incorporating social and structural determinants of health and using an equity approach. **Study design:** We conducted a retrospective cohort study using 2016-2018 linked birth certificate and hospital discharge data for live-born infants in New York City. We included deliveries from 2016 to 2017 in model development, randomly assigning 70%/30% of deliveries as training/test data. We used deliveries in 2018 for temporal model validation. We defined "Composite postpartum hospital use" as at least 1 readmission or emergency department visit within 30 days of the delivery discharge. We categorized diagnosis at first hospital use into 14 categories based on International Classification of Diseases-Tenth Revision diagnosis codes. We tested 72 candidate variables, including social determinants of health, demographics, comorbidities, obstetrical complications, and severe maternal morbidity. Structural determinants of health were the Index of Concentration at the Extremes, which is an indicator of racial-economic segregation at the zip code level, and publicly available indices of the neighborhood built/natural and social/economic environment of the Child Opportunity Index. We used 4 statistical and machine learning algorithms to predict "Composite postpartum hospital use", and an ensemble approach to predict "Cause-specific postpartum hospital use". We simulated the impact of each risk stratification method paired with an effective intervention on race-ethnic equity in postpartum hospital use. **Results:** The overall incidence of postpartum hospital use was 5.7%; the incidences among Black, Hispanic, and White people were 8.8%, 7.4%, and 3.3%, respectively. The most common diagnoses for hospital use were general perinatal complications (17.5%), hypertension/eclampsia (12.0%), nongynecologic infections (10.7%), and wound infections (8.4%). Logistic regression with least absolute shrinkage and selection operator selection retained 22 predictor variables and achieved an area under the receiver operating curve of 0.69 in the training, 0.69 in test, and 0.69 in validation data. Other machine learning algorithms performed similarly. Selected social and structural determinants of health features included the Index of Concentration at

the Extremes, insurance payor, depressive symptoms, and trimester entering prenatal care. The "Cause-specific postpartum hospital use" model selected 6 of the 14 outcome diagnoses (acute cardiovascular disease, gastrointestinal disease, hypertension/eclampsia, psychiatric disease, sepsis, and wound infection), achieving an area under the receiver operating curve of 0.75 in training, 0.77 in test, and 0.75 in validation data using a cross-validation approach. Models had slightly lower performance in Black and Hispanic subgroups. When simulating use of the risk stratification models with a postpartum intervention, identifying high-risk individuals with the "Composite postpartum hospital use" model resulted in the greatest reduction in racial-ethnic disparities in postpartum hospital use, compared with the "Cause-specific postpartum hospital use" model or a standard approach to identifying high-risk individuals with common pregnancy complications. **Conclusion:** The "Composite postpartum hospital use" prediction model incorporating social and structural determinants of health can be used at delivery discharge to identify persons at risk for postpartum hospital use.

120. Kern-Goldberger AR, Hirshberg A, James A, Levine LD, Howell E, Harbuck E, Srinivas SK. **Trends in Severe Maternal Morbidity Following an Institutional Team Goal Strategy for Disparity Reduction**. Am J Obstet Gynecol MFM. 2024 Dec;6(12):101529.

Background: Racial disparities in maternal pregnancy outcomes, specifically in morbidity and mortality, are persistent in the U.S., and a multifaceted approach to mitigating these disparate outcomes is critical. In 2020, our health system committed to reducing severe maternal morbidity (SMM) in Black patients, employing multiple strategic interventions including implicit bias training, regular reporting of a composite SMM metric stratified by race and ethnicity, standardization of best practices, focused efforts for hemorrhage risk reduction, and system-wide team building. **Objective:** The goal of this study is to investigate trends in SMM by race across this period of concentrated interventions to improve maternal outcomes overall, and specifically for Black patients. **Study design:** This is a retrospective cohort study evaluating all delivery admissions at an academic, urban, tertiary-care hospital in Philadelphia-one site of a health system encompassing five delivery hospitals-over a 3-year period from 2019 to 2021. Data including patient demographics, clinical features, and outcomes were extracted from the electronic medical record (EMR). Self-reported race was categorized as Black vs non-Black as documented in the EMR. SMM was defined according to established CDC indicators as well as additional codes identified by Vizient for common sources of SMM including hemorrhage, infection, and embolism. Data were analyzed by year with a multivariable logistic regression model including insurance type and obstetric comorbidity index (OB-CMI), a weighted scoring system accounting for numerous chronic medical conditions and antepartum pregnancy complications. **Results:** In total, 12,339 deliveries were included, 64.6% (N=8012) of which were to Black patients. Median OB-CMI score was higher for Black patients at 3 (interquartile range [IQR] 1-5) compared to 2 (IQR 1-4) for non-Black patients, P<.01. There was a significant decrease in SMM for the entire cohort over the study period (8.5% in 2019 to 6.5% in 2021, P=.001), driven by a decreased rate specifically among Black patients (8.9% in 2019 to 6.6% in 2021, P=.005) with a nonsignificant decrease for non-Black patients (7.8% in 2019 to 6.3% in 2021, P=.21). The adjusted model similarly demonstrated decreased risk of SMM over time for Black patients (2020 vs 2019 adjusted odds ratio [aOR] = 0.81, 95% confidence interval [CI] 0.69-0.96; 2021 vs 2019 aOR 0.73, 95% CI 0.62-0.86). **Conclusion:** Dedicated efforts to improve equity in maternal outcomes over a 2-year period (2020-2021) in this hospital serving a Black patient majority were associated with a significant decline in SMM, especially among Black patients. This finding demonstrates the success of a high-

level, coordinated, and systematic approach in reducing SMM and associated disparities, and is highly consequential in light of the ongoing major epidemic of racial disparities in obstetric outcomes.

121. Thomas CL, Lange EMS, Banayan JM, Zhu Y, Liao C, Peralta FM, Grobman WA, Scavone BM, Toledo P. **Racial and Ethnic Disparities in Receipt of General Anesthesia for Cesarean Delivery**. JAMA Netw Open. 2024 Jan 2;7(1):e2350825.

Importance: General anesthesia for cesarean delivery is associated with increased maternal morbidity, and Black and Hispanic pregnant patients have higher rates of general anesthesia use compared with their non-Hispanic White counterparts. It is unknown whether risk factors and indications for general anesthesia differ among patients of differing race and ethnicity. **Objective:** To evaluate differences in general anesthesia use for cesarean delivery and the indication for the general anesthetic by race and ethnicity. **Design, setting, and participants:** In this retrospective, cross-sectional, single-center study, electronic medical records for all 35 117 patients who underwent cesarean delivery at Northwestern Medicine's Prentice Women's Hospital from January 1, 2007, to March 2, 2018, were queried for maternal demographics, clinical characteristics, obstetric and anesthetic data, the indication for cesarean delivery, and the indication for general anesthesia when used. Data analysis occurred in August 2023. **Exposure:** Cesarean delivery. **Main outcomes and measures:** The rate of general anesthesia for cesarean delivery by race and ethnicity. **Results:** Of the 35 117 patients (median age, 33 years [IQR, 30-36 years]) who underwent cesarean delivery, 1147 (3.3%) received general anesthesia; the rates of general anesthesia were 2.5% for Asian patients (61 of 2422), 5.0% for Black patients (194 of 3895), 3.7% for Hispanic patients (197 of 5305), 2.8% for non-Hispanic White patients (542 of 19 479), and 3.8% (153 of 4016) for all other groups (including those who declined to provide race and ethnicity information) ($P < .001$). A total of 19 933 pregnant patients (56.8%) were in labor at the time of their cesarean delivery. Of those, 16 363 (82.1%) had neuraxial labor analgesia in situ. Among those who had an epidural catheter in situ, there were no racial or ethnic differences in the rates of general anesthesia use vs neuraxial analgesia use (Asian patients, 34 of 503 [6.8%] vs 1289 of 15 860 [8.1%]; Black patients, 78 of 503 [15.5%] vs 1925 of 15 860 [12.1%]; Hispanic patients, 80 of 503 [15.9%] vs 2415 of 15 860 [15.2%]; non-Hispanic White patients, 255 of 503 [50.7%] vs 8285 of 15 860 [52.2%]; and patients of other race or ethnicity, 56 of 503 [11.1%] vs 1946 of 15 860 [12.3%]; $P = .16$). Indications for cesarean delivery and for general anesthesia were not different when stratified by race and ethnicity. **Conclusions and relevance:** Racial disparities in rates of general anesthesia continue to exist; however, this study suggests that, for laboring patients who had labor epidural catheters in situ, no disparity by race or ethnicity existed. Future studies should address whether disparities in care that occur prior to neuraxial catheter placement are associated with higher rates of general anesthesia among patients from ethnic and racial minority groups.

122. Walheim LK, Hong CX, Hamm RF. **Racial Disparities in Sterilization Procedure Performed at Time of Cesarean Section**. Am J Perinatol. 2024 May;41(S 01):e934-e938.

Objectives: While bilateral tubal ligation has historically been performed for sterilization at cesarean delivery (CD), recent data supports the use and safety of opportunistic bilateral salpingectomy during CD to decrease lifetime ovarian cancer risk. Prior studies have described racial disparities in sterilization rates, but there is a paucity of data regarding racial disparities in type of sterilization procedure. Our objective was to determine differences in sterilization procedure type performed at CD by race (Black vs. non-Black) to evaluate for equity in bilateral salpingectomy utilization. **Study**

design: We performed a retrospective cohort study of patients included in the American College of Surgeons National Surgical Quality Improvement Program database who underwent sterilization at time of CD from January 2019, to December 2020, identified using Current Procedural Terminology codes. Patients without documented race were excluded. Multivariable logistic regression was used to determine odds of undergoing bilateral salpingectomy compared with bilateral tubal ligation by race while controlling for confounders. **Results:** Of 28,147 patients who underwent CD, 3,087 underwent concurrent sterilization procedure, and 2,161 met inclusion criteria (Black: n = 279; non-Black: n = 1,882). Black patients were significantly more likely to have hypertension (10.8 vs. 5.3%, p < 0.01), bleeding disorders (3.9 vs. 1.3%, p < 0.01), preoperative anemia (hemoglobin < 11 g/dL; 36.9 vs. 21.3%, p < 0.01), and be of American Society of Anesthesiologist class 3 or higher (29.4 vs. 22.5%, p = 0.01) than non-Black patients. After adjusting for differences, Black patients were almost 50% less likely than non-Black patients to undergo bilateral salpingectomy compared with bilateral tubal ligation for sterilization at CD (adjusted odds ratio = 0.52, 95% confidence interval: 0.36-0.75). **Conclusion:** Despite evidence that bilateral salpingectomy decreases ovarian cancer risk and is safe at CD, there is a racial disparity in bilateral salpingectomy utilization. While the cause of this disparity is unclear, further research is warranted to determine root causes and equitable solutions.

123. Potnuru PP, Jonna S, Orlando B, Nwokolo OO. **Racial and Ethnic Disparities in Epidural Blood Patch Utilization Among Obstetric Patients in the United States: A Nationwide Analysis, 2016-2020**. Anesth Analg. 2024 Dec 1;139(6):1190-1198.

Background: Racial and ethnic disparities in health care delivery can lead to inadequate peripartum pain management and associated adverse maternal outcomes. An epidural blood patch (EBP) is the definitive treatment for moderate to severe postdural puncture headache (PDPH), a potentially debilitating neuraxial anesthesia complication associated with significant maternal morbidity if undertreated. In this nationwide study, we examine the racial and ethnic disparities in the inpatient utilization of EBP after obstetric PDPH in the United States. **Methods:** In this retrospective observational study, we used the National Inpatient Sample, a nationally representative database of discharge records for inpatient admissions in the United States, from 2016 to 2020. We analyzed delivery hospitalizations of women of childbearing age (15-49 years) diagnosed with PDPH. Adjusting for maternal and hospitalization characteristics as confounders, we used a multilevel mixed-effects logistic regression model to compare the rates of EBP utilization by race and ethnicity. Secondarily, among hospitalizations with an EBP, we examined the association between race and ethnicity and the timing of the EBP procedure. **Results:** We analyzed 49,300 delivery hospitalizations with a diagnosis of PDPH. An EBP was performed in 24,075 (48.8%; 95% confidence interval [CI], 47.8%-49.9%) of these hospitalizations. EBP was performed in 52.7% (95% CI, 51.3%-54.1%) of White non-Hispanic patients with PDPH. Compared to White non-Hispanic patients, Black non-Hispanic (adjusted odds ratio [aOR] = 0.69; 99% CI, 0.56-0.84), Hispanic (aOR = 0.80, 99% CI, 0.68-0.95), and Asian or Pacific Islander patients (aOR = 0.74, 99% CI, 0.58-0.96) were less likely to receive an EBP. The median (interquartile range [IQR]) time to perform an EBP was 2 (1-3) days after admission, with 90% of EBP procedures completed within 4 days of admission. There was no significant association between race and ethnicity and the timing of EBP placement. **Conclusions:** In this nationwide analysis of delivery hospitalizations from 2016 to 2020 in the United States with a diagnosis of PDPH, we identified racial and ethnic disparities in the utilization of EBP. Minoritized patients identified as Black non-Hispanic, Hispanic, or Asian or Pacific Islander were less likely to receive an EBP for the treatment of PDPH compared to White non-Hispanic patients. Suboptimal treatment of PDPH may be associated with

adverse long-term outcomes such as postpartum depression, posttraumatic stress disorder, and chronic headaches. Racial and ethnic disparities in EBP utilization should be further investigated to ensure equitable health care delivery.

124. Hales EDS, Ferketich AK, Klebanoff MA. **The racial disparity of severe maternal morbidity across weeks of gestation: a cross-sectional analysis of the 2019 National Inpatient Sample.** Am J Obstet Gynecol. 2024 Jul;231(1):126.e1-126.e12.

Background: Severe maternal morbidity is increasing in the United States. Black women experience the highest rates of severe maternal morbidity and also of preterm births, which are associated with severe maternal morbidity. The racial disparity of severe maternal morbidity across weeks of gestation has not been well-studied. **Objective:** This study aimed to evaluate differences in severe maternal morbidity between Black and White birthing people by week of gestation. Differences may indicate periods of pregnancy when Black women are particularly vulnerable to severe maternal morbidity and may require additional interventions. **Study design:** This was a cross-sectional study using the National Inpatient Sample from 2019. We used International Classification of Diseases codes from Centers for Disease Control and Prevention guidelines to identify severe maternal morbidity from delivery hospitalizations. We examined the rates of severe maternal morbidity in Black vs White women by week of gestation to evaluate periods of pregnancy when Black women experience additional risks of severe maternal morbidity while adjusting for age, region, medical comorbidities, and Medicaid enrollment. Severe maternal morbidity was analyzed while both including and excluding cases for which blood transfusion was the only indicator of severe maternal morbidity. **Results:** Overall, Black birthing people had twice the rate of severe maternal morbidity births compared with White birthing people (2.7% vs 1.3%; P<.0001) and were more likely to deliver preterm (14.7% vs 9.4%; P<.0001). The racial disparity of severe maternal morbidity was present throughout all weeks of gestation, with the largest gap observed at extremely and moderately preterm gestations (22-33 weeks). Rates of severe maternal morbidity for Black women peaked at 22 to 33 weeks' gestation and were lowest at term (≥37 weeks). Black women had a greater proportion of severe maternal morbidity cases due to blood transfusion (68.3% vs 64.5%; P<.01) and acute renal failure (11.1% vs 8.5%; P<.001). **Conclusion:** Black women experience a substantially higher rate of severe maternal morbidity at preterm gestations (22-36 weeks) in addition to higher rates of preterm delivery. Even when accounting for age, medical comorbidities, and social determinants, Black birthing people have higher odds of severe maternal morbidity throughout pregnancy.

125. O'Carroll JE, Zucco L, Warwick E, Radcliffe G, Moonesinghe SR, El-Boghdadly K, Guo N, Carvalho B, Sultan P. **Ethnicity, socio-economic deprivation and postpartum outcomes following caesarean delivery: a multicentre cohort study**. Anaesthesia. 2024 May;79(5):486-497.

Disparities relating to postpartum recovery outcomes in different socio-economic and racial ethnic groups are underexplored. We conducted a planned analysis of a large prospective caesarean delivery cohort to explore the relationship between ethnicity, socio-economic status and postpartum recovery. Eligible patients were enrolled and baseline demographic, obstetric and medical history data were collected 18 h and 30 h following delivery. Patients completed postpartum quality of life and recovery measures in person on day 1 (EuroQoL EQ-5D-5L, including global health visual analogue scale; Obstetric Quality of Recovery-10 item score; and pain scores) and by telephone between day 28 and day 32 postpartum (EQ-5D-5L and pain scores). Socio-economic group was

determined according to the Index of Multiple Deprivation quintile of each patient's usual place of residence. Data from 1000 patients who underwent caesarean delivery were included. There were more patients of Asian, Black and mixed ethnicity in the more deprived quintiles. Patients of White ethnicities had shorter postpartum duration of hospital stay compared with patients of Asian and Black ethnicities (35 (28-56 [18-513]) h vs. 44 (31-71 [19-465]) h vs. 49 (33-75 [23-189]) h, respectively. In adjusted models at day 30, patients of Asian ethnicity had a significantly greater risk of moderate to severe pain (numerical rating scale ≥ 4) at rest and on movement (odds ratio (95%CI) 2.42 (1.24-4.74) and 2.32 (1.40-3.87)), respectively). There were no differences in readmission rates or incidence of complications between groups. Patients from White ethnic backgrounds experience shorter postpartum duration of stay compared with patients from Asian and Black ethnic groups. Ethnic background impacts pain scores and recovery at day 1 postpartum and following hospital discharge, even after adjusting for socio-economic group. Further work is required to understand the underlying factors driving differences in pain and recovery and to develop strategies to reduce disparities in obstetric patients.

With an editorial by Dennis, A. T and Sheridan, N. **Extreme inequity in analgesia and peri-operative management of pregnant patients**. Anaesthesia. 2024 May;79(5):455-460.

126. Liu C, Underhill K, Aubey JJ, Samari G, Allen HL, Daw JR. **Disparities in Mistreatment During Childbirth.** JAMA Netw Open. 2024 Apr 1;7(4):e244873.

Importance: Lack of respectful maternity care may be a key factor associated with disparities in maternal health. However, mistreatment during childbirth has not been widely documented in the US. **Objectives:** To estimate the prevalence of mistreatment by health care professionals during childbirth among a representative multistate sample and to identify patient characteristics associated with mistreatment experiences. **Design, setting, and participants:** This cross-sectional study used representative survey data collected from respondents to the 2020 Pregnancy Risk and Monitoring System in 6 states and New York City who had a live birth in 2020 and participated in the Postpartum Assessment of Health Survey at 12 to 14 months' post partum. Data were collected from January 1, 2021, to March 31, 2022. **Exposures:** Demographic, social, clinical, and birth characteristics that have been associated with patients' health care experiences. **Main outcomes and measures:** Any mistreatment during childbirth, as measured by the Mistreatment by Care Providers in Childbirth scale, a validated measure of self-reported experiences of 8 types of mistreatment. Survey-weighted rates of any mistreatment and each mistreatment indicator were estimated, and survey-weighted logistic regression models estimated odds ratios (ORs) and 95% CIs. **Results:** The sample included 4458 postpartum individuals representative of 552 045 people who had live births in 2020 in 7 jurisdictions. The mean (SD) age was 29.9 (5.7) years, 2556 (54.4%) identified as White, and 2836 (58.8%) were commercially insured. More than 1 in 8 individuals (13.4% [95% CI, 11.8%-15.1%]) reported experiencing mistreatment during childbirth. The most common type of mistreatment was being "ignored, refused request for help, or failed to respond in a timely manner" (7.6%; 95% CI, 6.5%-8.9%). Factors associated with experiencing mistreatment included being lesbian, gay, bisexual, transgender, queer identifying (unadjusted OR [UOR], 2.3; 95% CI, 1.4-3.8), Medicaid insured (UOR, 1.4; 95% CI, 1.1-1.8), unmarried (UOR, 0.8; 95% CI, 0.6-1.0), or obese before pregnancy (UOR, 1.3; 95% CI, 1.0-1.7); having an unplanned cesarean birth (UOR, 1.6; 95% CI, 1.2-2.2), a history of substance use disorder (UOR, 2.6; 95% CI, 1.3-5.1), experienced intimate partner or family violence (UOR, 2.3; 95% CI, 1.3-4.2), mood disorder (UOR, 1.5; 95% CI, 1.1-2.2), or giving birth during the

COVID-19 public health emergency (UOR, 1.5; 95% CI, 1.1-2.0). Associations of mistreatment with race and ethnicity, age, educational level, rural or urban geography, immigration status, and household income were ambiguous. **Conclusions and relevance:** This cross-sectional study of individuals who had a live birth in 2020 in 6 states and New York City found that mistreatment during childbirth was common. There is a need for patient-centered, multifaceted interventions to address structural health system factors associated with negative childbirth experiences.

127. Guglielminotti J, Lee A, Landau R, Samari G, Li G. **Structural Racism and Use of Labor Neuraxial Analgesia Among Non-Hispanic Black Birthing People.** Obstet Gynecol. 2024 Apr 1;143(4):571-581.

Objective: To assess the association between structural racism and labor neuraxial analgesia use. **Methods:** This cross-sectional study analyzed 2017 U.S. natality data for non-Hispanic Black and White birthing people. The exposure was a multidimensional structural racism index measured in the county of the delivery hospital. It was calculated as the mean of three Black-White inequity ratios (ratios for lower education, unemployment, and incarceration in jails) and categorized into terciles, with the third tercile corresponding to high structural racism. The outcome was the labor neuraxial analgesia rate. Adjusted odds ratios and 95% CIs of neuraxial analgesia associated with terciles of the index were estimated with multivariate logistic regression models. Black and White people were compared with the use of an interaction term between race and ethnicity and the racism index. **Results:** Of the 1,740,716 birth certificates analyzed, 396,303 (22.8%) were for Black people. The labor neuraxial analgesia rate was 77.2% for Black people in the first tercile of the racism index, 74.7% in the second tercile, and 72.4% in the third tercile. For White people, the rates were 80.4%, 78.2%, and 78.2%, respectively. For Black people, compared with the first tercile of the racism index, the second tercile was associated with 18.4% (95% CI, 16.9-19.9%) decreased adjusted odds of receiving neuraxial analgesia and the third tercile with 28.3% (95% CI, 26.9-29.6%) decreased adjusted odds. For White people, the decreases were 13.4% (95% CI, 12.5-14.4%) in the second tercile and 15.6% (95% CI, 14.7-16.5%) in the third tercile. A significant difference in the odds of neuraxial analgesia was observed between Black and White people for the second and third terciles. **Conclusion:** A multidimensional index of structural racism is associated with significantly reduced odds of receiving labor neuraxial analgesia among Black people and, to a lesser extent, White people.

128. Jiles M, Prata N, Harley KG. **Maternal and Infant Health Outcomes in US-Born and Non-US-Born Black Pregnant People in the US**. JAMA Netw Open. 2024 Dec 2;7(12):e2451693.

Importance: With disparate Black maternal health outcomes in the US and a steadily expanding non-US-born Black population, it is beneficial to investigate Black maternal health outcomes by country of origin. **Objective:** To compare the prevalence of maternal morbidity and infant birth outcomes between US-born and non-US-born Black populations in the US. **Design, setting, and participants:** This cross-sectional study included all registered hospital births in the US from the 2021 National Vital Statistics Systems (NVSS) Natality Data. Eligible patients identified as Black, excluding those who were younger than 15 years, gave birth to twins or multiple infants, gave birth outside of a hospital, or were missing data for maternal morbidity, nativity, or study covariates. **Exposures:** Maternal birthplace, characterized as born within the US or born outside of the US. **Main outcomes and measures:** Five maternal morbidities (ie, maternal transfusion, perineal laceration, ruptured uterus, unplanned hysterectomy, admission to intensive care unit) and two birth outcomes (low birthweight, preterm birth). Logistic regression analyses were utilized to calculate the associations of maternal

morbidity and adverse birth outcome with maternal birthplace. **Results:** Of a total 3 669 928 registered births in the US in 2021, 499 409 births to mothers who identified as Black were included in analysis; the majority of individuals were aged 20 to 24 years (117 173 [23.5%]), 25 to 29 years (142 890 [28.6%]), or 30 to 34 years (123 485 [24.7%]). Maternal birthplace in the US was associated with a decreased odds of experiencing any maternal morbidity (4411 of 403 822 births [1.1%]) compared with Black people born outside of the US (1593 of 95 587 births [1.7%]) (aOR, 0.67; 95% CI, 0.62-0.71). US-born Black people were significantly less likely to experience 3 of 5 maternal morbidities compared with non-US-born Black people: maternal transfusion (aOR, 0.87; 95% CI, 0.78-0.97), perineal laceration (aOR, 0.43; 95% CI, 0.39-0.48), and ruptured uterus (aOR, 0.63; 95% CI, 0.45-0.89). US-born Black people also had a nonsignificant decrease in odds for unplanned hysterectomy (aOR, 0.77; 95% CI, 0.56-1.05) and admission to intensive care unit (aOR, 0.92; 95% CI, 0.79-1.07). However, they were at increased odds of experiencing key adverse infant health outcomes, including low birthweight (aOR, 1.62; 95% CI, 1.58-1.67) and preterm birth (aOR, 1.51; 95% CI, 1.47-1.55). **Conclusions and relevance:** In this cross-sectional study, significant differences were observed in odds of maternal morbidity and birth outcomes by maternal birthplace within the Black pregnant population in the US. This suggests the need for increased assessment of nativity in Black maternal health research and specific strategies to reduce morbidity for non-US-born populations.

129. Odd DE, Stoianova S, Williams T, Odd D, Edi-Osagie N, McClymont C, Fleming P, Luyt K **Race and Ethnicity, Deprivation, and Infant Mortality in England, 2019-2022.** JAMA Netw Open. 2024 Feb 5;7(2):e2355403.

Importance: England has one of the highest infant mortality rates in Europe. Much of the variation in infant mortality rates between races and ethnicities may be due to socioeconomic factors, but how deprivation and race and ethnicity are associated with infant mortality is unclear. **Objectives:** To investigate the association of infant race and ethnicity with the infant mortality rate in England, adjusted for preterm birth and level of deprivation. **Design, setting, and participants:** This cohort study included children who died younger than 1 year of age, born at or after 22 weeks' gestation, occurring from April 1, 2019, to March 31, 2022, in England. Characteristics of the infant were derived from death notifications. **Exposures:** The racial and ethnic groups were derived from National Health Service data and were reported by the parents and characterized using the Office of National Statistics classification: Asian or Asian British (Bangladeshi, Chinese, Indian, Pakistani, or any other Asian background), Black or Black British (African, Caribbean, or any other Black background), multiracial (White and Asian, White and Black African, White and Black Caribbean, or any other multiracial background), White or White British (British, Irish, any other White background, or Gypsy or Irish Traveler), and other (Arab or any other racial or ethnic group). **Main outcomes and measures:** Risk of death for all racial and ethnic groups and relative risk of death compared with the reference group (White) were calcuated. Analyses were repeated, adjusting for deprivation, gestational age of infants, and region of England. **Results:** A total of 5621 infants who died younger than 1 year of age were reported to the National Child Mortality Database. A total of 2842 of 5130 infants (55.4%) were male; the median gestational age was 33 weeks (IQR, 25-38 weeks); of 5149 infants, 927 (18.0%) were Asian, 448 (8.7%) were Black, 3318 (64.4%) were White, 343 (6.7%) were multiracial, and 113 (2.2%) were from other racial and ethnic groups; and the median deprivation score was 4 (IQR, 3-5). In the unadjusted analysis, the relative risk of death compared with White infants was higher for Black (1.93 [95% CI, 1.75-2.13]) and Asian (1.67 [95% CI, 1.55-1.80]) infants. The population attributable risk fraction for all mortality rates among infants who were not White was 12.0% (95% CI, 10.3%-13.8%)

(unadjusted), 9.8% (95% CI, 8.0%-11.7%) (adjusted for deprivation), 7.7% (95% CI, 5.9%-9.5%) (adjusted for gestational age at birth), and 12.8% (95% CI, 11.0%-14.5%) (adjusted for region of England). **Conclusions and relevance:** This cohort study suggests that the proportion of infants who died before 1 year of age is associated with race and ethnicity, with a population attributable risk fraction of 12.0%. An overconservative adjustment for deprivation did not explain the overall patterns seen. Approximately half the population attributable risk fraction may be due to increased risk of preterm birth in Asian and Black communities. Work is needed to identify what can be done to reduce this incidence of infant mortality.

Neonatal Outcomes

130. Yamada NK, Szyld E, Strand ML, Finan E, Illuzzi JL, Kamath-Rayne BD, Kapadia VS, Niermeyer S, Schmölzer GM, Williams A, Weiner GM, Wyckoff MH, Lee HC. **2023 American Heart Association and American Academy of Pediatrics Focused Update on Neonatal Resuscitation: An Update to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care**. Circulation. 2024 Jan 2;149(1):e157-e166.

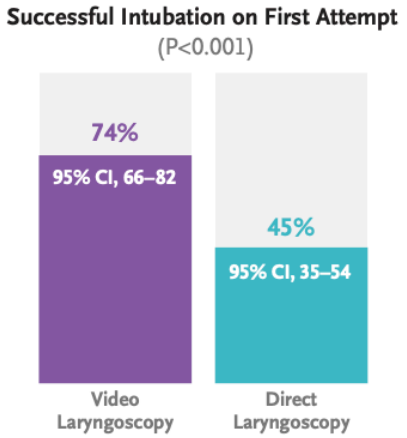
    This 2023 focused update to the neonatal resuscitation guidelines is based on 4 systematic reviews recently completed under the direction of the International Liaison Committee on Resuscitation Neonatal Life Support Task Force. Systematic reviewers and content experts from this task force performed comprehensive reviews of the scientific literature on umbilical cord management in preterm, late preterm, and term newborn infants, and the optimal devices and interfaces used for administering positive-pressure ventilation during resuscitation of newborn infants. These recommendations provide new guidance on the use of intact umbilical cord milking, device selection for administering positive-pressure ventilation, and an additional primary interface for administering positive-pressure ventilation.

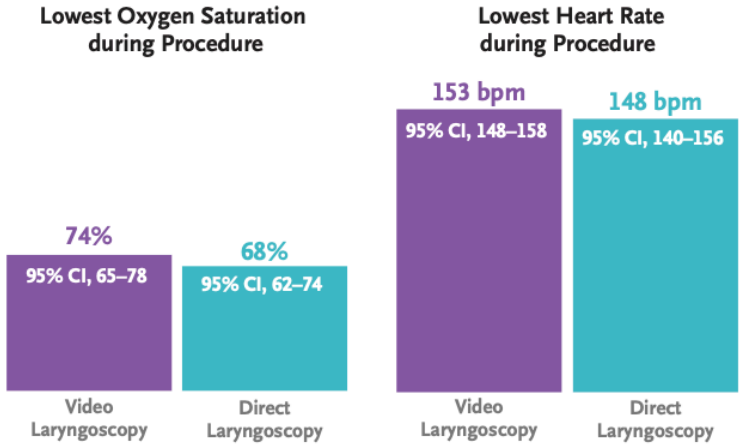
131. Geraghty LE, Dunne EA, Ní Chathasaigh CM, Vellinga A, Adams NC, O'Currain EM, McCarthy LK, O'Donnell CPF. **Video versus Direct Laryngoscopy for Urgent Intubation of Newborn Infants**. N Engl J Med. 2024 May 30;390(20):1885-1894.

    Background: Repeated attempts at endotracheal intubation are associated with increased adverse events in neonates. When clinicians view the airway directly with a laryngoscope, fewer than half of first attempts are successful. The use of a video laryngoscope, which has a camera at the tip of the blade that displays a view of the airway on a screen, has been associated with a greater percentage of successful intubations on the first attempt than the use of direct laryngoscopy in adults and children. The effect of video laryngoscopy among neonates is uncertain. **Methods:** In this single-center trial, we randomly assigned neonates of any gestational age who were undergoing intubation in the delivery room or neonatal intensive care unit (NICU) to the video-laryngoscopy group or the direct-laryngoscopy group. Randomization was stratified according to gestational age (<32 weeks or ≥32 weeks). The primary outcome was successful intubation on the first attempt, as determined by exhaled carbon dioxide detection. **Results:** Data were analyzed for 214 of the 226 neonates who were enrolled in the trial, 63 (29%) of whom were intubated in the delivery room and 151 (71%) in the NICU. Successful intubation on the first attempt occurred in 79 of the 107 patients (74%; 95% confidence interval [CI], 66 to 82) in the video-laryngoscopy group and in 48 of the 107 patients (45%; 95% CI, 35

to 54) in the direct-laryngoscopy group (P<0.001). The median number of attempts to achieve successful intubation was 1 (95% CI, 1 to 1) in the video-laryngoscopy group and 2 (95% CI, 1 to 2) in the direct-laryngoscopy group. The median lowest oxygen saturation during intubation was 74% (95% CI, 65 to 78) in the video-laryngoscopy group and 68% (95% CI, 62 to 74) in the direct-laryngoscopy group; the lowest heart rate was 153 beats per minute (95% CI, 148 to 158) and 148 (95% CI, 140 to 156), respectively. **Conclusions:** Among neonates undergoing urgent endotracheal intubation, video laryngoscopy resulted in a greater number of successful intubations on the first attempt than direct laryngoscopy.

A higher percentage of neonates were successfully intubated on the first attempt with video laryngoscopy than with direct laryngoscopy. The median number of intubation attempts was 1 in the video-laryngoscopy group and 2 in the direct-laryngoscopy group.





The median lowest oxygen saturation during the procedure was similar in the two groups, as was the median lowest heart rate during the procedure.

132. Halling C, Conroy S, Raymond T, Foglia EE, Haggerty M, Brown LL, Wyckoff MH. **Use of Initial Endotracheal Versus Intravenous Epinephrine During Neonatal Cardiopulmonary Resuscitation in the Delivery Room: Review of a National Database**. J Pediatr. 2024 Aug;271:114058.

Objective: To assess whether initial epinephrine administration by endotracheal tube (ET) in newly born infants receiving chest compressions and epinephrine in the delivery room (DR) is associated with lower rates of return of spontaneous circulation (ROSC) than newborns receiving initial intravenous (IV) epinephrine. **Study design:** We conducted a retrospective review of neonates receiving chest compressions and epinephrine in the DR from the AHA Get With The Guidelines-Resuscitation registry from October 2013 through July 2020. Neonates were classified according to initial route of epinephrine (ET vs IV). The primary outcome of interest was ROSC in the DR. **Results:** In total, 408 infants met inclusion criteria; of these, 281 (68.9%) received initial ET epinephrine and 127 (31.1%) received initial IV epinephrine. The initial ET epinephrine group included those infants who also received subsequent IV epinephrine when ET epinephrine failed to achieve ROSC. Comparing initial ET with initial IV epinephrine, ROSC was achieved in 70.1% vs 58.3% (adjusted risk difference 10.02; 95% CI 0.05-19.99). ROSC was achieved in 58.3% with IV epinephrine alone, and 47.0% with ET epinephrine alone, with 40.0% receiving subsequent IV epinephrine. **Conclusions:** This study suggests that initial use of ET epinephrine is reasonable during DR resuscitation, as there were greater

rates of ROSC compared with initial IV epinephrine administration. However, administration of IV epinephrine should not be delayed in those infants not responding to initial ET epinephrine, as almost one-half of infants who received initial ET epinephrine subsequently received IV epinephrine before achieving ROSC.

133. Wolfsberger CH, Schwaberger B, Urlesberger B, Avian A, Goeral K, Hammerl M, Perme T, Dempsey EM, Springer L, Lista G, Szczapa T, Fuchs H, Karpinski L, Bua J, Law B, Buchmayer J, Kiechl-Kohlendorfer U, Kornhauser-Cerar L, Schwarz CE, Gründler K, Stucchi I, Klebermass-Schrehof K, Schmölzer GM, Pichler G. **Reference Ranges for Arterial Oxygen Saturation, Heart Rate, and Cerebral Oxygen Saturation during Immediate Postnatal Transition in Neonates Born Extremely or Very Preterm.** J Pediatr. 2024 Oct;273:114132.

Objective: To define percentile charts for arterial oxygen saturation (SpO2), heart rate (HR), and cerebral oxygen saturation (crSO2) during the first 15 minutes after birth in neonates born very or extremely preterm and with favorable outcome. **Study design:** We conducted a secondary-outcome analysis of neonates born preterm included in the Cerebral regional tissue Oxygen Saturation to Guide Oxygen Delivery in preterm neonates during immediate transition after birth III (COSGOD III) trial with visible cerebral oximetry measurements and with favorable outcome, defined as survival without cerebral injuries until term age. We excluded infants with inflammatory morbidities within the first week after birth. SpO2 was obtained by pulse oximetry, and electrocardiogram or pulse oximetry were used for measurement of HR. crSO2 was assessed with near-infrared spectroscopy. Measurements were performed during the first 15 minutes after birth. Percentile charts (10th to 90th centile) were defined for each minute. **Results:** A total of 207 neonates born preterm with a gestational age of 29.7 (23.9-31.9) weeks and a birth weight of 1200 (378-2320) g were eligible for analyses. The 10th percentile of SpO2 at minute 2, 5, 10, and 15 was 32%, 52%, 83%, and 85%, respectively. The 10th percentile of HR at minute 2, 5, 10, and 15 was 70, 109, 126, and 134 beats/min, respectively. The 10th percentile of crSO2 at minute 2, 5, 20, and 15 was 15%, 27%, 59%, and 63%, respectively. **Conclusions:** This study provides new centile charts for SpO2, HR, and crSO2 for neonates born extremely or very preterm with favorable outcome. Implementing these centiles in guiding interventions during the stabilization process after birth might help to more accurately target oxygenation during postnatal transition period.

134. Midan DA, El-Gendy FM, Bahbah WA, Alamah HY, Elzayat RS. **Predictive Ability of Conventional and Combined Apgar Scores versus Neonatal Resuscitation and Adaptation Score in Early Neonatal Assessment.** Am J Perinatol. 2024 May;41(S 01):e1647-e1656.

Objective: The aim of this study was to assess the Neonatal Resuscitation and Adaptation Score (NRAS) value compared with the conventional and combined Apgar scores in predicting neonatal morbidity and mortality. **Study design:** A prospective cohort study was conducted on 289 neonates delivered at the Menoufia University Hospital. Trained physicians measured conventional Apgar score, combined Apgar score, and NRAS for the neonates at 1 and 5 minutes after delivery in the delivery room. Admitted neonates were followed during their stay to detect any adverse outcomes. **Results:** Morbidities such as the need for neonatal intensive care unit admission, mechanical ventilation, surfactant and inotropes administration, need for extensive phototherapy, intravenous immunoglobulin or exchange transfusion, anemia, metabolic acidosis, abnormal liver and kidney function tests, coagulopathies, hypoglycemia, development of seizures in the first 72 hours of life, and positive changes in cranial ultrasound were significantly higher in neonates who lie within low or

moderate NRAS than conventional and combined Apgar scores ($p < 0.05$). As predictors of mortality, the low and moderate values of the NRAS had higher positive predictive values at 1 (73.91 and 30.61%) and 5 minutes (88.89 and 50.94%) than the conventional Apgar scores at 1 (49.18 and 20.53%), 5 minutes (81.25 and 41.27%) and the combined Apgar scores at 1 (35.63 and 12.45%) and 5 minutes (53.1 and 41.33%). **Conclusion:** Our study suggests that the NRAS is better than conventional and combined Apgar scores in predicting neonatal morbidity and mortality. Furthermore, a depressed 5-minute NRAS is more predictive of mortality than 1-minute score. **Key points:** NRAS is better than conventional and combined Apgar scores in predicting neonatal morbidity. NRAS is more predictive of mortality than conventional and combined Apgar scores. A depressed 5-minute NRAS is more predictive of mortality than 1-minute score.

135. Tarvonen M, Markkanen J, Tuppurainen V, Jernman R, Stefanovic V, Andersson S. **Intrapartum cardiotocography with simultaneous maternal heart rate registration improves neonatal outcome.** Am J Obstet Gynecol. 2024 Apr;230(4):379.e1-379.e12.

Background: Intrapartum cardiotocographic monitoring of fetal heart rate by abdominal external ultrasound transducer without simultaneous maternal heart rate recording has been associated with increased risk of early neonatal death and other asphyxia-related neonatal outcomes. It is unclear, however, whether this increase in risk is independently associated with fetal surveillance method or is attributable to other factors. **Objective:** This study aimed to compare different fetal surveillance methods and their association with adverse short- and long-term fetal and neonatal outcomes in a large retrospective cohort of spontaneous term deliveries. **Study design:** Fetal heart rate and maternal heart rate patterns were recorded by cardiotocography during labor in spontaneous term singleton cephalic vaginal deliveries in the Hospital District of Helsinki and Uusimaa, Finland between October 1, 2005, and September 30, 2023. According to the method of cardiotocography monitoring at birth, the cohort was divided into the following 3 groups: women with ultrasound transducer, women with both ultrasound transducer and maternal heart rate transducer, and women with internal fetal scalp electrode. Umbilical artery pH and base excess values, low 1- and 5-minute Apgar scores, need for intubation and resuscitation, neonatal intensive care unit admission for asphyxia, neonatal encephalopathy, and early neonatal death were used as outcome variables. **Results:** Among the 213,798 deliveries that met the inclusion criteria, the monitoring type was external ultrasound transducer in 81,559 (38.1%), both external ultrasound transducer and maternal heart rate recording in 62,268 (29.1%), and fetal scalp electrode in 69,971 (32.7%) cases, respectively. The rates of both neonatal encephalopathy (odds ratio, 1.48; 95% confidence interval, 1.08-2.02) and severe acidemia (umbilical artery pH <7.00 and/or umbilical artery base excess ≤-12.0 mmol/L) (odds ratio, 2.03; 95% confidence interval, 1.65-2.50) were higher in fetuses of women with ultrasound transducer alone compared with those of women with concurrent external fetal and maternal heart rate recording. Monitoring with ultrasound transducer alone was also associated with increased risk of neonatal intubation for resuscitation (odds ratio, 1.22; 95% confidence interval, 1.03-1.44). A greater risk of severe neonatal acidemia was observed both in the ultrasound transducer (odds ratio, 2.78; 95% confidence interval, 2.23-3.48) and concurrent ultrasound transducer and maternal heart rate recording (odds ratio, 1.37; 95% confidence interval, 1.05-1.78) groups compared with those monitored with fetal scalp electrodes. No difference in risk of neonatal encephalopathy was found between newborns monitored with concurrent ultrasound transducer and maternal heart rate recording and those monitored with fetal scalp electrodes. **Conclusion:** The use of external

ultrasound transducer monitoring of fetal heart rate without simultaneous maternal heart rate recording is associated with higher rates of neonatal encephalopathy and severe neonatal acidemia. We suggest that either external fetal heart rate monitoring with concurrent maternal heart rate recording or internal fetal scalp electrode be used routinely as a fetal surveillance tool in term deliveries.

136. Ing C, Silber JH, Lackraj D, Olfson M, Miles C, Reiter JG, Jain S, Chihuri S, Guo L, Gyamfi-Bannerman C, Wall M, Li G. **Behavioural disorders after prenatal exposure to anaesthesia for maternal surgery.** Br J Anaesth. 2024 May;132(5):899-910.

Background: The association between prenatal exposure to general anaesthesia for maternal surgery during pregnancy and subsequent risk of disruptive or internalising behavioural disorder diagnosis in the child has not been well-defined. **Methods**: A nationwide sample of pregnant women linked to their liveborn infants was evaluated using the Medicaid Analytic eXtract (MAX, 1999-2013). Multivariate matching was used to match each child prenatally exposed to general anaesthesia owing to maternal appendectomy or cholecystectomy during pregnancy with five unexposed children. The primary outcome was diagnosis of a disruptive or internalising behavioural disorder in children. Secondary outcomes included diagnoses for a range of other neuropsychiatric disorders. **Results**: We matched 34,271 prenatally exposed children with 171,355 unexposed children in the database. Prenatally exposed children were more likely than unexposed children to receive a diagnosis of a disruptive or internalising behavioural disorder (hazard ratio [HR], 1.31; 95% confidence interval [CI], 1.23-1.40). For secondary outcomes, increased hazards of disruptive (HR, 1.32; 95% CI, 1.24-1.41) and internalising (HR, 1.36; 95% CI, 1.20-1.53) behavioural disorders were identified, and also increased hazards of attention-deficit/hyperactivity disorder (HR, 1.32; 95% CI, 1.22-1.43), behavioural disorders (HR, 1.28; 95% CI, 1.14-1.42), developmental speech or language disorders (HR, 1.16; 95% CI, 1.05-1.28), and autism (HR, 1.31; 95% CI, 1.05-1.64). **Conclusions:** Prenatal exposure to general anaesthesia is associated with a 31% increased risk for a subsequent diagnosis of a disruptive or internalising behavioural disorder in children. Caution is advised when making any clinical decisions regarding care of pregnant women, as avoidance of necessary surgery during pregnancy can have detrimental effects on mothers and their children.

With a comment by Ende HB, Habib AS, Lim G, Landau R, Beilin Y, Wong CA. **Behavioural disorders after prenatal exposure to anaesthesia for maternal surgery: is it the anaesthesia or the surgery?** Br J Anaesth. 2024 Sep;133(3):682-683.

137. Isik OG, Junaid S, Guo L, Lackraj D, Landau R, Miles CH, Pennell C, von Ungern Sternberg BS, Whitehouse AJO, Li G, Ing C. **Behavioural and neuropsychological outcomes in children exposed in utero to maternal labour epidural analgesia**. Br J Anaesth. 2024 Aug;133(2):334-343.

Background: Recent studies report conflicting results regarding the relationship between labour epidural analgesia (LEA) in mothers and neurodevelopmental disorders in their offspring. We evaluated behavioural and neuropsychological test scores in children of mothers who used LEA. **Methods:** Children enrolled in the Raine Study from Western Australia and delivered vaginally from a singleton pregnancy between 1989 and 1992 were evaluated. Children exposed to LEA were compared with unexposed children. The primary outcome was the parent-reported Child Behaviour Checklist (CBCL) reporting total, internalising, and externalising behavioural problem scores at age 10 yr. Score differences, an increased risk of clinical deficit, and a dose-response based on the duration

of LEA exposure were assessed. Secondary outcomes included language, motor function, cognition, and autistic traits. **Results:** Of 2180 children, 850 (39.0%) were exposed to LEA. After adjustment for covariates, exposed children had minimally increased CBCL total scores (+1.41 points; 95% confidence interval [CI] 0.09 to 2.73; P=0.037), but not internalising (+1.13 points; 95% CI -0.08 to 2.34; P=0.066) or externalising (+1.08 points; 95% CI -0.08 to 2.24; P=0.068) subscale subscores. Increased risk of clinical deficit was not observed for any CBCL score. For secondary outcomes, score differences were inconsistently observed in motor function and cognition. Increased exposure duration was not associated with worse scores in any outcomes. **Conclusions:** Although LEA exposure was associated with slightly higher total behavioural scores, there was no difference in subscores, increased risk of clinical deficits, or dose-response relationship. These results argue against LEA exposure being associated with consistent, clinically significant neurodevelopmental deficits in children.

With an editorial by Kearns RJ, Nelson SM, and Rex S. **Epidural analgesia in labour: separating fact from fiction for autism and neurodevelopment.** British Journal of Anaesthesia, 133 (2): 247e254 (2024)

138. Gemmill A, Margerison CE, Stuart EA, Bell SO. **Infant Deaths After Texas' 2021 Ban on Abortion in Early Pregnancy**. JAMA Pediatr. 2024 Aug 1;178(8):784-791.

Importance: Prior observational research has shown that infants born in states with more abortion restrictions are more likely to die during infancy. It is unclear how recent and more severe abortion bans in the US have impacted infant mortality. **Objective:** To examine whether Texas Senate Bill 8 (SB8), which banned abortions after embryonic cardiac activity and did not allow exemptions for congenital anomalies, is associated with infant mortality in the state of Texas. **Design, setting, and participants:** This population-based cohort study of all recorded infant deaths from the state of Texas and 28 comparison states used a comparative interrupted time series analysis with an augmented synthetic control approach and national birth certificate data from January 1, 2018, to December 31, 2022, to estimate the difference between the number of observed and expected infant and neonatal deaths and death rates among monthly cohorts exposed to Texas' SB8. **Exposure:** Deaths in March 2022 were treated as the first cohort exposed to the Texas' SB8 abortion policy because these infants (if born full term) were approximately 10 to 14 weeks' gestation when SB8 went into effect on September 1, 2021. The exposure period was thus March through December 2022. **Main outcomes and measures:** Our outcomes were monthly counts and rates of infant (aged <1 year) and neonatal (aged <28 days) deaths in the exposure period in Texas. In secondary analyses, annual changes in cause-specific infant deaths between 2021 and 2022 in Texas and the rest of the US were examined. **Results:** Between 2018 and 2022, there were 102 391 infant deaths in the US, with 10 351 of these deaths occurring in the state of Texas. Between 2021 and 2022, infant deaths in Texas increased from 1985 to 2240, or 255 additional deaths. This corresponds to a 12.9% increase, whereas the rest of the US experienced a comparatively lower 1.8% increase. On the basis of the counterfactual analysis that used data from Texas and eligible comparison states, an excess of 216 infant deaths (95% CI, -122 to 554) was observed from March to December 2022, or a 12.7% increase above expectation. At the monthly level, significantly greater-than-expected counts were observed for 4 months between March and December 2022: April, July, September, and October. An analysis of neonatal deaths found somewhat similar patterns, with significantly greater-than-expected neonatal deaths in April and October 2022. Descriptive statistics by cause of death showed that infant deaths attributable to

congenital anomalies in 2022 increased more for Texas (22.9% increase) but not the rest of the US (3.1% decrease). **Conclusions and relevance:** This study found that Texas' 2021 ban on abortion in early pregnancy was associated with unexpected increases in infant and neonatal deaths in Texas between 2021 and 2022. Congenital anomalies, which are the leading cause of infant death, also increased in Texas but not the rest of the US. Although replication and further analyses are needed to understand the mechanisms behind these findings, the results suggest that restrictive abortion policies may have important unintended consequences in terms of trauma to families and medical cost as a result of increases in infant mortality. These findings are particularly relevant given the recent Dobbs v Jackson Women's Health Organization US Supreme Court decision and subsequent rollbacks of reproductive rights in many US states.

139. Pyle A, Adams SY, Cortezzo DE, Fry JT, Henner N, Laventhal N, Lin M, Sullivan K, Wraight CL. **Navigating the post-Dobbs landscape: ethical considerations from a perinatal perspective.** J Perinatol. 2024 May;44(5):628-634.

Restrictive abortion laws have impacts reaching far beyond the immediate sphere of reproductive health, with cascading effects on clinical and ethical aspects of neonatal care, as well as perinatal palliative care. These laws have the potential to alter how families and clinicians navigate prenatal and postnatal medical decisions after a complex fetal diagnosis is made. We present a hypothetical case to explore the nexus of abortion care and perinatal care of fetuses and infants with life-limiting conditions. We will highlight the potential impacts of limited abortion access on families anticipating the birth of these infants. We will also examine the legally and morally fraught gray zone of gestational viability where both abortion and resuscitation of live-born infants can potentially occur, per parental discretion. These scenarios are inexorably impacted by the rapidly changing legal landscape in the U.S., and highlight difficult ethical dilemmas which clinicians may increasingly need to navigate.

140. Gregory ECW, Valenzuela CP, Hoyert DL. **Fetal Mortality: United States, 2022**. Natl Vital Stat Rep. 2024 Sep 12;(9).

Objectives: This report presents 2022 fetal mortality data by maternal race and Hispanic origin, age, tobacco use during pregnancy, and state of residence, as well as by plurality, sex, gestational age, birthweight, and selected causes of death. Trends in fetal mortality are also examined. **Methods:** Descriptive tabulations of data are presented and interpreted for all fetal deaths reported for the United States for 2022 with a stated or presumed period of gestation of 20 weeks or more. Cause-of-fetal-death data only are restricted to residents of the 43 states and District of Columbia where cause of death was based on the 2003 fetal death report revision and less than 50% of deaths were attributed to Fetal death of unspecified cause (P95). **Results:** A total of 20,202 fetal deaths at 20 weeks of gestation or more were reported in the United States in 2022. The 2022 U.S. fetal mortality rate was 5.48 fetal deaths at 20 weeks of gestation or more per 1,000 live births and fetal deaths, 4% lower than in 2021 (5.73) and a new historic low for the United States. The fetal mortality rate in 2022 for deaths occurring at 20-27 weeks of gestation was 2.79, a 5% decline from 2021 (2.95). For deaths occurring at 28 weeks of gestation or more, the rate in 2022 was 2.71, a 3% decline from 2021 (2.80). In 2022, the fetal mortality rate was highest for Native Hawaiian or Other Pacific Islander non-Hispanic (10.36) and Black non-Hispanic (10.05) females and lowest for Asian non-Hispanic females (3.70). Fetal mortality rates were highest for women ages 40 and older, for women who smoked during

pregnancy, and for women with multiple gestation pregnancies. Five selected causes accounted for 90.0% of fetal deaths in the 43-state and District of Columbia reporting area.

141. Ely DM, Driscoll AK. **Infant Mortality by Selected Maternal Characteristics and Race and Hispanic Origin in the United States, 2019-2021**. Natl Vital Stat Rep. 2024 Mar;73(3):1-9.

Objectives: This report presents infant mortality rates for selected maternal characteristics (prepregnancy body mass index, cigarette smoking during pregnancy, receipt of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) benefits during pregnancy, timing of prenatal care, and source of payment for delivery) for the five largest maternal race and Hispanic-origin groups in the United States for combined years 2019-2021. **Methods:** Descriptive tabulations based on data from the linked birth/infant death files for 2019-2021 are presented. The linked birth/infant death file is based on birth and death certificates registered in all 50 states and the District of Columbia. Infant mortality rates are presented for each maternal race and Hispanic-origin group overall and by selected characteristics. **Results:** Infant mortality rates varied across the five largest maternal race and Hispanic-origin groups and by selected maternal characteristics. For most race and Hispanic-origin groups, mortality rates were higher among infants of women with prepregnancy obesity compared with those of women who were normal weight, and were higher for infants of women who smoked cigarettes during pregnancy, received late or no prenatal care, or were covered by Medicaid as the source of payment for delivery. Overall, mortality rates were higher for infants of women who received WIC during pregnancy, but results varied across race and Hispanic-origin groups. Mortality rates for the maternal characteristics examined were generally highest among infants of Black non-Hispanic and American Indian and Alaska Native non-Hispanic women and lowest for Asian non-Hispanic women.

142. Ukah UV, Côté-Corriveau G, Nelson C, Healy-Profitós J, Auger N. **Risk of Adverse Neonatal Events in Pregnancies Complicated by Severe Maternal Morbidity**. J Pediatr. 2024 Oct;273:114149.

Objective: To investigate the risk of adverse neonatal events after a pregnancy complicated by severe maternal morbidity. **Study design:** We analyzed a population-based cohort of deliveries in Quebec, Canada, between 2006 and 2021. The main exposure measure was severe maternal morbidity, comprising life-threatening conditions such as severe hemorrhage, cardiac complications, and eclampsia. The outcome included adverse neonatal events such as very preterm birth (gestational age <32 weeks), bronchopulmonary dysplasia, hypoxic ischemic encephalopathy, and neonatal death. Using log-binomial regression models, we estimated adjusted relative risks (RRs) and 95% confidence intervals (CIs) for the association between severe maternal morbidity and adverse neonatal events. **Results:** Among 1 199 112 deliveries, 29 992 (2.5%) were complicated by severe maternal morbidity and 83 367 (7.0%) had adverse neonatal events. Severe maternal morbidity was associated with 2.96 times the risk of adverse neonatal events compared with no morbidity (95% CI 2.90-3.03). Associations were greatest for mothers who required assisted ventilation (RR 5.86, 95% CI 5.34-6.44), experienced uterine rupture (RR 4.54, 95% CI 3.73-5.51), or had cardiac complications (RR 4.39, 95% CI 3.98-4.84). Severe maternal morbidity was associated with ≥3 times the risk of neonatal death and hypoxic-ischemic encephalopathy and ≥10 times the risk of very preterm birth and bronchopulmonary dysplasia. **Conclusions:** Severe maternal morbidity is associated with an elevated risk of adverse

neonatal events. Better prevention of severe maternal morbidity may help reduce burden of severe neonatal morbidity.

With an editorial by Phibbs CS and Phibbs CM. **Assessing the Infant Effects of Severe Maternal Morbidity**. Journal of Pediatrics Oct 2024;273():114230

143. Fall C, Baer RJ, Jelliffe-Pawlowski L, Matoba N, Lee HC, Chambers CD, Bandoli G. **Racial and Ethnic Inequities in Therapeutic Hypothermia and Neonatal Hypoxic-Ischemic Encephalopathy: A Retrospective Cohort Study**. J Pediatr. 2024 Jun;269:113966.

Objective: To investigate racial inequities in the use of therapeutic hypothermia (TH) and outcomes in infants with hypoxic-ischemic encephalopathy (HIE). **Study design:** We queried an administrative birth cohort of mother-baby pairs in California from 2010 through 2019 using International Classification of Diseases codes to evaluate the association between race and ethnicity and the application of TH in infants with HIE. We identified 4779 infants with HIE. Log-linear regression was used to calculate risk ratios (RR) for TH, adjusting for hospital transfer, rural location, gestational age between 35 and 37 weeks, and HIE severity. Risk of adverse infant outcome was calculated by race and ethnicity and stratified by TH. **Results:** From our identified cohort, 1338 (28.0%) neonates underwent TH. White infants were used as the reference sample, and 410 (28.4%) received TH. Black infants were significantly less likely to receive TH with 74 (20.0%) with an adjusted risk ratio (aRR) of 0.7 (95% CI 0.5-0.9). Black infants with any HIE who did not receive TH were more likely to have a hospital readmission (aRR 1.36, 95% CI 1.10-1.68) and a tracheostomy (aRR 3.07, 95% CI 1.19-7.97). Black infants with moderate/severe HIE who did not receive TH were more likely to have cerebral palsy (aRR 2.72, 95% CI 1.07-6.91). **Conclusions:** In this study cohort, Black infants with HIE were significantly less likely to receive TH. Black infants also had significantly increased risk of some adverse outcomes of HIE. Possible reasons for this inequity include systemic barriers to care and systemic bias.

144. Bada HS, Westgate PM, Sithisarn T, Yolton K, Charnigo R, Pourcyrous M, Tang F, Gibson J, Shearer-Miller J, Giannone P, Leggas M. **Clonidine as Monotherapy for Neonatal Opioid Withdrawal Syndrome: A Randomized Trial.** Pediatrics. 2024 Nov 1;154(5):e2023065610.

Objective: We sought to determine whether clonidine, a non-opioid α-2-adrenergic agonist, would effectively treat neonatal opioid withdrawal syndrome (NOWS). **Methods:** This was an intention-to-treat randomized clinical trial. Enrollment criteria included prenatal opioid exposure, age ≤7 days, gestational age ≥35 weeks, no other medical condition, and need for pharmacotherapy. Primary outcomes were length of treatment and neurobehavioral performance. **Results:** A total of 1107 patients were screened for enrollment (645 ineligible, 91 parents or staff unavailable, 216 declined, 155 consented). Of 155 infants, 120 required treatment and were randomized to receive oral clonidine (n = 60) at 1 μg/kg/dose or morphine (n = 60), 0.06 mg/kg/dose, every 3 hours. Infants with no improvement had their doses increased by 25% of the initial dose every 12 to 24 hours. Those without improvement by the fourth dose increase, received adjunct therapy. Length of treatment did not differ between morphine and clonidine, with median (95% confidence interval [CI]) days, respectively, of 15 (13-17) and 17 (15-19), P = .48. More clonidine-treated infants (45%) needed adjunct therapy versus 10% in the morphine group, adjusted odds ratio (95% CI) = 8.85 (2.87-27.31). After treatment completion, the NICU Network Neurobehavioral Scales summary scores did not differ between clonidine-treated and morphine-treated infants. **Conclusions:** Length of pharmacologic treatment

and final neurobehavioral performance were not significantly different between the clonidine- and morphine-treated groups. Clonidine appears to be an effective non-opioid medication to treat NOWS. Future studies are needed to determine the optimal clonidine dosage for a quicker response and obviation of adjunct therapy.

145. Daboval T, Ouellet P, Racinet C. **Is it time to end the use of base deficit for fetal well-being assessment?** Am J Obstet Gynecol. 2024 Sep;231(3):315-320.

Authors have expressed reservations regarding the use of base deficit measured in umbilical artery blood samples to assess fetal well-being during the course of labor and to predict neonatal neurologic morbidity. Despite its integration into clinical practice for more than 50 years, obstetricians and maternal-fetal medicine specialists may not realize that this marker has significant limitations in accurately identifying neonatal metabolic acidosis as a proxy for fetal well-being. In brief, there are 2 large families of base deficit, namely whole blood and extracellular fluid. Both rely on equations that use normal adult acid-base characteristics (pH 7.40 and partial CO2 pressure of 40 mm Hg) that overlook the specificity of the normal in utero acid-base status of pH 7.27 and partial CO2 pressure of 54 mm Hg. In addition, it ignores the unique characteristic of the in utero fetal response to acute hypoxia. The dependence on placental circulation for CO2 elimination may lead to extremely high values (up to 130 to 150 mm Hg) during hypoxic events, a phenomenon that is absent in adults with acute metabolic acidosis who can hyperventilate. The dispute over if to include a correction for high partial CO2 pressure in the bicarbonate estimation, as presented in the Great Trans-Atlantic Debates, remains unresolved. The key constants computed for adult acid-base physiology in the current base deficit algorithms, without accounting for the impact of high partial CO2 pressure or other fetal characteristics of buffering capacity (eg, differences in body water content composition, plasma protein, and hemoglobin attributes), may lead to an overestimation of metabolic acidosis, especially in newborns who are experiencing hypercarbia during the early stages of the hypoxic response. These unrecognized limitations impact the base deficit results and may mislead clinicians on fetal well-being assessments when discussing the management of fetal heart rate monitoring and neonatal outcomes. Based on our arguments, we believe that it is prudent to consider an alternative to base deficit for drawing conclusions regarding fetal well-being during the course of birth management. We propose a marker specifically related to the newborn acid-base physiology--the neonatal eucapnic pH correction. This marker can be added to arterial cord blood gas analysis, and we have described how to interpret it as a marker of neonatal metabolic acidosis.

146. Baud O, Sentilhes L, Ursino M, Doret-Dion M, Alberti C, Aupiais C, Schmitz T. **Survival without severe neonatal morbidity after antenatal betamethasone dose reduction: a post hoc analysis of a randomized non-inferiority trial.** Am J Obstet Gynecol. 2024 Oct;231(4):458.e1-458.e16.

Background: Antenatal betamethasone is recommended before preterm delivery to accelerate fetal lung maturation. However, its optimal dose remains unknown. A 50% dose reduction was proposed to decrease the potential dose-related long-term neurodevelopmental side effects, including psychological development, sleep, and emotional disorders. Because noninferiority of the half dose in terms of the need for exogenous surfactant was not shown in the primary analysis, its impact on survival without major neonatal morbidity needs to be investigated. **Objective:** This study aimed to investigate the impact of antenatal betamethasone dose reduction on survival of very preterm infants without severe neonatal morbidity, a factor known to have a strong correlation with long-term

outcomes. **Study design:** We performed a post hoc secondary analysis of a randomized, multicenter, double-blind, placebo-controlled, noninferiority trial, testing half (11.4 mg once; n=1620) vs full (11.4 mg twice, 24 hours apart; n=1624) antenatal betamethasone doses in women at risk of preterm delivery. To measure survival without severe neonatal morbidity at hospital discharge among neonates born before 32 weeks of gestation, we used the definition of the French national prospective study on preterm children, EPIPAGE 2, comprising 1 of the following morbidities: grade 3 to 4 intraventricular hemorrhage, cystic periventricular leukomalacia, necrotizing enterocolitis stage ≥2, retinopathy of prematurity requiring anti-vascular endothelial growth factor therapy or laser, and moderate-to-severe bronchopulmonary dysplasia. **Results:** After exclusion of women who withdrew consent or had pregnancy termination and of participants lost to follow-up (8 in the half-dose and 10 in the full-dose group), the rate of survival without severe neonatal morbidity among neonates born before 32 weeks of gestation was 300 of 451 (66.5%) and 304 of 462 (65.8%) in the half-dose and full-dose group, respectively (risk difference, +0.7%; 95% confidence interval, -5.6 to +7.1). There were no significant between-group differences in the cumulative number of neonatal morbidities. Results were similar when using 2 other internationally recognized definitions of severe neonatal morbidity and when considering the overall population recruited in the trial. **Conclusion:** In the BETADOSE trial, severe morbidity at discharge of newborns delivered before 32 weeks of gestation was found to be similar among those exposed to 11.4-mg and 22.8-mg antenatal betamethasone. Additional studies are needed to confirm these findings.

147. Clapp MA, Li S, Cohen JL, Gyamfi-Bannerman C, Knudsen AB, Lorch SA, Thaweethai T, Wright JD, Kaimal AJ, Melamed A. **Betamethasone Exposure and Neonatal Respiratory Morbidity Among Late Preterm Births by Planned Mode of Delivery and Gestational Age.** Obstet Gynecol. 2024 Dec 1;144(6):747-754.

Objective: To estimate the effect of late preterm antenatal steroids on the risk of respiratory morbidity among subgroups of patients on the basis of the planned mode of delivery and gestational age at presentation. **Methods:** This was a secondary analysis of the ALPS (Antenatal Late Preterm Steroid) Trial, a multicenter trial conducted within the Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network of individuals with singleton gestations and without preexisting diabetes who were at high risk for late preterm delivery (34-36 weeks of gestation). We fit binomial regression models to estimate the risk of respiratory morbidity, with and without steroid administration, by gestational age and planned mode of delivery at the time of presentation. We assumed a homogeneous effect of steroids on the log-odds scale, as was reported in the ALPS trial. The primary outcome was neonatal respiratory morbidity, as defined in the ALPS Trial. **Results:** The analysis included 2,825 patients at risk for late preterm birth. The risk of respiratory morbidity varied significantly by planned mode of delivery (adjusted risk ratio [RR] 1.90, 95% CI, 1.55-2.33 for cesarean delivery vs vaginal delivery) and week of gestation at presentation (adjusted RR 0.56, 95% CI, 0.50-0.63). For those planning cesarean delivery and presenting in the 34th

week of gestation, the risk of neonatal respiratory morbidity was 39.4% (95% CI, 30.8-47.9%) without steroids and 32.0% (95% CI, 24.6-39.4%) with steroids. In contrast, for patients presenting in the 36th week and planning vaginal delivery, the risk of neonatal respiratory morbidity was 6.9% (95% CI, 5.2-8.6%) without steroids and 5.6% (95% CI, 4.2-7.0%) with steroids. **Conclusion:** The absolute risk difference of neonatal respiratory morbidity between those exposed and those unexposed to late preterm antenatal steroids varies considerably by gestational age at presentation and planned mode of delivery. Because only communicating the relative risk reduction of antenatal steroids for respiratory morbidity may lead to an inaccurate perception of benefit, more patient-specific estimates of risk expected with and without treatment may inform shared decision making.

With an editorial by Osmundson SS and Lappen JR. **Antenatal Corticosteroid Administration for Patients at Risk for Late Preterm Delivery: Shared Decision-Making, Individualizing Risk, and Centering Patient Values.** Obstet Gynecol 144(6):p 744-746, December 2024.

148. Ufkes S, Kennedy E, Poppe T, Miller SP, Thompson B, Guo J, Harding JE, Crowther CA. **Prenatal Magnesium Sulfate and Functional Connectivity in Offspring at Term-Equivalent Age.** JAMA Netw Open. 2024 May 1;7(5):e2413508.

Importance: Understanding the effect of antenatal magnesium sulfate (MgSO4) treatment on functional connectivity will help elucidate the mechanism by which it reduces the risk of cerebral palsy and death. **Objective:** To determine whether MgSO4 administered to women at risk of imminent preterm birth at a gestational age between 30 and 34 weeks is associated with increased functional connectivity and measures of functional segregation and integration in infants at term-equivalent age, possibly reflecting a protective mechanism of MgSO4. **Design, setting, and participants:** This cohort study was nested within a randomized placebo-controlled trial performed across 24 tertiary maternity hospitals. Participants included infants born to women at risk of imminent preterm birth at a gestational age between 30 and 34 weeks who participated in the MAGENTA (Magnesium Sulphate at 30 to 34 Weeks' Gestational Age) trial and underwent magnetic resonance imaging (MRI) at term-equivalent age. Ineligibility criteria included illness precluding MRI, congenital or genetic disorders likely to affect brain structure, and living more than 1 hour from the MRI center. One hundred and fourteen of 159 eligible infants were excluded due to incomplete or motion-corrupted MRI. Recruitment occurred between October 22, 2014, and October 25, 2017. Participants were followed up to 2 years of age. Analysis was performed from February 1, 2021, to February 27, 2024. Observers were blind to patient groupings during data collection and processing. **Exposures:** Women received 4 g of MgSO4 or isotonic sodium chloride solution given intravenously over 30 minutes. **Main outcomes and measures:** Prior to data collection, it was hypothesized that infants who were exposed to MgSO4 would show enhanced functional connectivity compared with infants who were not exposed. **Results:** A total of 45 infants were included in the analysis: 24 receiving MgSO4 treatment and 21 receiving placebo; 23 (51.1%) were female and 22 (48.9%) were male; and the median gestational age at scan was 40.0 (IQR, 39.1-41.1) weeks. Treatment with MgSO4 was associated with greater voxelwise functional connectivity in the temporal and occipital lobes and deep gray matter structures and with significantly greater clustering coefficients (Hedge g, 0.47 [95% CI, -0.13 to 1.07]), transitivity (Hedge g, 0.51 [95% CI, -0.10 to 1.11]), local efficiency (Hedge g, 0.40 [95% CI, -0.20 to 0.99]), and global

efficiency (Hedge g, 0.31 [95% CI, -0.29 to 0.90]), representing enhanced functional segregation and integration. **Conclusions and relevance:** In this cohort study, infants exposed to MgSO4 had greater voxelwise functional connectivity and functional segregation, consistent with increased brain maturation. Enhanced functional connectivity is a possible mechanism by which MgSO4 protects against cerebral palsy and death.

149. Fairchild KD, Petroni GR, Varhegyi NE, Strand ML, Josephsen JB, Niermeyer S, Barry JS, Warren JB, Rincon M, Fang JL, Thomas SP, Travers CP, Kane AF, Carlo WA, Byrne BJ, Underwood MA, Poulain FR, Law BH, Gorman TE, Leone TA, Bulas DI, Epelman M, Kline-Fath BM, Chisholm CA, Kattwinkel J. **Ventilatory Assistance Before Umbilical Cord Clamping in Extremely Preterm Infants: A Randomized Clinical Trial.** JAMA Netw Open. 2024 May 1;7(5):e2411140.

Importance: Providing assisted ventilation during delayed umbilical cord clamping may improve outcomes for extremely preterm infants. **Objective:** To determine whether assisted ventilation in extremely preterm infants (23 0/7 to 28 6/7 weeks' gestational age [GA]) followed by cord clamping reduces intraventricular hemorrhage (IVH) or early death. **Design, setting, and participants:** This phase 3, 1:1, parallel-stratified randomized clinical trial conducted at 12 perinatal centers across the US and Canada from September 2, 2016, through February 21, 2023, assessed IVH and early death outcomes of extremely preterm infants randomized to receive 120 seconds of assisted ventilation followed by cord clamping vs delayed cord clamping for 30 to 60 seconds with ventilatory assistance afterward. Two analysis cohorts, not breathing well and breathing well, were specified a priori based on assessment of breathing 30 seconds after birth. **Intervention:** After birth, all infants received stimulation and suctioning if needed. From 30 to 120 seconds, infants randomized to the intervention received continuous positive airway pressure if breathing well or positive-pressure ventilation if not, with cord clamping at 120 seconds. Control infants received 30 to 60 seconds of delayed cord clamping followed by standard resuscitation. **Main outcomes and measures:** The primary outcome was any grade IVH on head ultrasonography or death before day 7. Interpretation by site radiologists was confirmed by independent radiologists, all masked to study group. To estimate the association between study group and outcome, data were analyzed using the stratified Cochran-Mantel-Haenszel test for relative risk (RR), with associations summarized by point estimates and 95% CIs. **Results:** Of 1110 women who consented to participate, 548 were randomized and delivered infants at GA less than 29 weeks. A total of 570 eligible infants were enrolled (median [IQR] GA, 26.6 [24.9-27.7] weeks; 297 male [52.1%]). Intraventricular hemorrhage or death occurred in 34.9% (97 of 278) of infants in the intervention group and 32.5% (95 of 292) in the control group (adjusted RR, 1.02; 95% CI, 0.81-1.27). In the prespecified not-breathing-well cohort (47.5% [271 of 570]; median [IQR] GA, 26.0 [24.7-27.4] weeks; 152 male [56.1%]), IVH or death occurred in 38.7% (58 of 150) of infants in the intervention group and 43.0% (52 of 121) in the control group (RR, 0.91; 95% CI, 0.68-1.21). There was no evidence of differences in death, severe brain injury, or major morbidities between the intervention and control groups in either breathing cohort. **Conclusions and relevance:** This study did not show that providing assisted ventilation before cord clamping in extremely preterm infants reduces IVH or early death. Additional study around the feasibility, safety, and efficacy of assisted ventilation before cord clamping may provide additional insight.

150. Dieussaert I, Hyung Kim J, Luik S, Seidl C, Pu W, Stegmann JU, Swamy GK, Webster P, Dormitzer PR. **RSV Prefusion F Protein-Based Maternal Vaccine - Preterm Birth and Other Outcomes.** N Engl J Med. 2024 Mar 14;390(11):1009-1021.

Background: Vaccination against respiratory syncytial virus (RSV) during pregnancy may protect infants from RSV disease. Efficacy and safety data on a candidate RSV prefusion F protein-based maternal vaccine (RSVPreF3-Mat) are needed. **Methods:** We conducted a phase 3 trial involving pregnant women 18 to 49 years of age to assess the efficacy and safety of RSVPreF3-Mat. The women were randomly assigned in a 2:1 ratio to receive RSVPreF3-Mat or placebo between 24 weeks 0 days and 34 weeks 0 days of gestation. The primary outcomes were any or severe medically assessed RSV-associated lower respiratory tract disease in infants from birth to 6 months of age and safety in infants from birth to 12 months of age. After the observation of a higher risk of preterm birth in the vaccine group than in the placebo group, enrollment and vaccination were stopped early, and exploratory analyses of the safety signal of preterm birth were performed. **Results:** The analyses included 5328 pregnant women and 5233 infants; the target enrollment of approximately 10,000 pregnant women and their infants was not reached because enrollment was stopped early. A total of 3426 infants in the vaccine group and 1711 infants in the placebo group were followed from birth to 6 months of age; 16 and 24 infants, respectively, had any medically assessed RSV-associated lower respiratory tract disease (vaccine efficacy, 65.5%; 95% credible interval, 37.5 to 82.0), and 8 and 14, respectively, had severe medically assessed RSV-associated lower respiratory tract disease (vaccine efficacy, 69.0%; 95% credible interval, 33.0 to 87.6). Preterm birth occurred in 6.8% of the infants (237 of 3494) in the vaccine group and in 4.9% of those (86 of 1739) in the placebo group (relative risk, 1.37; 95% confidence interval [CI], 1.08 to 1.74; P = 0.01); neonatal death occurred in 0.4% (13 of 3494) and 0.2% (3 of 1739), respectively (relative risk, 2.16; 95% CI, 0.62 to 7.56; P = 0.23), an imbalance probably attributable to the greater percentage of preterm births in the vaccine group. No other safety signal was observed. **Conclusions:** The results of this trial, in which enrollment was stopped early because of safety concerns, suggest that the risks of any and severe medically assessed RSV-associated lower respiratory tract disease among infants were lower with the candidate maternal RSV vaccine than with placebo but that the risk of preterm birth was higher with the candidate vaccine.

With an editorial by Rasmussen SA and Jamieson DJ.**Maternal RSV Vaccine - Weighing Benefits and Risks**. New England Journal of Medicine Mar 14 2024;390(11):1050-1051

151. Cardemil CV, Cao Y, Posavad CM, Badell ML, Bunge K, Mulligan MJ, Parameswaran L, Olson-Chen C, Novak RM, Brady RC, DeFranco E, Gerber JS, Pasetti M, Shriver M, Coler R, Berube B, Suthar MS, Moreno A, Gao F, Richardson BA, Beigi R, Brown E, Neuzil KM, Munoz FM. **Maternal COVID-19 Vaccination and Prevention of Symptomatic Infection in Infants.** Pediatrics. 2024 Mar 1;153(3):e2023064252.

Background and objectives: Maternal vaccination may prevent infant coronavirus disease 2019 (COVID-19). We aimed to quantify protection against infection from maternally derived vaccine-induced antibodies in the first 6 months of an infant's life. **Methods:** Infants born to mothers vaccinated during pregnancy with 2 or 3 doses of a messenger RNA COVID-19 vaccine (nonboosted or

boosted, respectively) had full-length spike (Spike) immunoglobulin G (IgG), pseudovirus 614D, and live virus D614G, and omicron BA.1 and BA.5 neutralizing antibody (nAb) titers measured at delivery. Infant severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection was determined by verified maternal-report and laboratory confirmation through prospective follow-up to 6 months of age between December 2021 and July 2022. The risk reduction for infection by dose group and antibody titer level was estimated in separate models. **Results:** Infants of boosted mothers (n = 204) had significantly higher Spike IgG, pseudovirus, and live nAb titers at delivery than infants of nonboosted mothers (n = 271), and were 56% less likely to acquire infection in the first 6 months (P = .03). Irrespective of boost, for each 10-fold increase in Spike IgG titer at delivery, the infant's risk of acquiring infection was reduced by 47% (95% confidence interval 8%-70%; P = .02). Similarly, a 10-fold increase in pseudovirus titers against Wuhan Spike, and live virus nAb titers against D614G, and omicron BA.1 and BA.5 at delivery were associated with a 30%, 46%, 56%, and 60% risk reduction, respectively. **Conclusions:** Higher transplacental binding and nAb titers substantially reduced the risk of SARS-CoV-2 infection in infants, and a booster dose amplified protection during a period of omicron predominance. Until infants are age-eligible for vaccination, maternal vaccination provides passive protection against symptomatic infection during early infancy.

152. Jaswa EG, Cedars MI, Lindquist KJ, Bishop SL, Kim YS, Kaing A, Prahl M, Gaw SL, Corley J, Hoskin E, Cho YJ, Rogers E, Huddleston HG. **In Utero Exposure to Maternal COVID-19 Vaccination and Offspring Neurodevelopment at 12 and 18 Months.** AMA Pediatr. 2024 Mar 1;178(3):258-265.

Importance: Uptake of COVID-19 vaccines among pregnant individuals was hampered by safety concerns around potential risks to unborn children. Data clarifying early neurodevelopmental outcomes of offspring exposed to COVID-19 vaccination in utero are lacking. **Objective:** To determine whether in utero exposure to maternal COVID-19 vaccination was associated with differences in scores on the Ages and Stages Questionnaire, third edition (ASQ-3), at 12 and 18 months of age. **Design, setting, and participants:** This prospective cohort study, Assessing the Safety of Pregnancy During the Coronavirus Pandemic (ASPIRE), enrolled pregnant participants from May 2020 to August 2021; follow-up of children from these pregnancies is ongoing. Participants, which included pregnant individuals and their offspring from all 50 states, self-enrolled online. Study activities were performed remotely. **Exposure:** In utero exposure of the fetus to maternal COVID-19 vaccination during pregnancy was compared with those unexposed. **Main outcomes and measures:** Neurodevelopmental scores on validated ASQ-3, completed by birth mothers at 12 and 18 months. A score below the established cutoff in any of 5 subdomains (communication, gross motor, fine motor, problem solving, social skills) constituted an abnormal screen for developmental delay. **Results:** A total of 2487 pregnant individuals (mean [SD] age, 33.3 [4.2] years) enrolled at less than 10 weeks' gestation and completed research activities, yielding a total of 2261 and 1940 infants aged 12 and 18 months, respectively, with neurodevelopmental assessments. In crude analyses, 471 of 1541 exposed infants (30.6%) screened abnormally for developmental delay at 12 months vs 203 of 720 unexposed infants (28.2%; $\chi 2 = 1.32$; P = .25); the corresponding prevalences at 18 months were 262 of 1301 (20.1%) vs 148 of 639 (23.2%), respectively ($\chi 2 = 2.35$; P = .13). In multivariable mixed-effects logistic regression models adjusting for maternal age, race, ethnicity, education, income, maternal

depression, and anxiety, no difference in risk for abnormal ASQ-3 screens was observed at either time point (12 months: adjusted risk ratio [aRR], 1.14; 95% CI, 0.97-1.33; 18 months: aRR, 0.88; 95% CI, 0.72-1.07). Further adjustment for preterm birth and infant sex did not affect results (12 months: aRR, 1.16; 95% CI, 0.98-1.36; 18 months: aRR, 0.87; 95% CI, 0.71-1.07). **Conclusions and relevance:** Results of this cohort study suggest that COVID-19 vaccination was safe during pregnancy from the perspective of infant neurodevelopment to 18 months of age. Additional longer-term research should be conducted to corroborate these findings and buttress clinical guidance with a strong evidence base.

153. Vesco KK, Denoble AE, Lipkind HS, Kharbanda EO, DeSilva MB, Daley MF, Getahun D, Zerbo O, Naleway AL, Jackson L, Williams JTB, Boyce TG, Fuller CC, Weintraub ES, Vazquez-Benitez G. **Obstetric Complications and Birth Outcomes After Antenatal Coronavirus Disease 2019 (COVID-19) Vaccination.** Obstet Gynecol. 2024 Jun 1;143(6):794-802.

Objective: To evaluate the association between antenatal messenger RNA (mRNA) coronavirus disease 2019 (COVID-19) vaccination and risk of adverse pregnancy outcomes. **Methods:** This was a retrospective cohort study of individuals with singleton pregnancies with live deliveries between June 1, 2021, and January 31, 2022, with data available from eight integrated health care systems in the Vaccine Safety Datalink. Vaccine exposure was defined as receipt of one or two mRNA COVID-19 vaccine doses (primary series) during pregnancy. Outcomes were preterm birth (PTB) before 37 weeks of gestation, small-for-gestational age (SGA) neonates, gestational diabetes mellitus (GDM), gestational hypertension, and preeclampsia-eclampsia-HELLP (hemolysis, elevated liver enzymes, and low platelet count) syndrome. Outcomes in individuals vaccinated were compared with those in propensity-matched individuals with unexposed pregnancies. Adjusted hazard ratios (aHRs) and 95% CIs were estimated for PTB and SGA using a time-dependent covariate Cox model, and adjusted relative risks (aRRs) were estimated for GDM, gestational hypertension, and preeclampsia-eclampsia-HELLP syndrome using Poisson regression with robust variance. **Results:** Among 55,591 individuals eligible for inclusion, 23,517 (42.3%) received one or two mRNA COVID-19 vaccine doses during pregnancy. Receipt of mRNA COVID-19 vaccination varied by maternal age, race, Hispanic ethnicity, and history of COVID-19. Compared with no vaccination, mRNA COVID-19 vaccination was associated with a decreased risk of PTB (rate: 6.4 [vaccinated] vs 7.7 [unvaccinated] per 100, aHR 0.89; 95% CI, 0.83-0.94). Messenger RNA COVID-19 vaccination was not associated with SGA (8.3 vs 7.4 per 100; aHR 1.06, 95% CI, 0.99-1.13), GDM (11.9 vs 10.6 per 100; aRR 1.00, 95% CI, 0.90-1.10), gestational hypertension (10.8 vs 9.9 per 100; aRR 1.08, 95% CI, 0.96-1.22), or preeclampsia-eclampsia-HELLP syndrome (8.9 vs 8.4 per 100; aRR 1.10, 95% CI, 0.97-1.24). **Conclusion:** Receipt of an mRNA COVID-19 vaccine during pregnancy was not associated with an increased risk of adverse pregnancy outcomes; this information will be helpful for patients and clinicians when considering COVID-19 vaccination in pregnancy.

154. Naus CA, Mann DG, Andropoulos DB, Belfort MA, Sanz-Cortes M, Whitehead WE, Sutton CD. **"This is how we do it" Maternal and fetal anesthetic management for fetoscopic myelomeningocele repairs: the Texas Children's Fetal Center protocol.** Int J Obstet Anesth. 2024 Dec 16;61:104316.

Prenatal repair of myelomeningocele (MMC) is associated with lower rates of hydrocephalus requiring ventriculoperitoneal shunt and improved motor function when compared with postnatal repair. Efforts aiming to develop less invasive surgical techniques to decrease the risk for the pregnant patient while achieving similar benefits for the fetus have led to the implementation of fetoscopic surgical techniques. While no ideal anesthetic technique for fetoscopic MMC repair has been demonstrated, we present our anesthetic approach for these repairs, including considerations for both the pregnant patient and the fetus. We emphasize the importance of the preoperative consultation to optimize any medical conditions and to set expectations for the perioperative course. Our preferred anesthetic technique for the pregnant patient includes general anesthesia with an epidural for postoperative analgesia. Intraoperative anesthetic considerations for patients undergoing fetoscopic surgery include tocolysis, meticulous control of hemodynamics, judicious fluid administration, and maternal temperature regulation. We also avoid long-acting neuromuscular blocking agents due to significant weakness observed when given in combination with magnesium sulfate. While the maternal anesthetic crosses the placenta, direct administration of anesthesia to the fetus is required to reliably blunt the stress response. Additional considerations for the fetus include monitoring, fetal resuscitation strategies, and the theoretical risk of anesthetic neurotoxicity. Postoperatively, we use a multi-modal, opioid sparing regimen for analgesia. As advances in fetal surgery aiming to minimize risk to the pregnant patient alter the surgical approach, maternal-fetal anesthesiologists must adapt and incorporate the unique considerations of fetoscopy into their anesthetic management.

Innovation

155. Stringer JSA, Pokaprakarn T, Prieto JC, Vwalika B, Chari SV, Sindano N, Freeman BL, Sikapande B, Davis NM, Sebastião YV, Mandona NM, Stringer EM, Benabdelkader C, Mungole M, Kapilya FM, Almnini N, Diaz AN, Fecteau BA, Kosorok MR, Cole SR, Kasaro MP. **Diagnostic Accuracy of an Integrated AI Tool to Estimate Gestational Age From Blind Ultrasound Sweeps.** JAMA. 2024 Aug 27;332(8):649-657.

Importance: Accurate assessment of gestational age (GA) is essential to good pregnancy care but often requires ultrasonography, which may not be available in low-resource settings. This study developed a deep learning artificial intelligence (AI) model to estimate GA from blind ultrasonography sweeps and incorporated it into the software of a low-cost, battery-powered device. **Objective**: To evaluate GA estimation accuracy of an AI-enabled ultrasonography tool when used by novice users with no prior training in sonography. **Design, setting, and participants**: This prospective diagnostic accuracy study enrolled 400 individuals with viable, single, nonanomalous, first-trimester pregnancies in Lusaka, Zambia, and Chapel Hill, North Carolina. Credentialed sonographers established the "ground truth" GA via transvaginal crown-rump length measurement. At random follow-up visits throughout gestation, including a primary evaluation window from 14 0/7 weeks' to 27 6/7 weeks' gestation, novice users obtained blind sweeps of the maternal abdomen using the AI-

enabled device (index test) and credentialed sonographers performed fetal biometry with a high-specification machine (study standard). **Main outcomes and measures**: The primary outcome was the mean absolute error (MAE) of the index test and study standard, which was calculated by comparing each method's estimate to the previously established GA and considered equivalent if the difference fell within a prespecified margin of ±2 days. **Results**: In the primary evaluation window, the AI-enabled device met criteria for equivalence to the study standard, with an MAE (SE) of 3.2 (0.1) days vs 3.0 (0.1) days (difference, 0.2 days [95% CI, -0.1 to 0.5]). Additionally, the percentage of assessments within 7 days of the ground truth GA was comparable (90.7% for the index test vs 92.5% for the study standard). Performance was consistent in prespecified subgroups, including the Zambia and North Carolina cohorts and those with high body mass index. **Conclusions and relevance**: Between 14 and 27 weeks' gestation, novice users with no prior training in ultrasonography estimated GA as accurately with the low-cost, point-of-care AI tool as credentialed sonographers performing standard biometry on high-specification machines. These findings have immediate implications for obstetrical care in low-resource settings, advancing the World Health Organization goal of ultrasonography estimation of GA for all pregnant people

With an editorial by Gimovsky, Alexis C.; Eke, Ahizechukwu C.; Tuuli, Methodius G. **Enhancing Obstetric Ultrasonography With Artificial Intelligence in Resource-Limited Settings.** JAMA Aug 27 2024;332(8):626-628

156. Adedinsewo DA, Morales-Lara AC, Afolabi BB, Kushimo OA, Mbakwem AC, Ibiyemi KF, Ogunmodede JA, Raji HO, Ringim SH, Habib AA, Hamza SM, Ogah OS, Obajimi G, Saanu OO, Jagun OE, Inofomoh FO, Adeolu T, Karaye KM, Gaya SA, Alfa I, Yohanna C, Venkatachalam KL, Dugan J, Yao X, Sledge HJ, Johnson PW, Wieczorek MA, Attia ZI, Phillips SD, Yamani MH, Tobah YB, Rose CH, Sharpe EE, Lopez-Jimenez F, Friedman PA, Noseworthy PA, Carter RE. **Artificial intelligence guided screening for cardiomyopathies in an obstetric population: a pragmatic randomized clinical trial.** Nat Med. 2024 Oct;30(10):2897-2906.

Nigeria has the highest reported incidence of peripartum cardiomyopathy worldwide. This open-label, pragmatic clinical trial randomized pregnant and postpartum women to usual care or artificial intelligence (AI)-guided screening to assess its impact on the diagnosis left ventricular systolic dysfunction (LVSD) in the perinatal period. The study intervention included digital stethoscope recordings with point of-care AI predictions and a 12-lead electrocardiogram with asynchronous AI predictions for LVSD. The primary end point was identification of LVSD during the study period. In the intervention arm, the primary end point was defined as the number of identified participants with LVSD as determined by a positive AI screen, confirmed by echocardiography. In the control arm, this was the number of participants with clinical recognition and documentation of LVSD on echocardiography in keeping with current standard of care. Participants in the intervention arm had a confirmatory echocardiogram at baseline for AI model validation. A total of 1,232 (616 in each arm) participants were randomized and 1,195 participants (587 intervention arm and 608 control arm) completed the baseline visit at 6 hospitals in Nigeria between August 2022 and September 2023 with follow-up through May 2024. Using the AI-enabled digital stethoscope, the primary study end point was met with detection of 24 out of 587 (4.1%) versus 12 out of 608 (2.0%) patients with LVSD (intervention versus control odds ratio 2.12, 95% CI 1.05-4.27; P = 0.032). With the 12-lead AI-electrocardiogram model, the primary end point was detected in 20 out of 587 (3.4%) versus 12 out of 608 (2.0%) patients (odds ratio 1.75, 95% CI 0.85-3.62; P = 0.125). A similar direction of effect was

observed in prespecified subgroup analysis. There were no serious adverse events related to study participation. In pregnant and postpartum women, AI-guided screening using a digital stethoscope improved the diagnosis of pregnancy-related cardiomyopathy.

157. Kong AYH, Liu N, Tan HS, Sia ATH, Sng BL. **Artificial intelligence in obstetric anaesthesiology - the future of patient care?** Int J Obstet Anesth. 2024 Oct 24;61:104288.
The use of artificial intelligence (AI) in obstetric anaesthesiology shows great potential in enhancing our practice and delivery of care. In this narrative review, we summarise the current applications of AI in four key areas of obstetric anaesthesiology (perioperative care, neuraxial procedures, labour analgesia and obstetric critical care), where AI has been employed to varying degrees for decision support, event prediction, risk stratification and procedural assistance. We also identify gaps in current practice and propose areas for further research. While promising, AI cannot replace the expertise and clinical judgement of a trained obstetric anaesthesiologist. It should, instead, be viewed as a valuable tool to facilitate and support our practice.

158. Kovacheva VP, Eberhard BW, Cohen RY, Maher M, Saxena R, Gray KJ. **Preeclampsia Prediction Using Machine Learning and Polygenic Risk Scores From Clinical and Genetic Risk Factors in Early and Late Pregnancies.** Hypertension. 2024 Feb;81(2):264-272.

Background: Preeclampsia, a pregnancy-specific condition associated with new-onset hypertension after 20-weeks gestation, is a leading cause of maternal and neonatal morbidity and mortality. Predictive tools to understand which individuals are most at risk are needed. **Methods:** We identified a cohort of N=1125 pregnant individuals who delivered between May 2015 and May 2022 at Mass General Brigham Hospitals with available electronic health record data and linked genetic data. Using clinical electronic health record data and systolic blood pressure polygenic risk scores derived from a large genome-wide association study, we developed machine learning (XGBoost) and logistic regression models to predict preeclampsia risk. **Results:** Pregnant individuals with a systolic blood pressure polygenic risk score in the top quartile had higher blood pressures throughout pregnancy compared with patients within the lowest quartile systolic blood pressure polygenic risk score. In the first trimester, the most predictive model was XGBoost, with an area under the curve of 0.74. In late pregnancy, with data obtained up to the delivery admission, the best-performing model was XGBoost using clinical variables, which achieved an area under the curve of 0.91. Adding the systolic blood pressure polygenic risk score to the models did not improve the performance significantly based on De Long test comparing the area under the curve of models with and without the polygenic score. **Conclusions:** Integrating clinical factors into predictive models can inform personalized preeclampsia risk and achieve higher predictive power than the current practice. In the future, personalized tools can be implemented to identify high-risk patients for preventative therapies and timely intervention to improve adverse maternal and neonatal outcomes.

159. Soares FM, da Rocha Carvalho Rosa LO, Cecatti JG, Luz AG, Awe OD, Laureano EE, de Carvalho Pacagnella R. **Design, construction, and validation of obstetric risk classification systems to predict intensive care unit admission.** Int J Gynaecol Obstet. 2024 Dec;167(3):1243-1254.

Introduction: To develop and validate a support tool for healthcare providers, enabling them to make precise and critical decisions regarding intensive care unit (ICU) admissions for high-risk pregnant women, thus enhancing maternal outcomes. **Methods:** This retrospective study involves secondary

data analysis of information gathered from 9550 pregnant women, who had severe maternal morbidity (any unexpected complication during labor and delivery that leads to substantial short-term or long-term health issues for the mother), collected between 2009 and 2010 from the Brazilian Network for Surveillance of Severe Maternal Morbidity, encompassing 27 obstetric reference centers in Brazil. Machine-learning models, including decision trees, Random Forest, Gradient Boosting Machine (GBM), and Extreme Gradient Boosting (XGBoost), were employed to create a risk prediction tool for ICU admission. Subsequently, sensitivity analysis was conducted to compare the accuracy, predictive power, sensitivity, and specificity of these models, with differences analyzed using the Wilcoxon test. **Results:** The XGBoost algorithm demonstrated superior efficiency, achieving an accuracy rate of 85%, sensitivity of 42%, specificity of 97%, and an area under the receiver operating characteristic curve of 86.7%. Notably, the estimated prevalence of ICU utilization by the model (11.6%) differed from the prevalence of ICU use from the study (21.52%). **Conclusion:** The developed risk engine yielded positive results, emphasizing the need to optimize intensive care bed utilization and objectively identify high-risk pregnant women requiring these services. This approach promises to enhance the effective and efficient management of pregnant women, particularly in resource-constrained regions worldwide. By streamlining ICU admissions for high-risk cases, healthcare providers can better allocate critical resources, ultimately contributing to improved maternal health outcomes.

160. Lengerich BJ, Caruana R, Painter I, Weeks WB, Sitcov K, Souter V. **Interpretable Machine Learning Predicts Postpartum Hemorrhage with Severe Maternal Morbidity in a Lower Risk Laboring Obstetric Population**. Am J Obstet Gynecol MFM. 2024 Aug;6(8):101391.

Background: Early identification of patients at increased risk for postpartum hemorrhage (PPH) associated with severe maternal morbidity (SMM) is critical for preparation and preventative intervention. However, prediction is challenging in patients without obvious risk factors for postpartum hemorrhage with severe maternal morbidity. Current tools for hemorrhage risk assessment use lists of risk factors rather than predictive models. **Objective:** To develop, validate (internally and externally), and compare a machine learning model for predicting PPH associated with SMM against a standard hemorrhage risk assessment tool in a lower risk laboring obstetric population. **Study design:** This retrospective cross-sectional study included clinical data from singleton, term births (>=37 weeks' gestation) at 19 US hospitals (2016-2021) using data from 58,023 births at 11 hospitals to train a generalized additive model (GAM) and 27,743 births at 8 held-out hospitals to externally validate the model. The outcome of interest was PPH with severe maternal morbidity (blood transfusion, hysterectomy, vascular embolization, intrauterine balloon tamponade, uterine artery ligation suture, uterine compression suture, or admission to intensive care). Cesarean birth without a trial of vaginal birth and patients with a history of cesarean were excluded. We compared the model performance to that of the California Maternal Quality Care Collaborative (CMQCC) Obstetric Hemorrhage Risk Factor Assessment Screen. **Results:** The GAM predicted PPH with an area under the receiver-operating characteristic curve (AUROC) of 0.67 (95% CI 0.64-0.68) on external validation, significantly outperforming the CMQCC risk screen AUROC of 0.52 (95% CI 0.50-0.53). Additionally, the GAM had better sensitivity of 36.9% (95% CI 33.01-41.02) than the CMQCC

screen sensitivity of 20.30% (95% CI 17.40-22.52) at the CMQCC screen positive rate of 16.8%. The GAM identified in-vitro fertilization as a risk factor (adjusted OR 1.5; 95% CI 1.2-1.8) and nulliparous births as the highest PPH risk factor (adjusted OR 1.5; 95% CI 1.4-1.6). **Conclusion:** Our model identified almost twice as many cases of PPH as the CMQCC rules-based approach for the same screen positive rate and identified in-vitro fertilization and first-time births as risk factors for PPH. Adopting predictive models over traditional screens can enhance PPH prediction.

161. Reppucci ML, Rogerson JS, Pickett K, Kierstead S, Nolan MM, Moulton SL, Wood CL. **Detection of Postpartum Hemorrhage Using Compensatory Reserve Index in Patients Undergoing Cesarean Delivery.** Anesth Analg. 2024 Mar 1;138(3):562-571.

Background: Postpartum hemorrhage (PPH) is the leading cause of maternal death worldwide. Early recognition and management are imperative for improved outcomes. The compensatory reserve index (CRI) is a novel physiological parameter that trends changes in intravascular volume, by continuously comparing extracted photoplethysmogram waveforms to a reference model that was derived from a human model of acute blood loss. This study sought to determine whether the CRI pattern was differential between those who do and do not experience PPH during cesarean delivery and compare these results to the American Society of Anesthesiologists (ASA) standards for noninvasive monitoring. **Methods:** Parturients undergoing cesarean delivery were enrolled between February 2020 and May 2021. A noninvasive CRI monitor was applied to collect continuous CRI values throughout the intraoperative and immediate postpartum periods. Patients were stratified based on blood loss into PPH versus non-PPH groups. PPH was defined as a quantitative blood loss >1000 mL. Function-on-scalar (FoS) regression was used to compare trends in CRI between groups (PPH versus non-PPH) during the 10 to 60-minute window after delivery. Two subanalyses excluding patients who received general anesthesia and preeclamptics were performed. **Results:** Fifty-one patients were enrolled in the study. Thirteen (25.5%) patients experienced PPH. Pregnant patients who experienced PPH had, on average, lower postdelivery CRI values (-0.13; 95% CI, -0.13 to -0.12; P < .001) than those who did not experience PPH. This persisted even when adjusting for preeclampsia and administration of uterotonics. The average mean arterial pressure (MAP) measurements were not statistically significant (-1.67; 95% CI, -3.57 to 0.22; P = .09). Similar trends were seen when excluding patients who underwent general anesthesia. When excluding preeclamptics, CRI values remained lower in those who hemorrhaged (-0.18; 95% CI, -0.19 to -0.17; P < .001). **Conclusions:** CRI detects changes in central volume status not distinguished by MAP. It has the potential to serve as a continuous, informative metric, notifying providers of acute changes in central volume status due to PPH during cesarean delivery.

162. Nir O, Dvir G, Galler E, Axelrod M, Farhi A, Barkai G, Weisz B, Sivan E, Mazaki Tovi S, Tsur A. **Integrating technologies to provide comprehensive remote fetal surveillance: A prospective pilot study**. Int J Gynaecol Obstet. 2024 Feb;164(2):662-667.

Objective: To determine the feasibility of extending remote maternal-fetal care to include fetus well-being. **Methods:** The authors performed a prospective pilot study investigating low-risk pregnant participants who were recruited at the time of their first full-term in-person visit and scheduled for a follow-up telemedicine visit. Using novel self-operated fetal monitoring and ultrasound devices, fetal heart monitoring and amniotic fluid volume measurements were obtained to complete a modified biophysical profile (mBPP). Total visit length was measured for both the in-person first visit and the subsequent telemedicine encounter. A patient satisfaction survey form was obtained. **Results:** Ten

women between 40 + 1 and 40 + 6 weeks of gestation participated in telemedicine encounters. Nine women (90%) were able to complete remote mBPP assessment. For one participant, fetal assessment was not completed due to technically inconclusive fetal monitoring. Another participant was referred for additional assessment in the delivery room. Satisfactory amniotic fluid volume measurements were achieved in 100% of participants. The telemedicine encounter was significantly shorter (93.1 ± 33.1 min) than the in-person visit (247.2 ± 104.7 min; P < 0.001). We observed high patient satisfaction.**Conclusion:** Remote fetal well-being assessment is feasible and time-saving and results in high patient satisfaction. This novel paradigm of comprehensive remote maternal and fetal assessment is associated with important clinical, socioeconomic, and logistics advantages.

163. Jasinski SR, Rowan S, Presby DM, Claydon EA, Capodilupo ER. **Wearable-derived maternal heart rate variability as a novel digital biomarker of preterm birth**. PLoS One. 2024 Jan 31;19(1):e0295899.

Despite considerable health consequences from preterm births, their incidence remains unchanged over recent decades, due partially to limited screening methods and limited use of extant methods. Wearable technology offers a novel, noninvasive, and acceptable way to track vital signs, such as maternal heart rate variability (mHRV). Previous research observed that mHRV declines throughout the first 33 weeks of gestation in term, singleton pregnancies, after which it improves. The aim of this study was to explore whether mHRV inflection is a feature of gestational age or an indication of time to delivery. This retrospective case-control study considered term and preterm deliveries. Remote data collection via non-invasive wearable technology enabled diverse participation with subjects representing 42 US states and 16 countries. Participants (N = 241) were retroactively identified from the WHOOP (Whoop, Inc.) userbase and wore WHOOP straps during singleton pregnancies between March 2021 and October 2022. Mixed effect spline models by gestational age and time until birth were fit for within-person mHRV, grouped into preterm and term births. For term pregnancies, gestational age (Akaike information criterion (AIC) = 26627.6, R2m = 0.0109, R2c = 0.8571) and weeks until birth (AIC = 26616.3, R2m = 0.0112, R2c = 0.8576) were representative of mHRV trends, with significantly stronger fit for weeks until birth (relative log-likelihood ratio = 279.5). For preterm pregnancies, gestational age (AIC = 1861.9, R2m = 0.0016, R2c = 0.8582) and time until birth (AIC = 1848.0, R2m = 0.0100, R2c = 0.8676) were representative of mHRV trends, with significantly stronger fit for weeks until birth (relative log-likelihood ratio = 859.4). This study suggests that wearable technology, such as the WHOOP strap, may provide a digital biomarker for preterm delivery by screening for changes in nighttime mHRV throughout pregnancy that could in turn alert to the need for further evaluation and intervention.

164. Johnson S, Feldman S, Gessouroun R, Fuller M, Stafford-Smith M, Bronshteyn YS, Meng ML. **AI-augmented vs. conventional cardiac POCUS training: a pilot study among obstetric anesthesiologists**. Int J Obstet Anesth. 2024 Nov;60:104238.

In this pilot, prospective, randomized study to examine an eight week cardiac POCUS curriculum for obstetric anesthesiologists with and without AI-augmented ultrasound technology, the frequency of cardiac POCUS use and perception of skills improved from baseline in all participants regardless of training technique. Sustained improvement was more frequently present six months post curriculum among those who underwent AI-augmented training.

165. Ortner CM, Sheikh M, Athar MW, Padilla C, Guo N, Carvalho B. **Feasibility of Focused Cardiac Ultrasound Performed by Trainees During Cesarean Delivery.** Anesth Analg. 2024 Aug 1;139(2):332-338.

Background: Anesthesiology experts advocate for formal education in maternal critical care, including the use of focused cardiac ultrasound (FCU) in high-acuity obstetric units. While benefits and feasibility of FCU performed by experts have been well documented, little evidence exists on the feasibility of FCU acquired by examiners with limited experience. The primary aim of this study was to assess how often echocardiographic images of sufficient quality to guide clinical decision-making were attained by trainees with limited experience performing FCU in term parturients undergoing cesarean delivery (CD). **Methods:** In this prospective cohort study, healthy term parturients (American Society of Anesthesiologists [ASA] ≤ 3, ≥37 weeks of gestation) with singleton pregnancy, body mass index (BMI) <40 kg/m 2 , and no history of congenital and acquired cardiac disease undergoing scheduled, elective CD were recruited by a trainee. After undergoing standardized training, including an 8-hour online E-learning module, a 1-day hands-on FCU course, and 20 to 30 supervised scans until the trainee was assessed competent in image acquisition, 8 trainees with limited FCU experience performed apical 4-chamber (A4CH), parasternal long-axis (PLAX), and short-axis (PSAX) view preoperatively after spinal anesthesia (SPA) and intraoperatively after neonatal delivery (ND). Obtained FCU images were graded 1 to 5 by 2 blinded instructors (1 = no image to 5 = perfect image obtainable; ≥3 defined as image quality sufficient for clinical decision-making). **Results:** Following the screening of 95 women, 8 trainees with limited FCU experience each performed a median of 5 [3-8] FCUs in a total of 64 women. Images of sufficient quality were obtainable in 61 (95.3 %) and 57 (89.1 %) of women after SPA and ND, respectively. FCU images of perfect image quality were obtainable in 9 (14.1 %) and 7 (10.9 %) women preoperatively after SPA and intraoperatively after ND, respectively. A PLAX, PSAX, and A4CH view with grade ≥3 was obtained in 53 (82.8 %), 58 (90.6 %) and 40 (62.5 %) of women preoperatively after SPA and in 50 (78.1 %), 49 (76.6 %), and 29 (45.3 %) of women intraoperatively after ND. Left ventricular function could be assessed in 39 of 40 women (97.5 %) preoperatively after SPA and 39 of 40 (97.5%) intraoperatively after ND. Right ventricular function could be assessed in 31 of 40 (77.5 %) after SPA and in 23 of 40 (59%) after ND. We observed a difference in image grading between different trainees in the AP4CH-view (P = .0001). No difference in image grading was found between preoperative and intraoperative FCUs. **Conclusions:** FCU is feasible in the parturient undergoing CD and images of sufficient quality for clinical decision-making were obtained by trainees with limited experience in almost all parturients. Image acquisition and quality in the A4CH view may be impacted by the individual trainee performing the FCU.

166. Ngeow AJH, Moosa AS, Tan MG, Zou L, Goh MMR, Lim GH, Tagamolila V, Ereno I, Durnford JR, Cheung SKH, Hong NWJ, Soh SY, Tay YY, Chang ZY, Ong R, Tsang LPM, Yip BKL, Chia KW, Yap K, Lim MH, Ta AWA, Goh HL, Yeo CL, Chan DKL, Tan NC. **Development and Validation of a Smartphone Application for Neonatal Jaundice Screening.** JAMA Netw Open. 2024 Dec 2;7(12):e2450260.

Importance: This diagnostic study describes the merger of domain knowledge (Kramer principle of dermal advancement of icterus) with current machine learning (ML) techniques to create a novel tool for screening of neonatal jaundice (NNJ), which affects 60% of term and 80% of preterm infants. **Objective:** This study aimed to develop and validate a smartphone-based ML app to predict bilirubin (SpB) levels in multiethnic neonates using skin color analysis. **Design, setting, and participants:** This diagnostic study was conducted between June 2022 and June 2024 at a tertiary hospital and 4

primary-care clinics in Singapore with a consecutive sample of neonates born at 35 or more weeks' gestation and within 21 days of birth. **Exposure:** The smartphone-based ML app captured skin images via the central aperture of a standardized color calibration sticker card from multiple regions of interest arranged in a cephalocaudal fashion, following the Kramer principle of dermal advancement of icterus. The ML model underwent iterative development and k-folds cross-validation, with performance assessed based on root mean squared error, Pearson correlation, and agreement with total serum bilirubin (TSB). The final ML model underwent temporal validation. **Main outcomes and measures:** Linear correlation and statistical agreement between paired SpB and TSB; sensitivity and specificity for detection of TSB equal to or greater than 17mg/dL with SpB equal to or greater than 13 mg/dL were assessed. **Results:** The smartphone-based ML app was validated on 546 neonates (median [IQR] gestational age, 38.0 [35.0-41.0] weeks; 286 [52.4%] male; 315 [57.7%] Chinese, 35 [6.4%] Indian, 169 [31.0%] Malay, and 27 [4.9%] other ethnicities). Iterative development and cross-validation was performed on 352 neonates. The final ML model (ensembled gradient boosted trees) incorporated yellowness indicators from the forehead, sternum, and abdomen. Temporal validation on 194 neonates yielded a Pearson r of 0.84 (95% CI, 0.79-0.88; P < .001), 82% of data pairs within clinically acceptable limits of 3 mg/dL, sensitivity of 100%, specificity of 70%, positive predictive value of 10%, negative predictive value of 100%, positive likelihood ratio of 3.3, negative likelihood ratio of 0, and area under the receiver operating characteristic curve of 0.89 (95% CI, 0.82-0.96). **Conclusions and relevance:** In this diagnostic study of a new smartphone-based ML app, there was good correlation and statistical agreement with TSB with sensitivity of 100%. The screening tool has the potential to be an NNJ screening tool, with treatment decisions based on TSB (reference standard). Further prospective studies are needed to establish the generalizability and cost-effectiveness of the screening tool in the clinical setting.

167. Gonzalez Fiol A, Mootz AA, He Z, Delgado C, Ortiz V, Reale SC. **Accuracy of Spanish and English-generated ChatGPT responses to commonly asked patient questions about labor epidurals: a survey-based study among bilingual obstetric anesthesia experts.** Int J Obstet Anesth. 2024 Nov 6;61:104290.

Background: Large language models (LLMs), of which ChatGPT is the most well known, are now available to patients to seek medical advice in various languages. However, the accuracy of the information utilized to train these models remains unknown. **Methods:** Ten commonly asked questions regarding labor epidurals were translated from English to Spanish, and all 20 questions were entered into ChatGPT version 3.5. The answers were transcribed. A survey was then sent to 10 bilingual fellowship-trained obstetric anesthesiologists to assess the accuracy of these answers utilizing a 5-point Likert scale. **Results:** Overall, the accuracy scores for the ChatGPT-generated answers in Spanish were lower than for the English answers with a median score of 34 (IQR 33-36.5) versus 40.5 (IQR 39-44.3), respectively (P value 0.02). Answers to two questions were scored significantly lower: "Do epidurals prolong labor?" (2 (IQR 2-2.5) versus 4 (IQR 4-4.5), P value 0.03) and "Do epidurals increase the risk of needing cesarean delivery?" (3(IQR 2-4) versus 4 (IQR 4-5); P value 0.03). There was a strong agreement that answers to the question "Do epidurals cause autism" were accurate in both Spanish and English. **Conclusion:** ChatGPT-generated answers in Spanish to ten questions about labor epidurals scored lower for accuracy than answers generated in English, particularly regarding the effect of labor epidurals on labor course and mode of delivery. This disparity

in ChatGPT-generated information may extend already-known health inequities among non-English-speaking patients and perpetuate misinformation.

Guidelines and Consensus Statements

168. Forbes L, Werner E, Lappen JR. **Society for Maternal-Fetal Medicine Position Statement: Access to abortion care**. Am J Obstet Gynecol. 2024 Jul;231(1):B7-B8.

The Society for Maternal-Fetal Medicine supports the right of all individuals to access the full spectrum of reproductive health services, including abortion care. Reproductive health decisions are best made by each individual with guidance and support from their healthcare providers. The Society opposes legislation and policies that limit access to abortion care or criminalize abortion care and self-managed abortion. In addition, the Society opposes policies that compromise the patient-healthcare provider relationship by limiting a healthcare provider's ability to counsel patients and provide evidence-based, medically appropriate treatment.

169. Heerboth S, Devlin PM, Benipal S, Trawick E, Raghuraman N, Coviello E, Brown EE, Quist-Nelson J. **Evidence-based obstetric guidance in the setting of a global intravenous fluid shortage**. Am J Obstet Gynecol MFM. 2024 Dec;6(12):101556.

Intravenous fluid (IVF) administration is a ubiquitous medical intervention. Although there are clear benefits to IVF in certain obstetric scenarios, IVF is often given in unindicated circumstances; the ongoing IVF shortage highlights an opportunity to reduce unindicated IVF in obstetrics. This document provides evidence-based recommendations to reduce IVF use within general obstetric practice. The three sections address IVF use within (1) antepartum care, (2) intrapartum care, and (3) postpartum care, including postpartum hemorrhage (PPH) risk reduction. Using the GRADE framework, we provide a summary of the available evidence surrounding use of IVF in obstetrics and recommend strategies to reduce IVF. We recommend transitioning intravenous (IV) antibiotics to IV push or oral when possible, discontinuing IVF bolus prior to neuraxial anesthesia or for the treatment of preterm labor, and avoiding unnecessary continuous IVF infusions. There may be further opportunities for fluid conservation with IV medications that could be given intramuscularly. These suggestions for IVF use reduction should be evaluated based on local need and capabilities as well as the characteristics and risk factors of the population. Patients with sepsis, PPH, burns, diabetic ketoacidosis, and hemodynamic instability should not have a reduction in IVF administration as these diagnoses have evidence-based resuscitation guidelines that include IVF. The recommendations presented may be applicable beyond the immediate IVF shortage and should be considered as an area for future research.

170. ACOG Committee Statement No. 10: **Racial and Ethnic Inequities in Obstetrics and Gynecology**. Obstet Gynecol. 2024 Sep 1;144(3):e62-e74.

Disparate health outcomes and unequal access to care have long plagued many communities in the United States. Individual demographic characteristics, such as geography, income, education, and race, have been identified as critical factors when seeking to address inequitable health outcomes. To provide the best care possible, obstetrician–gynecologists should be keenly aware of the existence of and contributors to health inequities and be engaged in the work needed to eliminate racial and ethnic

health inequities. Obstetrician–gynecologists should improve their understanding of the etiologies of health inequities by participating in lifelong learning to understand the roles clinician bias and personally mediated, systemic, and structural racism play in creating and perpetuating adverse health outcomes and health care experiences.

171. American Society of Anesthesiologists Committee on Obstetric Anesthesia. **Statement on Anesthesia Support of Postpartum Sterilization**

    https://www.asahq.org/standards-and-practice-parameters/statement-on-anesthesia-support-of-postpartum-sterilization

    Overcoming the many challenges in achieving postpartum sterilization procedures requires a multifaceted approach. Anesthesiologists can play an important role in overcoming some of these barriers. Addressing biases, improving hospital resources, and streamlining consent processes through innovative strategies can enhance access to this important patient choice of contraceptive method, ensuring fair and equitable care for all individuals, regardless of socioeconomic status or background.

172. American Society of Anesthesiologists Committee on Obstetric Anesthesia. **Statement on Providing Psychological Support for Obstetric Patients**

    https://www.asahq.org/standards-and-practice-parameters/statement-on-providing-psychological-support-for-obstetric-patients

    This statement highlights the importance of providing psychological support to obstetric patients, a key aspect of a positive birth experience, by providing the best patient-centered care in the perioperative and perinatal periods. Up to 6% of postpartum patients have childbirth-related post-traumatic stress disorder, with 12% reporting post-traumatic stress. Anesthesiologists play a prominent role in delivering patient-centered care, particularly in addressing the psychological needs of patients with pre-existing mental health conditions or past traumatic experiences. This statement helps clarify terminology, summarize data on patient-centered outcomes, and suggest guidance and some best practices to help anesthesia professionals meet these goals. A holistic approach helps provide a positive birth experience supporting the psychosocial well-being of patient and family as well as health care providers. Additional resources are provided.

173. American Society of Anesthesiologists Committee on Obstetric Anesthesia. **Statement on the Use of Adjuvant Medications and Management of Intraoperative Pain During Cesarean Delivery**

    https://www.asahq.org/standards-and-practice-parameters/statement-on-the-use-of-adjuvant-medications-and-management-of-intraoperative-pain-during-cesarean-delivery

    American Society of Anesthesiologists Statement on Pain During Cesarean Delivery provided background and guidance in the recognition and treatment of pain during cesarean delivery, which occurs in about 15%. Multiple medication types can be delivered via varied routes to help manage pain during cesarean delivery. This statement provides guidance on the use of adjuvant medications to help manage pain during cesarean delivery. No one technique or adjuvant can guarantee full pain relief.

174. American Society of Anesthesiologists Committee on Obstetric Anesthesia. **Statement on Resuming Breastfeeding after Anesthesia**

https://www.asahq.org/standards-and-practice-parameters/statement-on-resuming-breastfeeding-after-anesthesia

The American Society of Anesthesiologists offers this statement to provide anesthesiologists with evidence-based information so they may appropriately counsel nursing patients undergoing surgery who are concerned about adverse neonatal effects from medication exposure via breastmilk. All anesthetic and analgesic drugs can transfer into breastmilk; however, only small amounts are present in very low concentrations which are considered clinically insignificant. Despite an excellent safety record, breastfeeding persons who require opioid pain medicines should monitor for potential signs of sedation and additional consideration for when to resume breastfeeding postoperatively should be given to patients with neonates or infants at high risk for apnea. Patients should resume breastfeeding as soon as desired after surgery.

175. American Society of Anesthesiologists Committee on Obstetric Anesthesia. **Statement on Support of In Vitro Fertilization**

https://www.asahq.org/standards-and-practice-parameters/statement-on-support-of-in-vitro-fertilization

Key principles for managing patient care during In Vitro Fertilization treatment include:

- Building a trusted physician-patient relationship.
- Involving patients and physicians in shared decision-making without interference from outside entities.
- Ensuring access to safe anesthesia care.
- Prioritizing the safety of patients and healthcare personnel.
- Respecting the values of both patients and healthcare providers.

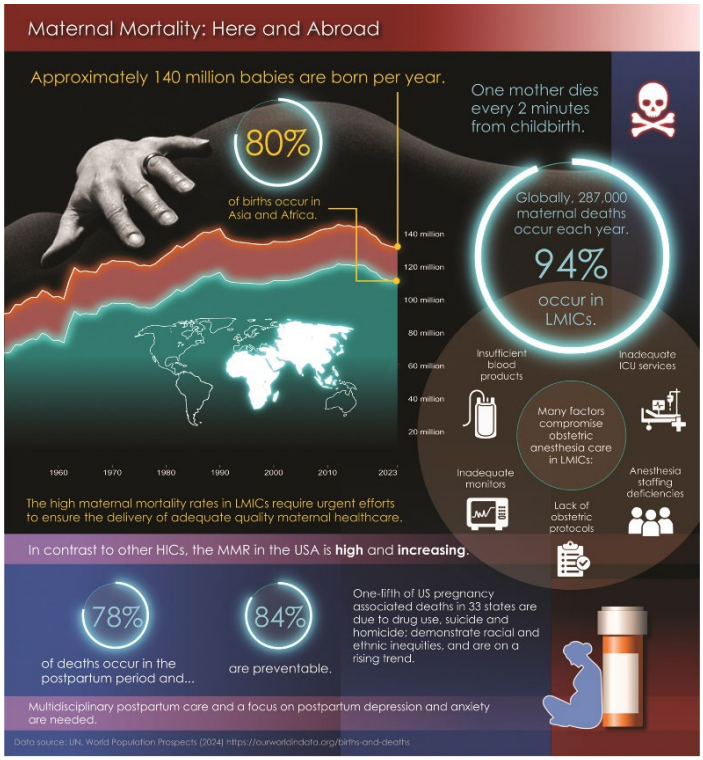
Prior Ostheimer Review

176. Sultan, P. **A narrative review of the literature relevant to obstetric anesthesiologists: the 2023 Gerard W. Ostheimer lecture.** Int J Obstet Anesth. 2024 May;58:103973.

This narrative review of the 2023 Gerard W. Ostheimer lecture presented at the Society for Obstetric Anesthesia and Perinatology 2023 annual meeting summarizes 2022 literature relevant to obstetric anesthesiologists. **Antenatal studies:** Neonatal morbidity is reduced with antenatal maternal buprenorphine compared with methadone for treatment of opioid use disorder. Antenatal pregnancy allergy testing is safe and feasible. **Analgesia and anesthesia studies:** Intrathecal (IT) 3% chloroprocaine for cervical cerclage results in faster sensory block resolution and discharge readiness compared with bupivacaine. The ED90 of 3% chloroprocaine (with IT fentanyl 10 μg) is 49.5 mg. Dural puncture epidural technique does not improve the quality of labor analgesia in obese parturients compared with epidural analgesia. Low- (>0.08 to ≤0.1%) and ultra-low (<0.08%) concentrations of bupivacaine for epidural analgesia maintenance result in similar maternal and neonatal outcomes. Lower doses of first line uterotonic agents are non-inferior to higher doses

(oxytocin 0.5 IU vs. 5 IU and carbetocin 20 vs. 100 µg) in patients at low risk for postpartum hemorrhage. Supplemental analgesia or conversion to general anesthesia is necessary in approximately 15% of elective cesarean deliveries. Intravenous dexamethasone improves analgesia outcomes, however optimal dosing and timing remain unclear; it may induce neonatal hypoglycemia in the setting of gestational diabetes. **Postpartum studies:** A core outcome set may help evaluate enhanced recovery protocol implementation. History of migraine and accidental dural puncture (ADP) above the L3 level are associated with epidural blood patch (EBP) failure and ADP at or below L3 and >48 h interval between ADP and EBP are associated with success.

177. Sultan, Pervez. **The 2023 Gerard W. Ostheimer Lecture. A Contemporary Narrative Review of Maternal Mortality and Morbidity: Opportunities to Improve Peripartum Outcomes**. Anesth Analg. 2024 Dec 1;139(6):1133-1142.



The Gerard W. Ostheimer lecture is given annually to members of the Society for Obstetric Anesthesia and Perinatology. This lecture summarizes new and emerging literature that informs the clinical practice of obstetric anesthesiology. This is a narrative review of 2022 literature pertinent to maternal morbidity and mortality in all income settings globally. Themes associated with worse maternal mortality rate (MMR), challenges health care workers face, public health priority areas, and initiatives to help countries achieve the United Nations Sustainable Development Goal targets for MMR are discussed. MMRs are higher in low- and middle-income countries (LMICs) compared to high-income countries (HICs). Cesarean delivery rates are rising most rapidly in LMICs, warranting urgent maternal health care workforce planning efforts in these settings. Globally racial, ethnic, and geographical disparities in maternal mortality continue to be evident in global health care settings. In the United States, the MMR is rising. The evolving changes in abortion legislation in the United States may further negatively impact maternal morbidity and mortality. The need to implement American Society of Anesthesiologists-recommended obstetric anesthesia quality metrics to facilitate benchmarking and to improve patient experience and outcomes is discussed as well as the need for professional society guidance on minimum staffing levels in American labor and delivery units.

Program Material
Sunday, May 4, 2025

Opening Remarks
Ron George, MD & Phil Rubin, MD

SOAP/ASRA Panel: Spinal Pathology & Neuraxial Techniques
Moderator: Phil Rubin, MD
Panelists: Hans Sviggum, MD; Pamela Flood, MD; Jeanette Bauchat, MD

Concurrent Sessions
Sol Shnider Track #3 (Main Stage)

1. Troubleshooting Tricky Epidurals
    a. Troubleshooting Epidurals in Labor
    b. Troubleshooting Epidurals for Intrapartum Cesarean
    c. #Hot Take - Every Intrapartum Cesarean Gets a Spinal

    Presenters: Ron George, MD; Dominique Arce, MD; Michael Hoffkamp, MD
2. Updates from ASA Committee on OB Anesthesia
    Presenter: Mark Zakowski, MD
3. Totally *Epic* Enhancements in the Electronic Medical Record
    a. Building an Interactive Dashboard for the OB Anesthesiologist
    b. New and Improved Epic Workflows for OB Anesthesiology

    Moderator: Thomas Klumpner, MD
    Presenters: Mahesh Vaidyanathan, MD; Alice O'Brien, MD

Concurrent Sessions
Oral Research Presentations #2 (Breakout Room)

Moderators: Michaela Farber, MD & Brandon Togioka, MD

1. Reduction of Emergency Release Blood Product Ordering on Labor and Delivery: A Quality Improvement Initiative - Kelly Fedoruk MD, FRCPC
2. Antepartum point-of-care gastric ultrasound in fasted obstetric patients undergoing non-delivery surgical procedures -Saranya Lertkovit, MD
3. Comparative Thromboelastography on Peripheral vs Uterine Blood as an Early Marker of Postpartum Coagulation Changes – Tyler Guidugli, DO
4. Improving Postpartum Hemorrhage Risk Prediction by Integrating Time-Based Anesthesia Factors with Traditional Confounders – Kelly Li
5. A Retrospective Study of Associations between Antepartum Psychiatric Medications and Hypertensive Disorders of Pregnancy in Patients with Mood and Anxiety Disorders - Heather Acuff, MD, PhD
6. Duration of Urinary Catheterization and Barriers to Early Catheter Removal After Cesarean Deliveries - A Mixed-Methods Study – Aislynn Sharrock, BA (Hons)
7. Leveraging a 3D-Printed Spine Model to Study Medication Spread in Spinal Anesthesia – Jaber Hanhan, MD
8. How Do Abortion Laws Affect Where Residents and Fellows Accept Their First Post-Training Jobs? – Rachel Douglas, DO
9. The effect of sugammadex administration on fetal outcomes in pregnant patients who underwent non-obstetric surgery under general anesthesia – Jacob Nieb, MD

10. Machine Learning Analysis of Arterial Stiffness Trends throughout Pregnancy to Predict the Development of Preterm, Term and Postpartum Preeclampsia - Allison Engo
11. Expert Consensus on Minimum Anesthesia Requirements for Cesarean (MARC) Delivery: A Delphi Study - Ronald George, MD, FRCPC
12. Measuring Changes In Cardiac Output During Cesarean Section Using Left Ventricular Outflow Tract Velocity Time Integral - Julia Morrison, MD

Abstract Breakout Session #4 (Breakout Rooms)

Room 1: Endocrine & Autonomic
Room 2: Cancer
Room 3: HEME General
Room 4: Pulmonary & Infection
Room 5: Cardiac 4 – Cardiomyopathy, VADS, Non-Obstetric Surgery
Room 6: Epidural Complications – not PDPH

Evaluation & Troubleshooting of Labor Epidurals

Ronald B. George, MD FRCPC
Professor & Director of Obstetric Anesthesiology
Mount Sinai Hospital - University of Toronto
Sinai Health | Department of Anesthesia & Pain Management

SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

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Evaluation & Troubleshooting of Labor Epidurals

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Presenter Disclosure

- Relationships with financial sponsors:
  - Any direct financial relationships including receipt of honoraria
    - Canadian Journal of Anesthesia - Associate Editor
  - Memberships on advisory boards or speakers' bureau
    - Canadian Anesthesia Research Foundation
    - International Journal of Obstetric Anesthesia
    - Society for Obstetric Anesthesia and Perinatology
- Patents for drugs or devices: N/A
- Other: N/A

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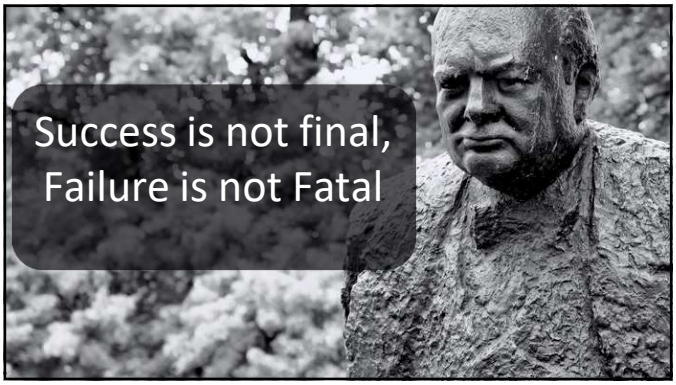

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CANADIAN ANESTHESIOLOGISTS' SOCIETY
SOCIÉTÉ CANADIENNE DES ANESTHÉSIOLOGISTES
American Society of Anesthesiologists
RCOA Royal College of Anaesthetists

- Combined spinal epidural (CSE) analgesia availability
- Low concentration local anesthetic solutions with opioids
- Patient controlled epidural analgesia (PCEA)
- **Effective neuraxial labour analgesia on request & responsive**

5

Define "breakthrough" labour epidural pain?

- Pain or pressure that required and was successfully treated with supplemental epidural medications
- Pain greater than a 1/10, "consider" PCEA, I after 10 min if pain still greater than 1/10, you will require medication either given by your Nurse or Anesthetist
- Parturient perception of inadequate analgesia (defined as a NRS pain score > 3) after pushing the PCEA button twice in a 20 min period
- Effective pain control is defined as numeric pain rating scale score documented as ≤ 3/10 or ≤ 30/100 during a contraction measured.

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International Journal of Obstetric Anesthesia (2004) 13, 227–233
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doi:10.1016/j.ijoa.2004.04.008

ORIGINAL ARTICLE

Incidence and characteristics of failures in obstetric neuraxial analgesia and anesthesia: a retrospective analysis of 19,259 deliveries

P. H. Pan, T. D. Bogard, M. D. Owen
Department of Anesthesiology, Division of Obstetric Anesthesia, Wake Forest University School of Medicine, Winston-Salem, NC, USA

poor analgesia

Pan et al. IJOA 2004; 13:227-233

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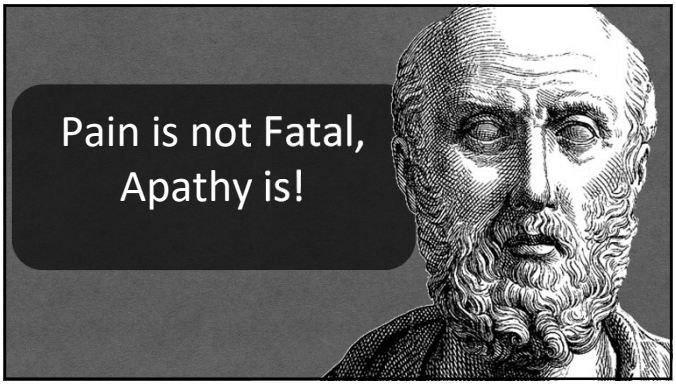

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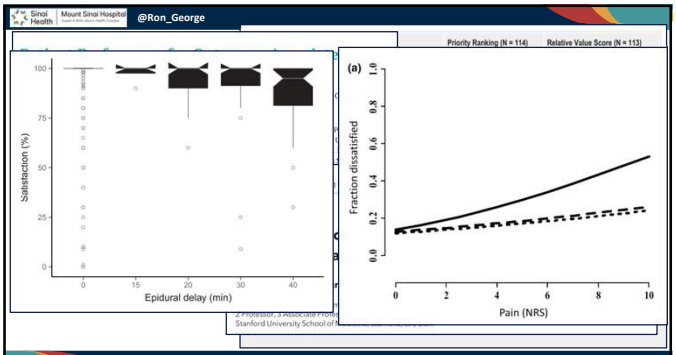

Harding et al. Cureus 2022 Feb 25;14(2):e22599
Yurashevich et al. Anesthesia 2019;74:1112-1120

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1 The percentage of women who had an epidural (or a combined spinal epidural) for labour analgesia who had an accidental dural puncture;
2 Whether there are guidelines for the referral of patients to an anaesthetist for an antenatal review;
3 Whether there are elective caesarean section lists with dedicated (i.e. not expected to cover emergency work) obstetric, anaesthetic and theatre staff;
4 Whether point-of-care testing is available for estimation of haemoglobin (e.g. Hemocue®, Hemocue AB, Ängelholm, Sweden or blood gas analyser);
5 The percentage of epidurals for labour analgesia that provided adequate pain relief within 45 min of placement (from the start of epidural insertion).

Original Article
The identification of key indicators to drive quality improvement in obstetric anaesthesia: results of the Obstetric Anaesthetists' Association/National Perinatal Epidemiology Unit collaborative Delphi project
J. H. Bamber,[1] D. N. Lucas,[2] F. Plaat,[3] B. Allin,[4] M. Knight[5] and collaborators for the Obstetric Anaesthetists' Association Quality and Outcomes Working Group*

Effective & Responsive neuraxial labour analgesia

Bamber JH et al. Anaesthesia 2020, 75, 617–625

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European Journal of Anaesthesiology 2008; 23: 611–617

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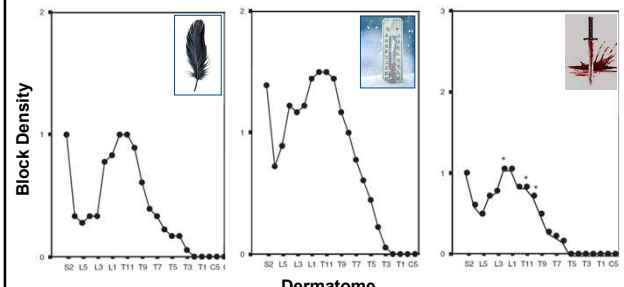
11

5-minutes



European Journal of Anaesthesiology 2008; 23: 611–617

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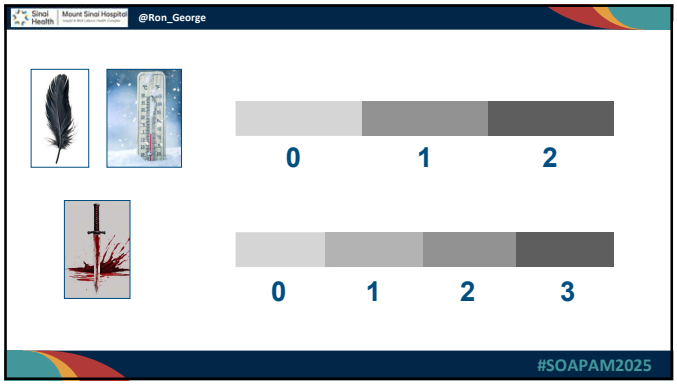

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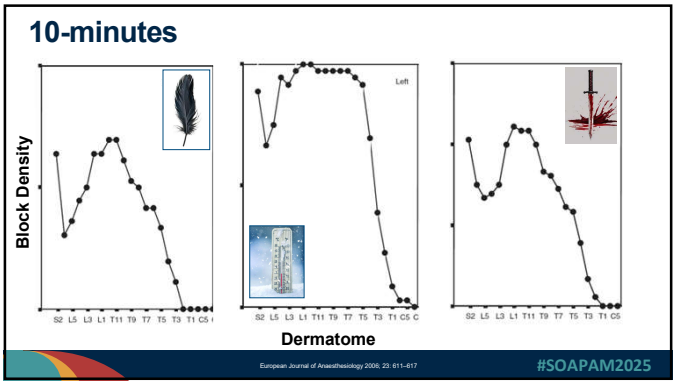

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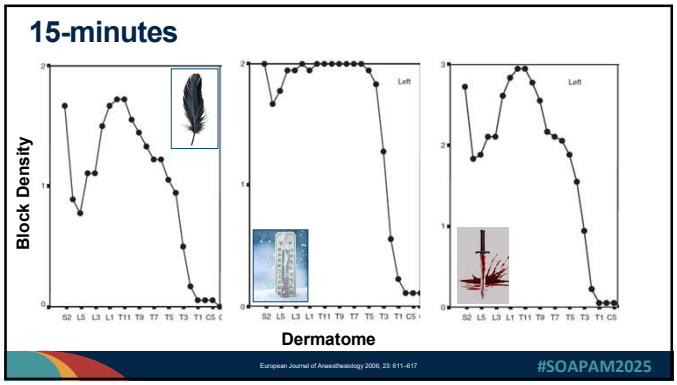

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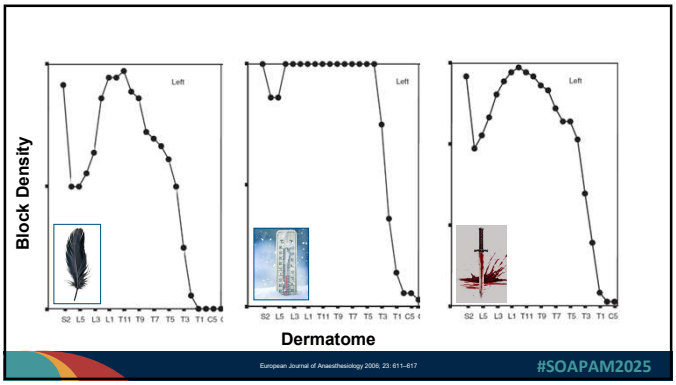

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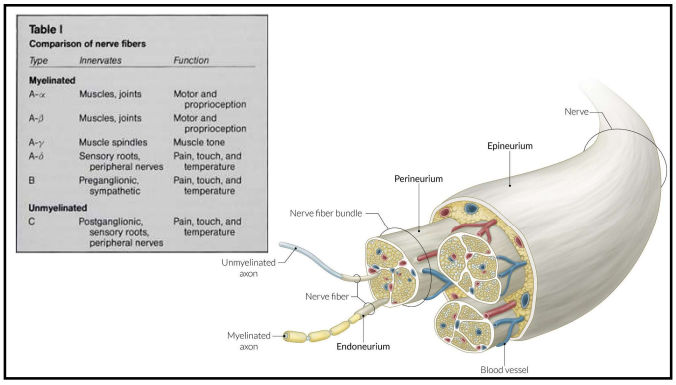

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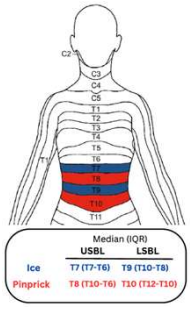
USBL

- Dermatome at which and below which the sensation was present but not the same as the control areas

LSBL

- Dermatome at which and below which there was complete loss of sensation



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Casellato JF, et al. Can J Anaesth 2024

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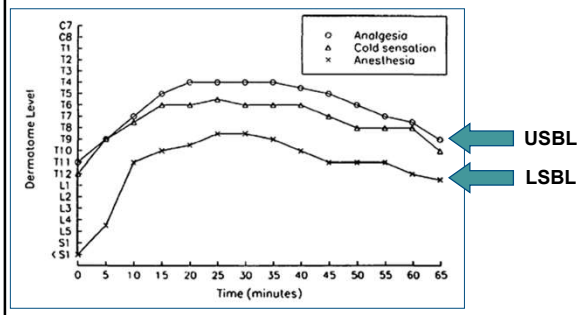

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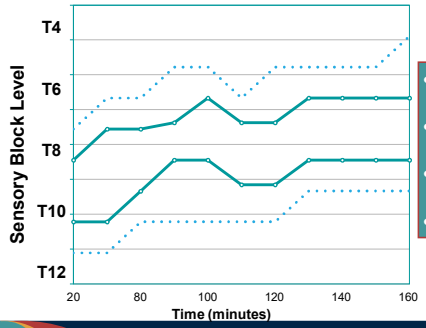

- Bup 0.0625% + Fent
- $PIEB_b$ = 10 mL
- $PIEB_i$ = 40 min
- PCEA 5 ml / 10 min

Casellato et al. CJA 2022; 10.1007/s12630-022-02318-w

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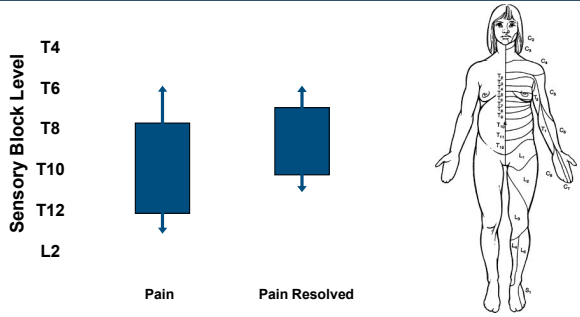

Kordich et al. Submitted for publication

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Obstetric Anesthesiology

Section Editor: Jill M. Mhyre

The Labor Analgesia Requirements in Nulliparous Women Randomized to Epidural Catheter Placement in a High or Low Intervertebral Space

Albert Moore, MD, Valerie Villeneuve, MD, Bruno Bravim, MD, Aly el-Bahrawy, MD, Eva el-Mouallem, MD, Ian Kaufman, MD, Roupen Hatzakorzian, MD, and William Li Pi Shan, MD

Anesth Analg 2017;125:1969–74

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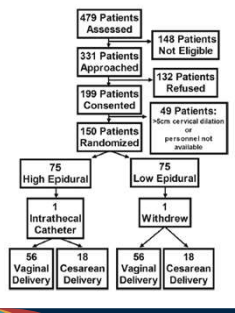

Table 2. Summary of Pain Scores, Analgesic Requirements, and Dermatome Blockade for the Nulliparous Laboring Patients Who Were Randomized to Epidural Catheter Placement in Either the L4-5 (Low) or L1-2 (High) Interspace

	Low Epidural (n = 74)	High Epidural (n = 74)	P
Required manual bolus	34 (46%)	38 (51%)	1.0
Total number of boluses[a]			
Early labor	22 (52%)	9 (20%)	.014
Late labor	20 (48%)	36 (80%)	
30 min			
Abdominal VAS	3 [1, 6]	0 [0, 2]	.013
Perineal VAS	0 [0, 2]	1 [1, 3]	.36
Cephalad dermatome	T9 [T8, T10]	T8 [T6, T9]	.013
Caudal dermatome	S1 [L5, S2]	L5 [L4, L5]	.013
60 min			
Abdominal VAS	1 [1, 3]	0 [0, 1]	.013
Perineal VAS	0 [0, 1]	1 [1, 3]	.014
Cephalad dermatome	T9 [T6, T9]	T7 [T5–T8]	.013
Caudal dermatome	S2 [S1, S2]	S1 [L5, S1]	.013
Pain during pushing[a]			
Abdominal VAS	1 [0,5]	0 [0,3]	.9
Perineal VAS	2 [0,5]	4 [1,8]	.025
PCEA[c] solution (mL/h)	14.3 (6.2)	14.1 (7.2)	1.0

Anesth Analg 2017;125:1969–74

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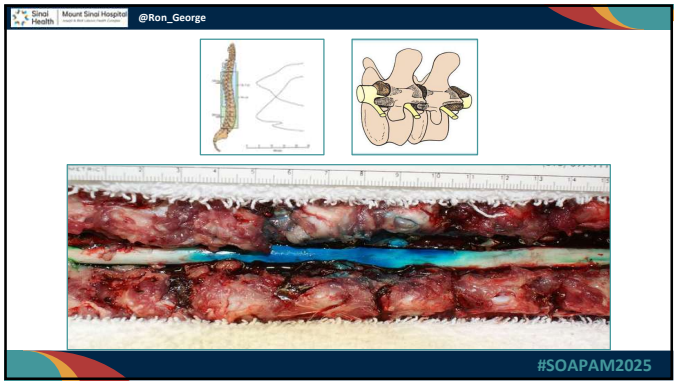

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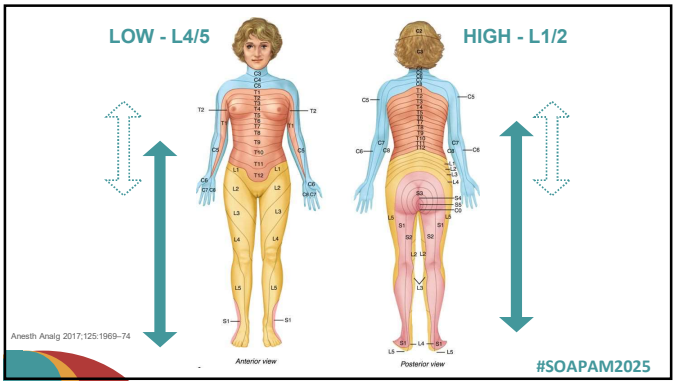

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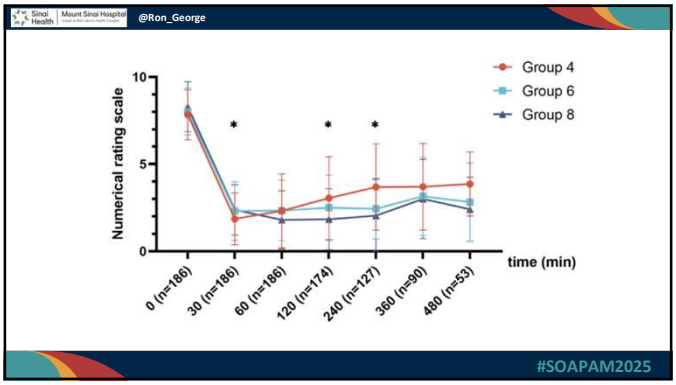

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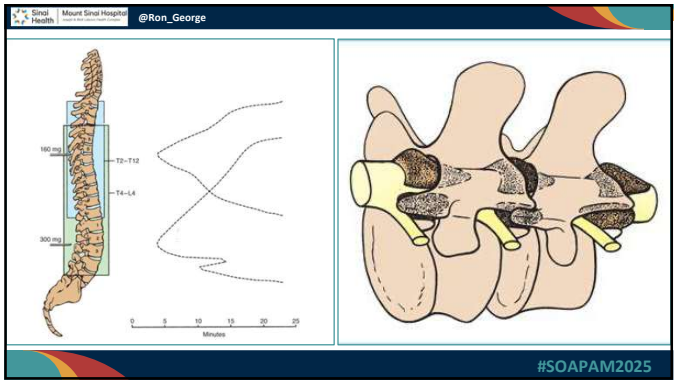

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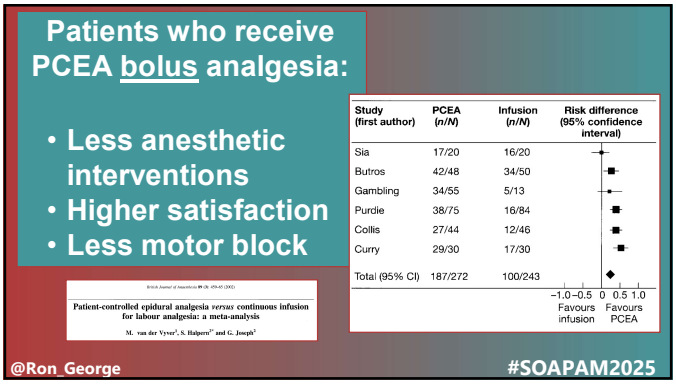

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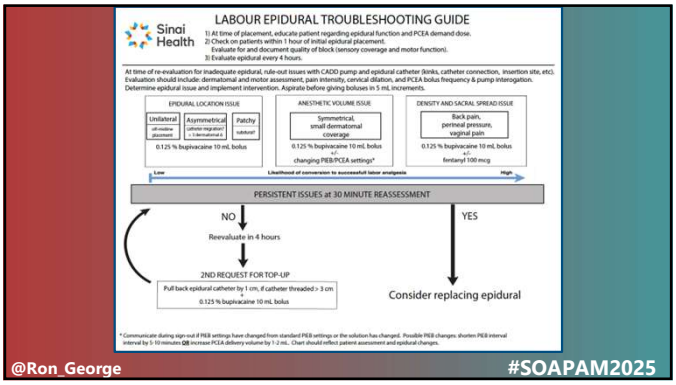

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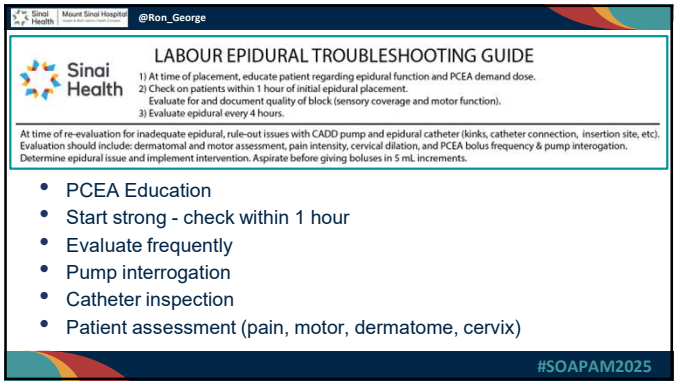

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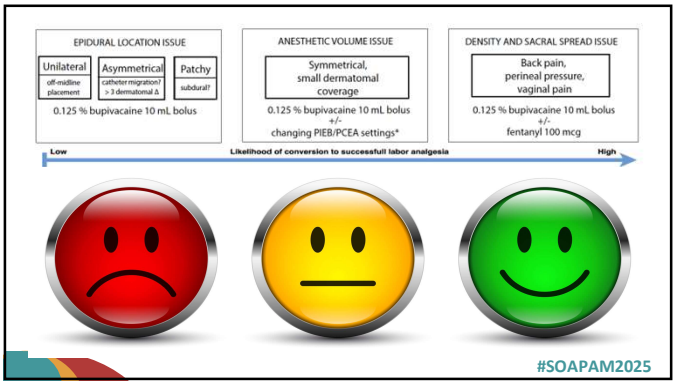

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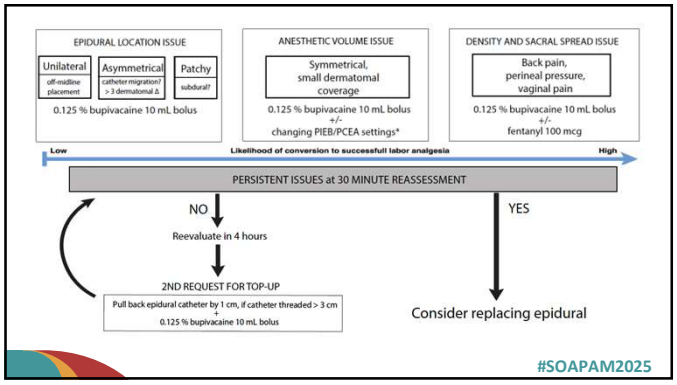

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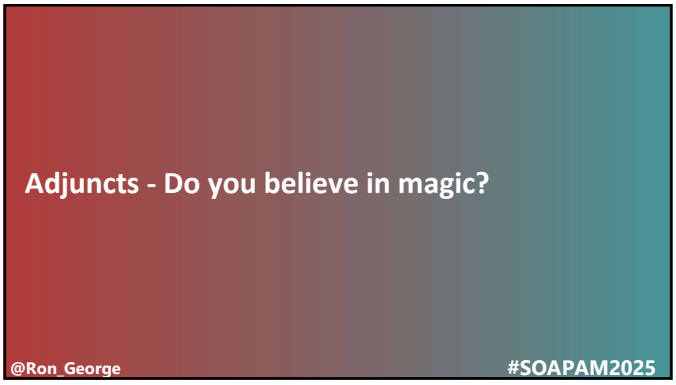

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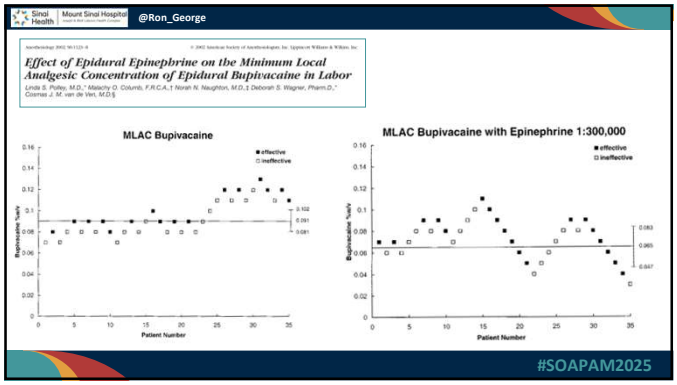

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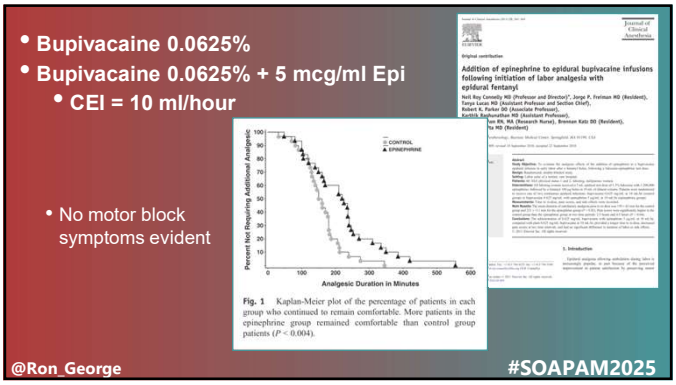

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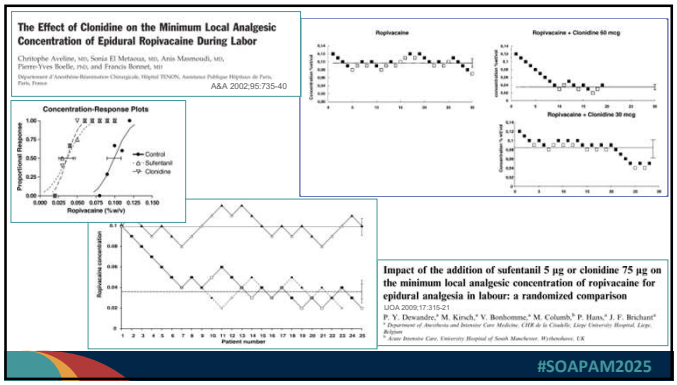

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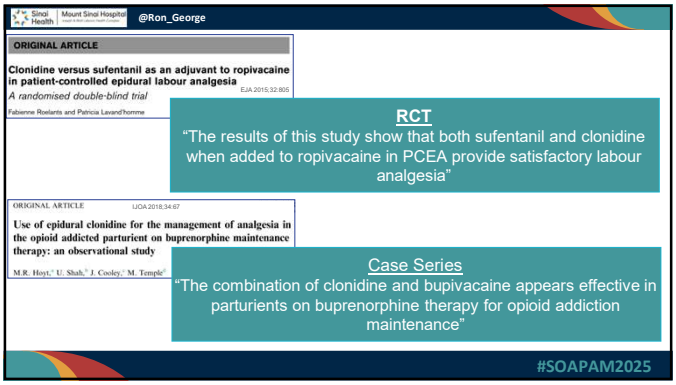

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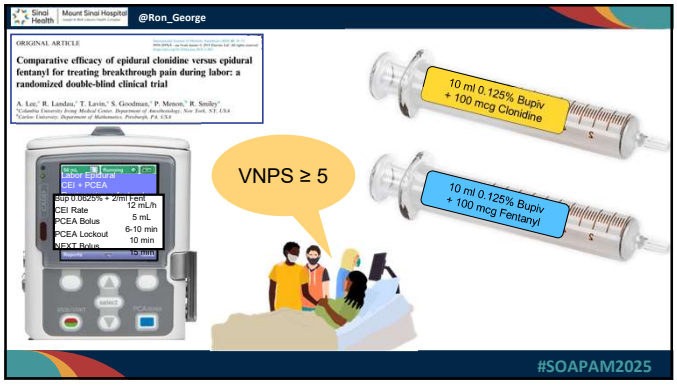

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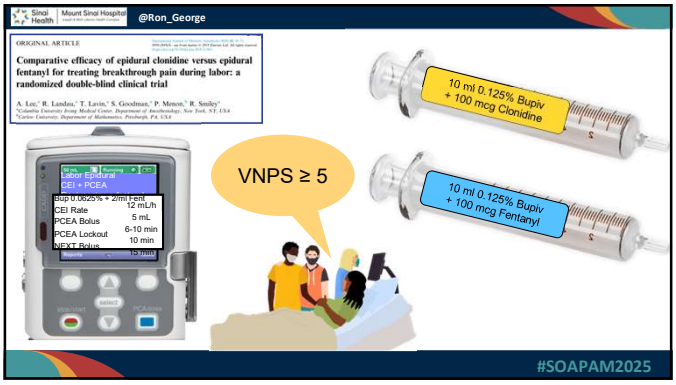

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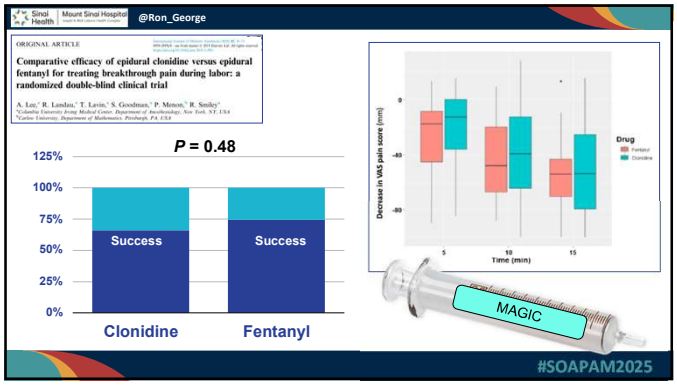
@Ron_George
ORIGINAL ARTICLE
Comparative efficacy of epidural clonidine versus epidural fentanyl for treating breakthrough pain during labor: a randomized double-blind clinical trial
P = 0.48
125%
100%
75%
50%
25%
0%
Success
Success
Clonidine
Fentanyl
Decrease in VAS pain score (mm)
Time (min)
Drug
MAGIC
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@Ron_George
EJA
GUIDELINES
ESAIC focused guidelines for the management of the failing epidural during labour epidural analgesia
Anesthesiologists must take responsibility
Regular & objective assessments of pain
Algorithm/protocol driven management
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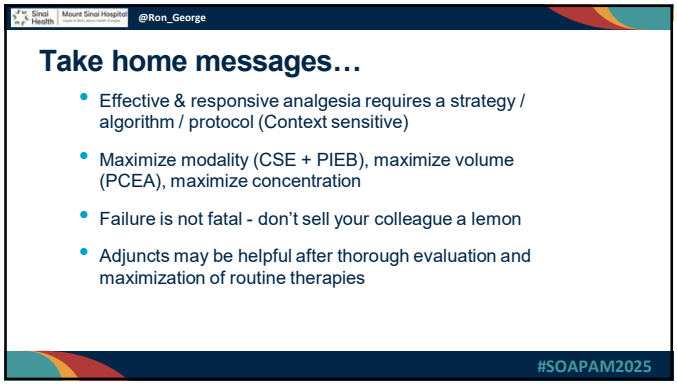
@Ron_George
Take home messages…
Effective & responsive analgesia requires a strategy / algorithm / protocol (Context sensitive)
Maximize modality (CSE + PIEB), maximize volume (PCEA), maximize concentration
Failure is not fatal - don't sell your colleague a lemon
Adjuncts may be helpful after thorough evaluation and maximization of routine therapies
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ELSEVIER

Revalidation FOR ANAESTHETISTS RCA Revalidation matrix
Matrix codes: 1A02, 2B03, 2B04, 3B00

BJA Education, 20(1): 26–31 (2020)

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Advance Access Publication Date: 19 November 2019

Conversion of labour epidural analgesia to surgical anaesthesia for emergency intrapartum Caesarean section

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Learning objectives

By reading this article you should be able to:

- Describe the risk factors associated with the failure of converting epidural analgesia for labour to anaesthesia for Caesarean section.
- Discuss the merits and limitations of the methods used to confirm the correct location of the epidural catheter and the techniques used to evaluate the adequacy of neuraxial blockade.
- Debate the advantages and disadvantages of the different drugs used in the epidural top-up solution.
- Explain the implications of the options for management after a failed epidural top-up.

Key points

- Conversion of epidural analgesia for labour to surgical anaesthesia and general anaesthesia for emergency Caesarean section can be attained in comparable decision-to-delivery times.
- The fastest onset of sensory blockade when converting the epidural is achieved using lidocaine 2% and adrenaline (epinephrine), with or without fentanyl.
- The addition of ropivacaine 0.75% to the epidural top-up solution reduces the need for supplementation during surgery.
- Loss of sensation to touch up to and including the T5 dermatome is required to prevent pain reliably during Caesarean section.
- Optimal management of a failed 'epidural top-up' is subject to debate and best practice guidelines are required.

Introduction

Between 2017 and 2018, more than 100,000 emergency Caesarean deliveries were carried out in England, 21% of which were performed with epidural anaesthesia alone.[1] If a Caesarean section is needed in a parturient with an existing labour epidural, it is common practice to convert or 'top-up' the epidural catheter, with the aim of initiating surgical anaesthesia by injecting more concentrated local anaesthetic (LA) solution, normally combined with a lipid-soluble opioid. Guidelines from the Royal College of Anaesthetists (RCoA) recommend that the decision-to-delivery interval for ≥90% of

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Accepted: 19 September 2019

Table 1 Risk factors associated with the failure of conversion of epidural analgesia for labour to surgical anaesthesia for Caesarean section.[4] CSE, combined spinal–epidural; OR, odds ratio

Consistent factors
• Greater number of unscheduled epidural top-ups needed to maintain effective analgesia in labour (OR 3.2)
• Increased parturient reported pain in the 2 h before Caesarean section
• Management by a non-obstetric anaesthetist (OR 4.6)
• Urgency of the Caesarean section (OR 40.4)
Inconsistent factors
• Increased BMI or weight
• Cervical dilatation at the commencement of labour epidural analgesia
• Epidural rather than CSE for analgesia in labour
• Increasing duration of epidural analgesia

Categories 1 and 2 Caesarean sections should be ≤30 and 75 min, respectively.[2]

Successful neuraxial anaesthesia conversion is a useful measure of quality of care, indicating the prior presence of functional labour epidural analgesia and limiting the use of general anaesthesia in obstetrics. In an effort to raise the clinical standard, guidelines from the RCoA state that the rate of conversion from neuraxial to general anaesthesia for Category 1 and Categories 1–3 Caesarean section overall should be <15% and 5%, respectively.[2]

In this article, we review the anaesthetic principles and practice associated with the effective and safe conversion of labour epidural analgesia to surgical anaesthesia for emergency intrapartum Caesarean section.

Assessment of a labour epidural for conversion to surgical anaesthesia

Conversion of an existing labour epidural for an emergency Caesarean section can fail, the incidence of which has been reported to range between 0% and 21%.[3] Hence, careful assessment of the function of the labour epidural is needed to be able to make an appropriate decision about whether or not to top it up.

Numerous factors are associated with the failed conversion of an existing labour epidural (Table 1).[4] Breakthrough pain in labour could be a marker of a poorly functioning epidural or may signify dysfunctional labour. However, in a retrospective study, many epidurals that had required unscheduled boluses in labour were still found to function well when topped up for Caesarean section. Compared to 'generalists', specialist obstetric anaesthetists might possibly have a lower rate of failed labour epidural conversion because they are more experienced in managing problematic labour epidural analgesia and are more likely to replace a poorly functioning epidural catheter before the need for Caesarean section arises. Several recommendations have been made in order to decrease the risk of failed labour epidural to surgical anaesthesia top-up (Table 2).[3]

Consideration of a labour epidural for conversion to surgical anaesthesia in a Category 1 Caesarean section

Compared to combined spinal–epidural (CSE) and spinal anaesthesia, general anaesthesia is consistently associated with a shorter decision-to-delivery interval in Caesarean section.[5] Labour epidural conversion, however, can facilitate a comparable decision-to-delivery interval to general anaesthesia, with a retrospective audit demonstrating a mean decision-to-delivery interval of 19 and 17 min, respectively, for labour epidural top-up and general anaesthesia.[6] In a recent retrospective cohort study, the operating-room-to-incision interval was shorter for general anaesthesia at 6 min relative to epidural top-up at 11 min, but the longer operating room-to-incision interval did not lead to inferior neonatal outcomes.[5] Use of general anaesthesia, in contrast, has been related to many potential drawbacks for the mother and the neonate.

In the opinion of the authors, labour epidurals that are not working well enough to manage labour pain (e.g. consequent to missed segments or unilateral blockade on objective assessment), cannot be expected to provide adequate surgical anaesthesia for Caesarean section. If a Category 1 Caesarean section is required, a labour epidural that is judged adequate for conversion to surgical anaesthesia should be topped up as soon as practically and safely possible in preference to general anaesthesia. The anaesthetist should continue to evaluate for bilateral and progressively cephalad blockade, yet must be prepared and ready to induce general anaesthesia should the adequate density and level of blockade not be obtained.

Confirmation of the correct location of the labour epidural catheter

Between 1970 and 1998 in the USA, almost one-fifth of maternal deaths associated with obstetric anaesthesia were related to the administration of epidural anaesthesia, many following the administration of bupivacaine 0.75% and the result of inadvertent high or total spinal blockade or LA systemic toxicity (LAST).[7] In view of such severe consequences, it is crucial that the correct location of the epidural catheter is confirmed before the injection of drugs.

Gentle aspiration of the epidural catheter, examining for blood or cerebrospinal fluid (CSF), allows a misplaced epidural catheter to be identified effectively and immediately. Gentle aspiration has been associated with a sensitivity of 98% and a specificity of 100%, but can give rise to false negative findings. In 2003 in the UK, only 34% of respondents with an interest in obstetric anaesthesia administered an epidural test dose for emergency Caesarean section.[8] The epidural test dose can be defined as the administration of a small amount of LA with or without adrenaline in order to determine whether or not the epidural catheter is located in a blood vessel or the subarachnoid space. This practice is an area of continued controversy and many argue that the use of an epidural test dose

Table 2 Recommendations to decrease the risk of failure of converting epidural analgesia for labour to surgical anaesthesia for Caesarean section[3]

In the delivery room before any decision to proceed to Caesarean section
- Early recognition of poorly functioning epidural analgesia, providing the anaesthetist with an opportunity to manipulate or replace the epidural catheter
- If the obstetrician expresses concern about a parturient's slow progress in labour or the fetal heart rate tracing, the anaesthetist must re-evaluate how well the epidural is functioning in anticipation of the need to convert to surgical anaesthesia

In the operating theatre after the decision to proceed to Caesarean section
- Inspection of the epidural catheter to check that it has not migrated since placement in labour
- If sufficient time is available, the function of the epidural can be tested by administering one-quarter to one-third of the full LA dose, examining initially and subsequently every 3–5 min for the bilaterally, level and density of sensory blockade
- In the absence of definite evidence of bilateral and progressively cephalad sensory blockade of adequate density, more than half of the full LA dose should not be administered

is not needed in this setting as the position of the epidural catheter has already been confirmed during labour. Despite this, multicompartmental block, rupture of the arachnoid mater after subdural placement of the epidural catheter and secondary migration of the epidural catheter can all still occur. Multicompartmental block is the misplacement of multi-orifice epidural catheters where a distal opening lies in a blood vessel or the subarachnoid space while a proximal orifice simultaneously retains access to the epidural space. Use of an epidural test dose needs to be balanced against the delay incurred in establishing adequate blockade for Caesarean section to commence.

In a prospective cohort study in parturients, the mean onset of objective block was 1.5 min after the intrathecal injection of 2 ml lidocaine 1.5%, compared with 9 min, with no detectable sensory blockade at 1.5 min, after the epidural injection of 3 ml lidocaine 1.5%.[9] If an epidural test dose consists of a LA with a lengthier onset time, such as levobupivacaine, then the time required to exclude the intrathecal placement of an epidural catheter can be longer than one is willing to wait. Unlike intrathecal 3 ml lidocaine 2%, the spinal administration of 3 ml bupivacaine 0.25–0.5% does not reliably produce motor blockade.[10] The anaesthetist can use clinical judgment to differentiate between the pattern of increases in heart rate induced by adrenaline or pain and enquire about the occurrence of systemic symptoms such as dizziness, metallic taste, palpitations, or tinnitus. If the criterion of an increase in maternal heart rate of 10 beats min^{-1} within 1 min after injection is used in conjunction with clinical evaluation, the epidural administration of adrenaline at a test dose of 10–15 μg with lidocaine in uterine diastole has a sensitivity and specificity of up to 100% and 96%, respectively.[11] However, not all research supports this conclusion, and, in one study, adrenaline as part of an epidural test dose with lidocaine did not compare favourably with the simple aspiration of the epidural catheter. Furthermore, some are concerned about the possibility of adverse effects of adrenaline on the mother and fetus, but studies suggest that i.v. adrenaline at a dose of 10–15 μg is not harmful to the fetus.

In the opinion of the authors, even with an appropriately functioning labour epidural, every epidural top-up dose must be considered a test dose such that with incremental dosing no harm will result, even if the epidural catheter is located in the intrathecal or intravascular space. In this regard, lidocaine 2% with or without adrenaline, fentanyl, or both can be considered advantageous in serving as both the epidural test and top-up dose for Caesarean section. The anaesthetist should administer the epidural top-up and continue to evaluate for bilateral and progressively cephalad blockade over a time interval suitable to the urgency of the Caesarean section.

Location of the labour epidural conversion

The decision of where to best initiate the labour epidural conversion continues to be debated and is influenced by many factors including the local logistics and urgency of Caesarean section. In 2003 in the UK and in 2014 in Scandinavia, 81% and 33% of respondents with an interest in obstetric anaesthesia, respectively, initiated extension of the labour epidural blockade in the delivery room as opposed to the operating theatre.[8,12] It has been argued that administration of an epidural top-up in the delivery room and concurrent urgent transfer to the operating theatre can enable provision of an epidural test dose and decrease the decision-to-delivery interval. Conversely, it has been reasoned that administration of an epidural top-up in the operating theatre can facilitate improved monitoring of the parturient and increased identification of complications such as high or total blockade, hypotension and LAST.

In the opinion of the authors, an individualised risk–benefit decision should be made about the administration of an epidural test dose, appropriate location of epidural conversion and the rate of administration. In our clinical practice, after the negative aspiration of the epidural catheter, we administer an epidural test dose where possible to the parturient in the delivery room as soon as a decision for Caesarean section has been made. This is followed by immediate transfer to the operating theatre for full conversion of labour epidural analgesia to surgical anaesthesia in the presence of safe monitoring and resuscitation facilities, once the effect of the epidural test dose has been evaluated. For a Category 1 Caesarean section, in contrast, a more aggressive strategy of epidural top-up with increased dosing in the delivery room may be suitable. The anaesthetist should stay with the patient at all times once an epidural top-up has been started.

Choice of LAs and adjuncts

Opinions expressed in previous surveys are divided with regard to the optimal epidural top-up solution for Caesarean section.[8,12] In a meta-analysis, lidocaine 2% plus adrenaline (usually added to achieve a concentration of 5 μg ml^{-1} in the resulting mixture), with or without fentanyl, was associated with the fastest onset of surgical blockade, with a mean

difference of 1.7–4.5 min compared with bupivacaine or levobupivacaine 0.5% or ropivacaine 0.75%.[13] The addition of epidural fentanyl at a dose of 50–75 μg further decreased the onset time of surgical blockade by a mean difference of more than 2 min. Ropivacaine 0.75% was related to the lowest need for intraoperative supplementation but the addition of fentanyl, unlike in elective Caesarean section,[14] did not reduce this requirement. It is possible that the fentanyl contained in the epidural solution administered for labour could have already produced a near-maximal effect, explaining the observed difference in the emergency compared with elective Caesarean section. Bupivacaine and levobupivacaine 0.5% were the least effective solutions with respect to speed of onset and quality of block. Mixing of bupivacaine 0.5% and lidocaine 2% in a 1:1 ratio does not seem to confer an advantage over lidocaine 2% alone and adds an extra step to the drug preparation process. However, it is difficult to make a decision about which drugs to use in the epidural top-up solution when we seek both speed of onset and quality of block. Moreover, in terms of the risk of LAST, levobupivacaine and ropivacaine are less cardiotoxic and have a greater margin of safety relative to bupivacaine, which at higher concentrations has been previously related to maternal mortality.[7]

Bicarbonate can facilitate the alkalinisation of the epidural top-up solution, increasing the unionised fraction of lidocaine available to cross the neuronal membrane and possibly increasing the lipid solubility of fentanyl and its penetration into both the spinal cord and systemic circulation. It can be added as 2 ml bicarbonate 8.4% to 20 ml lidocaine with 2 ml of the resulting mixture then discarded, but should not be administered with bupivacaine, levobupivacaine, or ropivacaine as precipitation can occur. Comparison of lidocaine and adrenaline with or without bicarbonate in the epidural top-up solution has shown a mean reduction in onset of 4.5 min when bicarbonate was added.[15] Nevertheless, concerns have been raised about whether the extra drug preparation time may offset some of the time saved and the potential risk of error and safety implications when mixing medications in the emergency situation.[13] With anaesthetists unfamiliar with the preparation of the lidocaine, adrenaline and bicarbonate solutions for epidural use, the preparation time increased four-fold when compared to bupivacaine, yet in those familiar with it, the extra preparation time is less than 1 min.

Evaluation of the adequacy of neuraxial blockade

In view of the lack of standardisation in the assessment of neuraxial blockade for Caesarean section, multiple different sensory modalities have been used by obstetric anaesthetists to test whether the extent of blockade corresponds to particular dermatomal levels.[16] However, it has been demonstrated that the loss of sensation to touch up to and including T5, between the nipple line and the xiphisternum, is the most reliable modality to prevent pain during Caesarean section.[17] Russell advocates that the cephalad dermatomal level to touch should be characterised as the first sensation of light touch.[18] Conversely Yentis recommends that this should be defined as the point at which the sensation of touch no longer changes when the stimulus is applied yet more cranially.[19] Such contrasting definitions add confusion to the interpretation of the dermatomal level of touch for adequate anaesthesia. Given that the afferent nerves carrying sensation of pain from the pelvic organs are thought to accompany the sympathetic nerves and enter the spinal cord around T10 to L1 and that the neuraxial blockade is required to be much higher than T10, other non-conventional nerve pathways must be involved in the transmission of pain in Caesarean section. It could be that some of the pelvic afferent nerves follow the sympathetic nerves through the intra-abdominal plexuses and the greater splanchnic nerve to reach the spinal cord as high as T5. It may be that the visceral pain is not of pelvic origin but originates from other intra-abdominal structures innervated by the afferent nerves which enter the spinal cord at T5.[17] In the absence of neuraxial opioids, testing for loss of sensation to touch was shown to have a sensitivity of 98% and a specificity of 53% in discriminating effective from ineffective neuraxial blockade for Caesarean section.

In 2010 in the UK, more than two-thirds of respondents with an interest in obstetric anaesthesia who evaluated a single modality to test neuraxial blockade used the loss of cold sensation to T4.[16] Cold and sharp pinprick testing have sensitivities of 12% and 55%, respectively, in discriminating effective from ineffective neuraxial blockade. The significance of this is that just 12% of parturients who encounter pain in Caesarean section will have a loss of sensation to cold below T4.[18] If and when assessing modalities other than touch, it is fundamental to ensure adequate anaesthesia, defined as the lack of awareness to the sensation rather than only the absence of cold or sharp pinprick. The loss of sensation to cold or sharp pinprick should not be a substitute or surrogate measure for loss of sensation to touch. In neuraxial blockade, loss of sensation to cold is found to be many dermatomes higher than the level at which sensation to sharp pinprick is lost and this, in turn, is observed to be several dermatomes higher than loss of sensation to touch. Nevertheless, there is not a constant relationship between the dermatomal levels assessed by these three sensory modalities with significant variation within and between individuals. Thus, determining the dermatomal level of blockade to one modality does not facilitate the prediction of the dermatomal level of blockade of any other modality. The caudal dermatomal level of blockade should be assessed for by loss of sensation from the lateral margin of the foot, corresponding to S1, to the anterior leg and thigh, covering the lumbar dermatomes. It is important to block the sacral segments in order to prevent pain during pressure and traction on the lower uterus, cervix and vagina. Motor block of the lower limbs is secondary to blockade of the lumbar segments and can be evaluated with the Bromage scale or straight leg raising.

Clinical management of failed labour epidural analgesia to surgical anaesthesia conversion

If conversion of labour epidural analgesia to Caesarean section anaesthesia fails, the anaesthetist can be confronted with a complex clinical dilemma. Optimal management of a failed labour epidural top-up is subject to continued controversy, particularly in the absence of best practice guidelines.[20] Subsequent anaesthesia management options, including manipulation or replacement of the epidural, performance of a CSE or spinal, or induction of general anaesthesia, all have potential drawbacks and can introduce anaesthetic risk to the parturient and the neonate (Table 3).[3]

Table 3 Drawbacks and risks associated with the various different management options after failed conversion of epidural analgesia for labour to surgical anaesthesia for Caesarean section. CSE, combined spinal–epidural; LAST, LA systemic toxicity; PONV, postoperative nausea and vomiting

Management	Drawbacks and risks
CSE	Longer time to perform Difficult to choose the optimal intrathecal dose of LA Untested epidural catheter if subsequent epidural dosing needed Potential of LAST with epidural administration of additional LA
General anaesthesia	Accidental awareness Complications associated with aspiration and failed intubation Greater maternal and neonatal sedation Increased risk of poor uterine tone and blood loss Related to depressed Apgar scores at 5 min, the need for bag mask ventilation and admission to neonatal intensive care Increased postoperative pain and PONV Impairment of early breast feeding and maternal–neonatal bonding
Manipulation or replacement of epidural	Longer time to perform Potential of LAST with epidural administration of additional LA
Spinal	Difficulty in obtaining cerebrospinal fluid and increased risk of block failure Difficult to select the optimal intrathecal dose of LA Decreases in the intrathecal dose of LA further increase the risk of block failure Potential of high or total spinal with standard or modestly reduced intrathecal dose of LA

If unilateral sensory blockade occurs, the unfavourable location of the epidural catheter, either positioned too lateral in the epidural space or outside the epidural space after passing through the intervertebral foramen, may be corrected by withdrawal. Such withdrawal of the epidural catheter followed by the administration of additional LA in surgical anaesthetic concentrations was identified as an effective intervention in more than four-fifths of cases of failed labour epidural conversion in a retrospective analysis.[21] However, this approach can take a long time to perform, leading to delays, and further administration of LA can increase the risk of LAST.

It can be challenging to perform a spinal in the context of a failed labour epidural conversion because of the associated difficulty in obtaining CSF. This could be attributable to the collapse of the subarachnoid space below the termination of the spinal cord secondary to the volume effect of the epidural bolus. Spinal anaesthesia performed within 30 min of a failed labour epidural top-up has been associated with an increased risk of failure and may reflect the erroneous assumption that the free flow of clear fluid must be CSF rather than previously injected LA within the epidural space. The increased likelihood of high or total spinal blockade related to spinal anaesthesia subsequent to failed labour epidural conversion might be secondary to the pre-existing subclinical analgesia caused by prior exposure of the neuronal tissue to epidural LA solution, compression of the dural sac by residual LA in the epidural space resulting in cephalad displacement of the intrathecally injected drugs and the leakage of LA through the dural hole into the subarachnoid space. Measures recommended to decrease the risk of high and total spinal blockade include performing the spinal in the sitting position, reducing the dose of intrathecal bupivacaine by 20% and delaying supine positioning following the spinal injection.[22] Nevertheless, such a decrease in the dose of intrathecal LA may not be sufficient to prevent high or total spinal blockade and can further increase the likelihood of later intraoperative block failure.

Use of a CSE facilitates the administration of a decreased initial dose of intrathecal LA with a reduced risk of block failure because of the ability to provide additional LA as needed through the epidural catheter. Concerns about the risk of the untested epidural catheter have not been substantiated by the literature, which suggests that the incidence of a failed epidural component is unlikely after a successful CSE.[23] Studies report longer performance times for CSE compared to spinal, but only one trial showed a clinically meaningful difference of 11 min.[24] General anaesthesia has been associated with accidental awareness under anaesthesia and complications related to aspiration and failed intubation, with critical incidents mainly occurring after the failed conversion of neuraxial anaesthesia rather than primary general anaesthesia.[25]

Table 4 Comprehensive components of an obstetric anaesthetic follow-up

- Ask about the presence and control of postpartum pain
- Confirm the appropriate prescription and use of optimal multimodal analgesics and determine her opioid requirements
- Evaluate for adverse effects to include nausea, vomiting and pruritus
- If received general anaesthesia, determine if any awareness or recall is present
- If received neuraxial blockade, exclude the presence of complications: postdural puncture headache; nerve injury (sensory or motor changes in the lumbar or sacral distribution); early epidural abscess (risk factors, back pain and pyrexia); and epidural haematoma (risk factors, back pain, motor impairment, sensory loss and urinary retention)
- Consider affect and mood, evaluating for evidence of symptoms consistent with depression or post-traumatic stress disorder
- Enquire about her ability to drink, eat, mobilise and sleep, and the capacity to care for her neonate
- Elicit her views about the quality of intrapartum, intraoperative and postpartum pain relief provided
- Enquire about her overall level of satisfaction with the anaesthetic care received
- Safety net: educate her about the symptoms of postdural puncture headache, if at risk, and pre-eclampsia; and provide verbal and written information about when and how to seek further advice and help

Follow-up

All women who receive intrapartum anaesthetic care, whether analgesia for labour or anaesthesia for operative procedures, should be followed up routinely in order to determine general well-being, exclude any complications such as epidural haematoma or postdural puncture headache, monitor for adverse effects such as pruritus or vomiting, and obtain comments and feedback on the quality of the analgesia and anaesthesia service (Table 4).[26] Serious complications such as epidural abscess may not manifest clinically until after a woman has been discharged from hospital and it is thus necessary that verbal and written information about when and how to seek further advice and help is provided. Those with identified complications such as postdural puncture headache should be contacted daily and offered postpartum follow-up review as an outpatient with a consultant anaesthetist.

Declaration of interest

The authors declare that they have no conflicts of interest.

MCQs

The associated MCQs (to support CME/CPD activity) will be accessible at www.bjaed.org/cme/home by subscribers to BJA Education.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bjae.2019.09.006.

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1

Hot Take - Every Intrapartum Cesarean Gets a Spinal

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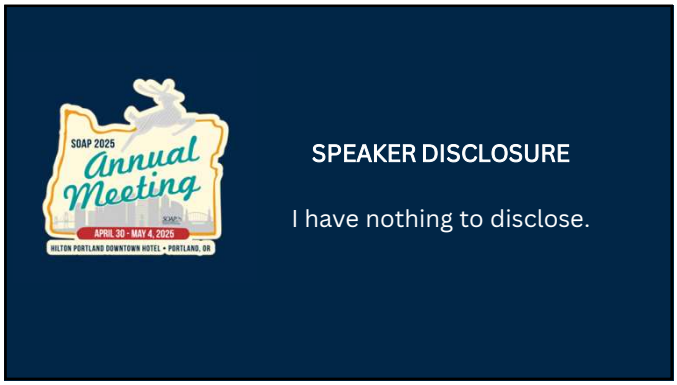
2



3

Learning Objectives

- Describe the evidence for removing an indwelling epidural catheter and performing a new neuraxial technique for an intrapartum cesarean delivery
- Estimate the incidence of high neuraxial block associated with a new neuraxial technique after labor epidural analgesia
- Determine when removal of an indwelling labor epidural catheter followed by a new neuraxial technique is indicated

4

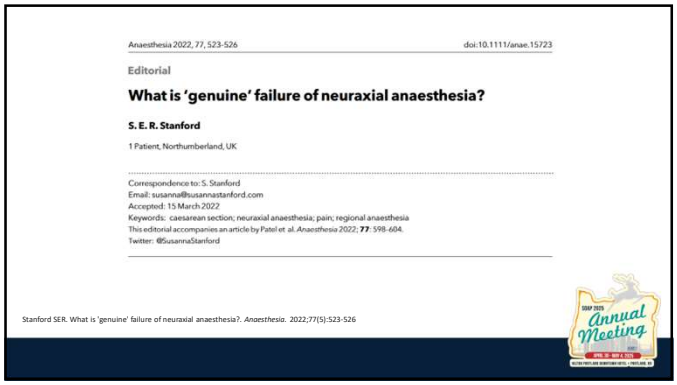
Overview

- Pain during cesarean delivery
- Evidence for removal of indwelling labor epidural followed by new neuraxial technique
- Safety concerns
- Practical tips

5

Pain during cesarean delivery

6



7

Stanford

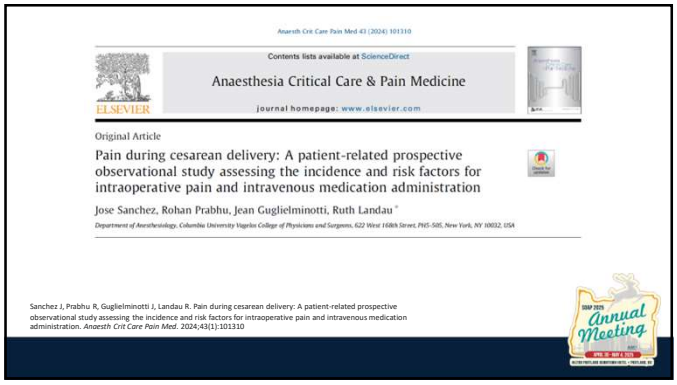
"Taking conversion to general anaesthesia as the measure by which 'significant failure' is accepted may lead to underestimating and normalising the prevalence and severity of harm to those not undergoing general anaesthesia, while providing false reassurance to clinicians around the efficacy of neuraxial blocks"

8

9

Topping up epidurals for cesarean = "no bueno"

10

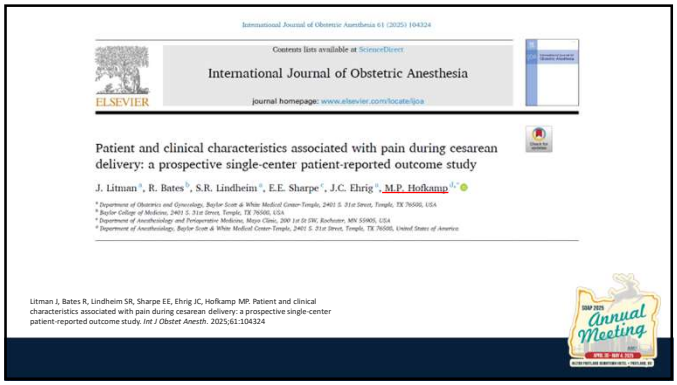


11

Sanchez et al

- 0-1 top ups during labor: aOR 5.98 [1.71-20.94]
- 2 or greater top ups: aOR 14.51 [3.38-62.24]

12



13

Litman et al

- Activation of any labor epidural catheter: aOR 6.13 [1.36-27.62] (p=0.02)
- Removal of labor epidural catheter followed by new neuraxial technique: aOR 4.80 [0.87-26.44] (p=0.07)

14

15

Charles et al

- 34 articles included (21 randomized, 13 non-randomized), 11,351 pts
- Overall pooled incidence of pain: 17%
- Spinal pooled incidence of pain: 14%
- Epidural top up pooled incidence of pain: 33%

16

Charles et al

"Further prospective studies are required to characterize and understand the impact of patient experiences of pain and develop techniques to reduce this complication."

17

How about removing the epidural catheter and doing a spinal??

18

PROC (BAYL UNIV MED CENT)
2023;36(4):473–477
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A comparison of anesthetic outcomes between activation and removal of epidural catheters for patients who underwent unscheduled intrapartum cesarean delivery

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Shepherd B, Sharpe EE, Hammonds K, Hofkamp MP. A comparison of anesthetic outcomes between activation and removal of epidural catheters for patients who underwent unscheduled intrapartum cesarean delivery. *Proc (Bayl Univ Med Cent)*. 2023;36(4):473-477

19

Shepherd et al

1611 cesarean deliveries → 410 met inclusion criteria → Propensity matched using indication for cesarean and number of rescue boluses during labor

- 124 patients with activation of catheter
- 124 patients with removal of catheter followed by new neuraxial

Patients who had removal of catheter more likely to have "regional only" anesthesia (odds ratio 4.298; 95% confidence interval 2.448, 7.548; P < 0.01)

Removal group:
- **3 patients did not have successful new neuraxial technique**
- **1 patient required intubation for dyspnea**

20

Spinal after removal of labor epidural?

DANGER!!!!

21

High neuraxial block (my hospital)

- Spinal or CSE: 1:1644 (95% CI 1:291-1:9312)
- Activation of labor epidural: 1:313 (95% CI 1:56-1:1773)
- Removal of labor epidural followed by new neuraxial technique: **1:146** (95% CI 1:41-1:534)

22

PERIOPERATIVE MEDICINE

ANESTHESIOLOGY

Frequency and Risk Factors for Difficult Intubation in Women Undergoing General Anesthesia for Cesarean Delivery: A Multicenter Retrospective Cohort Analysis

Sharon C. Reale, M.D., Melissa E. Bauer, D.O., Thomas T. Klumpner, M.D., Michael F. Aziz, M.D., Kara G. Fields, M.S., Rachel Hurwitz, B.S., Manal Saad, B.S., Sachin Khetarpal, M.D., M.B.A., Brian T. Bateman, M.D., M.Sc.; Multicenter Perioperative Outcomes Group Collaborators*

Anesthesiology 2022; 136:697–708

- MPOG data
- 14,758 cesarean deliveries under GA
- Frequency of difficult intubation: 1:49 (95% CI 1:55 to 1:44)
- Frequency of failed intubation: 1:808 (95% CI 1:1,276 to 1:511)

23

PROC (BAYL UNIV MED CENT)
2023;36(2):179–180
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Taylor & Francis

Airway management for 362 cesarean deliveries performed with general anesthesia at a Texas level IV maternal facility

Alyson Win, BS[a], Adam Olson, MD[b], Kendall Hammonds, MPH[c], and Michael P. Hofkamp, MD[d]

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24

Practical advice

25

My practice

- Low threshold to remove any catheter that is less than perfect
- "Recipe": CSE with 9 mg bupivacaine 0.75%, 15 mcg fentanyl, 150 mcg morphine
- Will top up epidural catheters for: 1) pt refusal for new technique, 2) emergencies, 3) ridiculously difficult epidural catheter placement

26

My evidence

- Shepherd et al
- Obstetricians claim that surgical field is more relaxed compared to epidural top up
- Difficult to do prospective studies on patients who are pregnant and in labor at time of enrollment/randomization

27

Summary

- Epidural top up is strongly associated with pain during cesarean delivery
- Removal of labor epidural catheter and performance of a new neuraxial technique may prevent pain during cesarean delivery
- I believe benefits of improved analgesia outweigh risks of high neuraxial block

28

Thanks!!!

29

1

Hot Take - Every Intrapartum Cesarean Gets a Spinal

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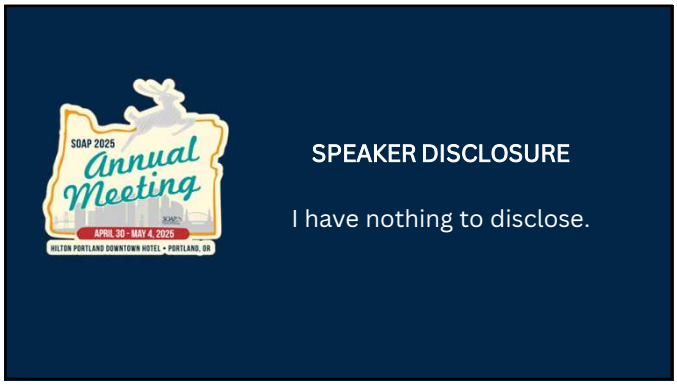
2



3

Learning Objectives

- Describe the evidence for removing an indwelling epidural catheter and performing a new neuraxial technique for an intrapartum cesarean delivery
- Estimate the incidence of high neuraxial block associated with a new neuraxial technique after labor epidural analgesia
- Determine when removal of an indwelling labor epidural catheter followed by a new neuraxial technique is indicated

4

Overview

- Pain during cesarean delivery
- Evidence for removal of indwelling labor epidural followed by new neuraxial technique
- Safety concerns
- Practical tips

5

Pain during cesarean delivery

6

Anaesthesia 2022, 77, 523-526 doi:10.1111/anae.15723

Editorial

What is 'genuine' failure of neuraxial anaesthesia?

S. E. R. Stanford

1 Patient, Northumberland, UK

Correspondence to: S. Stanford
Email: susanna@susannastanford.com
Accepted: 15 March 2022
Keywords: caesarean section; neuraxial anaesthesia; pain; regional anaesthesia
This editorial accompanies an article by Patel et al. *Anaesthesia* 2022; **77**: 598-604.
Twitter: @SusannaStanford

Stanford SER. What is 'genuine' failure of neuraxial anaesthesia?. *Anaesthesia*. 2022;77(5):523-526

7

Stanford

"Taking conversion to general anaesthesia as the measure by which 'significant failure' is accepted may lead to underestimating and normalising the prevalence and severity of harm to those not undergoing general anaesthesia, while providing false reassurance to clinicians around the efficacy of neuraxial blocks"

8

STANDARDS AND PRACTICE PARAMETERS

Statement on Pain During Cesarean Delivery

Developed by: Committee on Obstetric Anesthesia
Original Approval: October 18, 2023

Purpose

The purpose of this statement on pain during cesarean delivery is to support clinician awareness, provide pragmatic advice, and suggested best practices while helping to improve maternal outcomes and patient experience. This statement and recommendations assist the practitioner and patient in making decisions about health care. These recommendations while designed to assist, may be adopted, modified, or rejected according to clinical needs and constraints, are not intended to replace local institutional policies, are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome.[1]

https://www.asahq.org/standards-and-practice-parameters/statement-on-pain-during-cesarean-delivery

9

Topping up epidurals for cesarean = "no bueno"

10

Anaesth Crit Care Pain Med 43 (2024) 101310

Contents lists available at ScienceDirect

Anaesthesia Critical Care & Pain Medicine

journal homepage: www.elsevier.com

Original Article

Pain during cesarean delivery: A patient-related prospective observational study assessing the incidence and risk factors for intraoperative pain and intravenous medication administration

Jose Sanchez, Rohan Prabhu, Jean Guglielminotti, Ruth Landau *

Department of Anesthesiology, Columbia University Vagelos College of Physicians and Surgeons, 622 West 168th Street, PH5-505, New York, NY 10032, USA

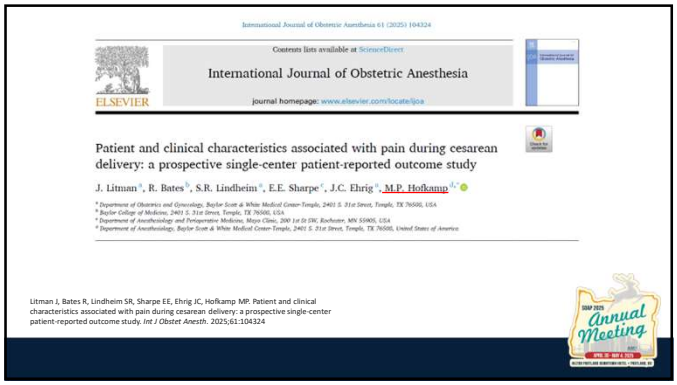
Sanchez J, Prabhu R, Guglielminotti J, Landau R. Pain during cesarean delivery: A patient-related prospective observational study assessing the incidence and risk factors for intraoperative pain and intravenous medication administration. *Anaesth Crit Care Pain Med*. 2024;43(1):101310

11

Sanchez et al

- 0-1 top ups during labor: aOR 5.98 [1.71-20.94]
- 2 or greater top ups: aOR 14.51 [3.38-62.24]

12



13

Litman et al

- Activation of any labor epidural catheter: aOR 6.13 [1.36-27.62] (p=0.02)
- Removal of labor epidural catheter followed by new neuraxial technique: aOR 4.80 [0.87-26.44] (p=0.07)

14

15

Charles et al

- 34 articles included (21 randomized, 13 non-randomized), 11,351 pts
- Overall pooled incidence of pain: 17%
- Spinal pooled incidence of pain: 14%
- Epidural top up pooled incidence of pain: 33%

16

Charles et al

"Further prospective studies are required to characterize and understand the impact of patient experiences of pain and develop techniques to reduce this complication."

17

How about removing the epidural catheter and doing a spinal??

18

PROC (BAYL UNIV MED CENT)
2023;36(4):473–477
Copyright ©: 2023 Baylor University Medical Center
https://doi.org/10.1080/08998280.2023.2204288

Taylor & Francis

A comparison of anesthetic outcomes between activation and removal of epidural catheters for patients who underwent unscheduled intrapartum cesarean delivery

Bailey Shepherd, MD[a], Emily E. Sharpe, MD[b], Kendall Hammonds, MPH[c], and Michael P. Hofkamp, MD[d]

[a]Department of Anesthesiology, Baylor Scott & White Medical Center – Temple, Temple, Texas; [b]Department of Anesthesiology and Perioperative Medicine, Mayo Clinic, Rochester, Minnesota; [c]Biostatistics Core, Baylor Scott & White Research Institute, Temple, Texas

Shepherd B, Sharpe EE, Hammonds K, Hofkamp MP. A comparison of anesthetic outcomes between activation and removal of epidural catheters for patients who underwent unscheduled intrapartum cesarean delivery. *Proc (Bayl Univ Med Cent)*. 2023;36(4):473-477

19

Shepherd et al

1611 cesarean deliveries → 410 met inclusion criteria → Propensity matched using indication for cesarean and number of rescue boluses during labor

- 124 patients with activation of catheter
- 124 patients with removal of catheter followed by new neuraxial

Patients who had removal of catheter more likely to have "regional only" anesthesia (odds ratio 4.298; 95% confidence interval 2.448, 7.548; P < 0.01)

Removal group:
- **3 patients did not have successful new neuraxial technique**
- **1 patient required intubation for dyspnea**

20

Spinal after removal of labor epidural?

DANGER!!!!

21

High neuraxial block (my hospital)

- Spinal or CSE: 1:1644 (95% CI 1:291-1:9312)
- Activation of labor epidural: 1:313 (95% CI 1:56-1:1773)
- Removal of labor epidural followed by new neuraxial technique: **1:146** (95% CI 1:41-1:534)

22

PERIOPERATIVE MEDICINE

ANESTHESIOLOGY

Frequency and Risk Factors for Difficult Intubation in Women Undergoing General Anesthesia for Cesarean Delivery: A Multicenter Retrospective Cohort Analysis

Sharon C. Reale, M.D., Melissa E. Bauer, D.O., Thomas T. Klumpner, M.D., Michael F. Aziz, M.D., Kara G. Fields, M.S., Rachel Hurwitz, B.S., Manal Saad, B.S., Sachin Khetarpal, M.D., M.B.A., Brian T. Bateman, M.D., M.Sc.; Multicenter Perioperative Outcomes Group Collaborators*

Anesthesiology 2022; 136:697–708

- MPOG data
- 14,758 cesarean deliveries under GA
- Frequency of difficult intubation: 1:49 (95% CI 1:55 to 1:44)
- Frequency of failed intubation: 1:808 (95% CI 1:1,276 to 1:511)

23

PROC (BAYL UNIV MED CENT)
2023;36(2):179–180
Copyright ©: 2022 Baylor University Medical Center
https://doi.org/10.1080/08998280.2022.2150929

Taylor & Francis

Airway management for 362 cesarean deliveries performed with general anesthesia at a Texas level IV maternal facility

Alyson Win, BS[a], Adam Olson, MD[b], Kendall Hammonds, MPH[c], and Michael P. Hofkamp, MD[d]

[a]College of Medicine, Texas A&M Health Science Center, Temple, Texas; [b]Department of Anesthesiology, Wake Forest University, Winston-Salem, North Carolina; [c]Biostatistics Core, Baylor Scott & White Research Institute, Temple, Texas; [d]Department of Anesthesiology, Baylor Scott & White Medical Center – Temple, Temple, Texas

24

Practical advice

25

My practice

- Low threshold to remove any catheter that is less than perfect
- "Recipe": CSE with 9 mg bupivacaine 0.75%, 15 mcg fentanyl, 150 mcg morphine
- Will top up epidural catheters for: 1) pt refusal for new technique, 2) emergencies, 3) ridiculously difficult epidural catheter placement

26

My evidence

- Shepherd et al
- Obstetricians claim that surgical field is more relaxed compared to epidural top up
- Difficult to do prospective studies on patients who are pregnant and in labor at time of enrollment/randomization

27

Summary

- Epidural top up is strongly associated with pain during cesarean delivery
- Removal of labor epidural catheter and performance of a new neuraxial technique may prevent pain during cesarean delivery
- I believe benefits of improved analgesia outweigh risks of high neuraxial block

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Thanks!!!

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ASA Committee on Obstetric Anesthesia: Update

Mark Zakowski, M.D., FASA
Obstetric Anesthesiology Cedars-Sinai
Professor, Anesthesiology
Chair, ASA Committee of Obstetric Anesthesia
Chair, ASA Educational Track OB Anesthesia
Vice-Chair, ASA Quality Management & Dept Administration
Past-President, Society of Obstetric Anesthesia and Perinatology
Past-President, California Society of Anesthesiologists

1

SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

SPEAKER DISCLOSURE

I have nothing to disclose.

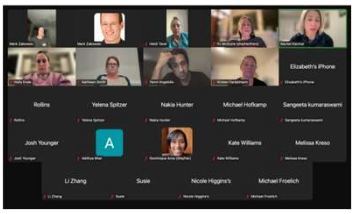
2

ASA CObA: Process

- Apply committee membership Nov-Jan ASAHQ.org
  - 2-year appointments (NEW)
- Larger committee for greater diversity of opinion, practice type, geo
- Survey Monkey ideas to address Summer – SOAP, ACOG, SMFM, OAA
- CObA meets Q2 months virtual, in person ASA, SOAP annual meetings
- Working groups for ideas to develop into product
- Deadline for submission to BOD packet mid-June
  - ASA BOD mid-August
  - ASA HOD mid-October

3

ASA CObA: Process



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ASA CObA

2021:

Statement on Post-Dural Puncture Headache Management #1 complication!

Statement on Reducing Maternal Peripartum Racial and Ethnic Disparities in Anesthesia Care Improve outcomes!

Statement on Neuraxial Analgesia or Anesthesia in Obstetrics

Statement on Optimal Goals for Anesthesia Care in Obstetrics

5

ASA CObA

2022:

Statement on Anesthesiologists' Role in Reducing Maternal Mortality and Severe Maternal Morbidity #1 priority

Statement on Oral Intake During Labor #1 controversy

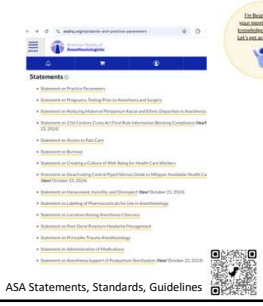
Statement on Quality Metrics [Obstetric Anesthesia]

Post dural puncture headache 'Member Toolkit': https://www.asahq.org/standards-and-practice-parameters/resources-from-asa-committees#oa Member benefit

- Epidural blood patch placement – aka 'cheat sheet'
- Differential Diagnosis of Postpartum Headache – aka 'cheat sheet'
- Template for Obstetric Patients with PDPH – consult note
- Information about your headache – patient handout

6

ASA Statements and Committee Work Products

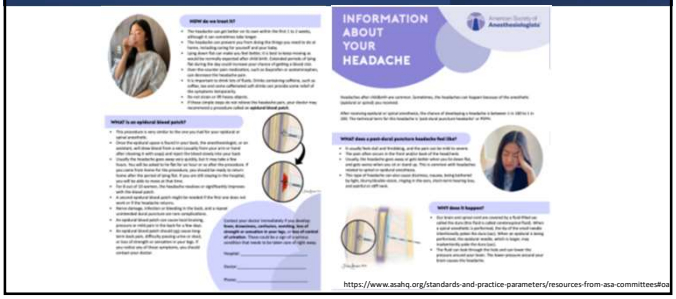


ASA Statements, Standards, Guidelines

ASA Committee work products

7

Patient Educational Handout



https://www.asahq.org/standards-and-practice-parameters/resources-from-asa-committees#oa

8

ASA Professional Template & Education

https://www.asahq.org/standards-and-practice-parameters/resources-from-asa-committees#oa

9

ASA CObA

2023:

Shortages common problem – help members

Statement on Neuraxial Medication Shortage and Alternatives

Statement on Neurologic Complications of Neuraxial Analgesia/Anesthesia in Obstetrics

Statement on Pain During Cesarean Delivery #1 problem in Obstetric Anesthesia !!!

2024:

Statement on Resuming Breastfeeding after Anesthesia 5-year review

Statement on Use of Systemic and Neuraxial Adjuvants for Pain during Cesarean

Statement on Psychological support in Obstetric Anesthesia #1 issue

Statement on Anesthesia Support of Postpartum tubal ligation

Statement on Anesthesia Support of In Vitro Fertilization

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ASA CObA: Neuraxial Medication Shortage Alternative

Table 2: Epidural Surgical Anesthesia—Local Anesthetic Alternatives

Local Anesthetic (PF)	Dose	Onset (min)	Duration (min)
Lidocaine 2% with 1:200,000 epinephrine†	15 – 25 ml	5 – 10	75 – 100
2-Chloroprocaine 3%	15 – 25 ml	3 – 5	40 – 50 *Suggested re-dosing strategy – 5 ml q 10 min starting 20 – 30 min after initial dose*
Bupivacaine 0.5% †	15 – 25 ml	15 – 25	120 – 180
Ropivacaine 0.5% †	15 – 25 ml	15 – 25	120 – 180

PF: Preservative Free

†Note: Consider adding epinephrine 1:200,000 as an intravascular marker to plain local anesthetics. 1:200,000 solution = 5 mcg epinephrine/ml local anesthetic

Table 3: Spinal Surgical Anesthesia—Local Anesthetic Alternatives

Local Anesthetic (PF)	Dose	Onset (min)	Duration (min)
Bupivacaine 0.75% (Hyperbaric)	7.5 – 15 mg	7 – 10	60 – 120
Bupivacaine 0.5% (Isobaric)† *	7.5 – 15 mg	7 – 10	60 – 120
Ropivacaine 0.5% (Isobaric)	15 – 25 mg	7 – 10	60 – 120
2-Chloroprocaine 2.3% (Hyperbaric)†	40 – 50 mg	5 – 7	40 – 60
Lidocaine 1.5% or 5% (Hyperbaric)	70 – 100 mg	5 – 8	45 – 75
Tetracaine 0.5% (Isobaric)	10 – 16 mg	8- 10	120 – 180

PF: Preservative Free

https://www.asahq.org/standards-and-practice-parameters/statement-on-neuraxial-medication-shortage-and-alternatives, 2023

11

ASA CObA

2025 Statements in development:

Anesthesia Services Staffing Labor & Delivery – R.George lead

Antenatal Provision of Anesthesia Consultation and Interdisciplinary Care – Kacmar lead

Anesthesia Support for External Cephalic Version – Fardelmann lead

COE - input on ASA Physical Status examples for obstetric patients

OB Difficult Airway – Rollins lead for HOD 2026

ASA Community Forum – monitor OB Anesthesia questions - Higgins lead

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ASA CObA

2026:

Send your thoughts - #1 problem to address

https://www.surveymonkey.com/r/cobasurveysoap2025

ASA-SOAP Obstetric Anesthesia Guideline update start via CPP (?)

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Pain During Cesarean Delivery


STANDARDS AND PRACTICE PARAMETERS

Statement on Pain During Cesarean Delivery

Developed by: Committee on Obstetric Anesthesia
Original Approval: October 18, 2023

Purpose

The purpose of this statement on pain during cesarean delivery is to support clinician awareness, provide pragmatic advice, and suggested best practices while helping to improve maternal outcomes and patient experience. This statement and recommendations assist the practitioner and patient in making decisions about health care. These recommendations while designed to assist, may be adapted, modified, or rejected according to clinical needs and constraints, are not intended to replace local institutional policies, are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome.[1]

Introduction

Neuraxial anesthesia for cesarean delivery is generally considered the preferred method of anesthesia, being used for more than 95% of elective and 86% of emergent cesarean deliveries in the US.[2-4] Although very reliable, neuraxial techniques (i.e. spinal-epidural, combined spinal-epidural, or epidural) can be inadequate or fail to provide full surgical anesthesia. Pain during cesarean delivery may be treated with supplementation of neuraxial anesthesia, intravenous or inhaled analgesia/anesthesia, or conversion to general anesthesia. In a prospective study of over 5,000 cesarean deliveries, failure to achieve pain-free surgery occurred in 6% of patients with spinal anesthesia, 18% with combined spinal-epidural, 24% with labor epidural to cesarean top-up and with an overall rate of conversion to general anesthesia of 4.9%.[5] Pain or discomfort during cesarean delivery may be due to multiple reasons, some of which may be preventable.[6] This statement is intended to help raise awareness, inform, and help improve outco

Statement on the Use of Adjuvant Medications and Management of Intraoperative Pain During Cesarean Delivery

Developed by: Committee on Obstetric Anesthesia
Original Approval: October 23, 2024

Executive Summary

Executive Summary Introduction

- American Society of Anesthesiologists Statement on Pain During Cesarean Delivery provided background and guidance in the recognition and treatment of pain during cesarean delivery, which occurs in about 15%.
- Multiple medication types can be delivered via varied routes to help manage pain during cesarean delivery.
- This statement provides guidance on the use of adjuvant medications to help manage pain during cesarean delivery. No one technique or adjunct can guarantee full pain relief.

Neuraxial adjuvant medication

Adjuvants

https://www.asahq.org/standards-and-practice-parameters/statement-on-pain-during-cesarean-delivery

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Adjuvants for Pain During Cesarean

1. Neuraxial adjuvant medication
2. Intravenous adjuvant medication
3. Inhalational adjuvant medication
4. Sedation for cesarean delivery
5. Decision to convert to general anesthesia
6. Quality improvement

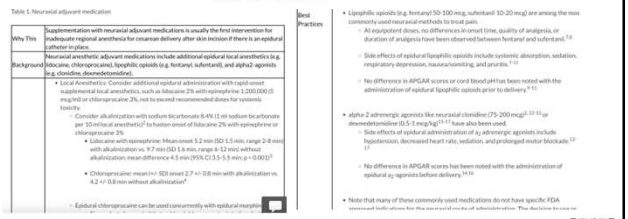


Table 1. Neuraxial adjuvant medication

		Best Practices
Why This	Supplementation with neuraxial adjuvant medications is usually the first intervention for inadequate regional anesthesia for cesarean delivery after skin incision if there is an epidural catheter in place.	
Background	Neuraxial anesthetic adjuvant medications include additional epidural local anesthetics (e.g. lidocaine, chloroprocaine), lipophilic opioids (e.g. fentanyl, sufentanil), and alpha2-agonists (e.g. clonidine, dexmedetomidine).	
	• Local Anesthetics: Consider additional epidural administration with rapid-onset supplemental local anesthetics, such as lidocaine 2% with epinephrine 1:200,000 (5 mcg/ml) or chloroprocaine 3%, not to exceed recommended doses for systemic toxicity. ◦ Consider alkalinization with sodium bicarbonate 8.4% (1 ml sodium bicarbonate per 10 ml local anesthetic)[1] to hasten onset of lidocaine 2% with epinephrine or chloroprocaine 3%: • Lidocaine with epinephrine: Mean onset 5.2 min (SD 1.5 min, range 2-8 min) with alkalinization vs. 9.7 min (SD 1.6 min, range 6-12 min) without alkalinization; mean difference 4.5 min (95% CI 3.5-5.5 min; p < 0.001)[2] • Chloroprocaine: mean (+/- SD) onset 2.7 +/- 0.8 min with alkalinization vs. 4.2 +/- 0.8 min without alkalinization[3] ◦ Epidural chloroprocaine can be used concurrently with epidural morphine	• Lipophilic opioids (e.g. fentanyl 50-100 mcg, sufentanil 10-20 mcg) are among the most commonly used neuraxial methods to treat pain. ◦ At equipotent doses, no differences in onset time, quality of analgesia, or duration of analgesia have been observed between fentanyl and sufentanil.[7,8] ◦ Side effects of epidural lipophilic opioids include systemic absorption, sedation, respiratory depression, nausea/vomiting, and pruritis.[9-11] ◦ No difference in APGAR scores or cord blood pH has been noted with the administration of epidural lipophilic opioids prior to delivery.[9-11] • alpha-2 adrenergic agonists like neuraxial clonidine (75-200 mcg)[5,12-15] or dmedetomidine (0.5-1 mcg/kg)[13,16] have also been used. ◦ Side effects of epidural administration of α_2 adrenergic agonists include hypotension, decreased heart rate, sedation, and prolonged motor blockade.[12-17] ◦ No difference in APGAR scores has been noted with the administration of epidural α_2-agonists before delivery.[14,16] • Note that many of these commonly used medications do not have specific FDA

https://www.asahq.org/standards-and-practice-parameters/statement-on-the-use-of-adjuvant-medications-and-management-of-intraoperative-pain-during-cesarean-delivery

15

Providing Psychological Support


STANDARDS AND PRACTICE PARAMETERS

Statement on Providing Psychological Support for Obstetric Patients

Developed by: Committee on Obstetric Anesthesia
Original Approval: October 23, 2024

Executive Summary

This statement highlights the importance of providing psychological support to obstetric patients, a key aspect of a positive birth experience, by providing the best patient-centered care in the perioperative and perinatal periods. Up to 6% of postpartum patients have childbirth-related post-traumatic stress disorder, with 32% reporting post-traumatic stress. Anesthesiologists play a prominent role in delivering patient-centered care, particularly in addressing the psychological needs of patients with pre-existing mental health conditions or past traumatic experiences. This statement helps clarify terminology, summarize data on patient-centered outcomes, and suggest guidance and some best practices to help anesthesia professionals meet these goals. A holistic approach helps provide a positive birth experience supporting the psychosocial well-being of patient and family as well as health care providers. Additional resources are provided.

Key points include the following:

1. **Risk Factors and Prevention:** Multiple factors contribute to traumatic birth experiences, including obstetric complications, inadequate pain management, and poor communication. This statement advocates for early identification of at-risk patients through screening and collaborative care
2. **Trauma-Informed Care:** This

1. **Risk Factors and Prevention:** Multiple factors contribute to traumatic birth experiences, including obstetric complications, inadequate pain management, and poor communication. This statement advocates for early identification of at-risk patients through screening and collaborative care planning, involving obstetric, mental health, and anesthesiology professionals.
2. **Trauma-Informed Care:** This statement highlights how the best practices of trauma-informed care (TIC) can be applied by anesthesiology professionals in obstetric settings. The principles of TIC can help avoid exacerbating prior trauma and to promote a positive childbirth experience for all patients.
3. **Pain Management and Anxiolysis:** Effective pain management is important in reducing the risk of poor birth experiences. This statement outlines strategies for both pain control and anxiolysis, including the use of pharmacologic anxiolysis, while balancing the potential risks and benefits to both the mother and neonate.
4. **Systems of Care and Provider Wellbeing:** Integrated systems of care should address maternal mental health comprehensively, ensuring immediate and long-term mental health needs are met, including providing support for anesthesiology professionals working to improve their health systems. The importance of recognizing the emotional toll of providing healthcare in challenging settings is discussed. Healthcare providers can be affected and a comprehensive list of additional resources for self-care to maintain empathy and compassion in challenging clinical settings provided.
5. **Patient Experience and Empowerment:** Empowering patients through shared decision-making, clear communication, and respecting patient autonomy is critical to improving their overall birth experience. Strategies and additional resources are provided to enhance patient experience.

https://www.asahq.org/standards-and-practice-parameters/statement-on-providing-psychological-support-for-obstetric-patients

16

Earned Media

2019: **Fox Television News, CBD use ill-advised during pregnancy,** https://www.fox35orlando.com/video/617234

2019 **St Louis Radio KMOX**/article:. https://www.audacy.com/kmox/articles/news/pregnant-women-should-be-cautious-cbd-oil-study-says

2021: https://www.pregnancymagazine.com/pregnancy/pregnancy-health/risks-of-marijuana-use-during-pregnancy-expecting-mothers-need-to-know

2024: Zakowski M. **CBS Interview** Pain During Cesarean, carried by 120 affiliate television stations. 2024: May 22. https://www.wboc.com/news/working-to-eliminate-c-section-pain/video_89b4c741-94a3-50a4-b1b5-562f3ed07a83.html

2024: Zakowski M. Epidurals may do more than relieve pain – they could save lives. **National Geographic** 2024 May 24. https://www.nationalgeographic.com/premium/article/epidural-benefits-complications

17

Introduction

- Pain during cesarean 15%
  - Prospective up to 23%
- USA 3.7 million births
  - 32% cesarean
  - 15% pain => 180,000
- Worldwide cesarean rising
- Consequences
- Society statements
- Treatment options

https://www.asahq.org/standards-and-practice-parameters/statement-on-pain-during-cesarean-delivery, ASA 20223, Zakowski MI. Anesthesiology 2024:140:1236-7

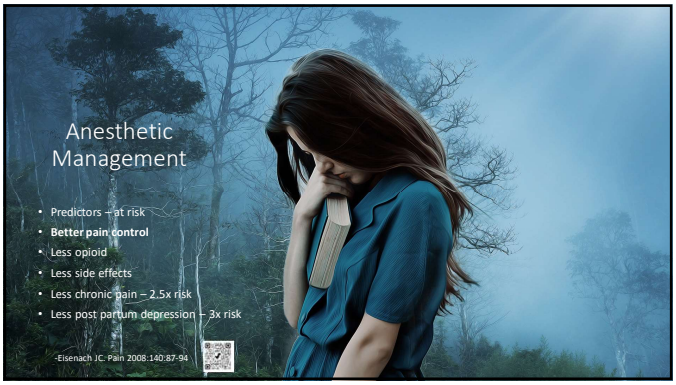
18

Pain during Cesarean: Consequences

- Patient experience
- **Malpractice litigation #1 UK**
- Bonding
- Stress disorder
- **Chronic pain**
- Postpartum depression
- **PTSD**

ASA Statement on Pain During Cesarean Delivery 2023, McCombe K. Anaesthesia 2018:73:223-30

19



20

Historical Priorities

- **Don't cause neonatal depression**
  - Almost all anesthetic/analgesics cross placenta
- Fear of oversedation
  - Aspiration risk
    - 3% OB - ASA Aspiration Closed Claims Warner MA. Anesthesiology 2021:135:284-91
- Many anesthetic medications enter breastmilk
  - Neonatal depression ASA 2019 Resuming breastfeeding after anesthesia
- **Fear of 'overdosing' anesthesia**
  - High neuraxial block
    - 1:4336 D'Angelo R. Anesthesiology 2014120:1505-12

21

New Priorities

- Maternal well-being
- Perioperative outcomes
- Long term outcomes
- Shared decision making
- Disparity reduction
- Hear Her campaign – CDC
- Women's pain – Axios April 22, 2024
  - "That's just not acceptable. We want to drive it down to zero," said Mark Zakowski, chairman of the ASA committee that wrote the new guidelines.

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Neuraxial Inadequacy Cesarean

- Neuraxial
  - 95% elective
  - 80% emergency cesarean
- Failure to achieve pain free cesarean
  - 6% spinal
  - 18% CSE
  - 24% labor to cesarean
  - 4.9% neuraxial to General anesthesia emergencies

ASA Statement Pain During Cesarean, 2023, Kinsella SM. Anaesthesia 2008:63:822

23

Society Guidance

- Obstetric Anaesthetists Association
- College d'Anesthesie-Reanimation en Obstetrique
- American Society of Anesthesiologists
  - Statement on Pain During Cesarean Delivery 2023
  - Statement on the Use of Adjuvant Medications and Management of Intraoperative Pain During Cesarean Delivery – 2024

ASA Statement on Pain During Cesarean 2023, Plaat F. Anaesthesia 2022, Keita H. Anaesth Crit Care Pain Med 2021

24

ASA 1: Preoperative Assessment

- Patient specific
  - High BMI
  - Pain prior cesarean
  - Fear of pain
  - Chronic pain/OUD
- Neuraxial @ L5-S1
- Labor specific
  - Intrapartum breakthrough pain
  - Increased pain within 2 h of CD
  - Chorioamnionitis
- Obstetric factors
  - Urgent/emergent cesarean
  - Duration cesarean
  - Exteriorization of uterus

ASA Domain 1

ASA Statement on Pain during Cesarean 2023

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ASA 2: Minimizing Risk of Inadequate Regional

- **Labor epidural to cesarean**
  - Quality of analgesia
  - Dosing requirements
    - OR 3.2 failed conversion
  - **Early replacement if inadequate**
  - Emergent
    - OR 40 failed conversion
  - OB anesthesiologist
    - 7.2% -> 1.6% failed conversion
- Spinal anesthesia
  - Add lipophilic opioid
  - ED95 – 12 mg hyperbaric Bupiv
- **Check neuraxial level**
  - Method of testing level
  - Document
  - OAA –
    - T5 light touch
    - Cold ice cube, ethyl chloride spray
    - Motor block - Straight leg raise
  - Survey

ASA Domain 2

ASA Statement on Pain during Cesarean 2023, Plaat F. Anaesthesia 2022:77:588-97

26

ASA 3: Supplementation of Inadequate Regional

- 13%-18% adjuvant retrospective
- **No single method**
- Surgical relief
  - Local anesthetic surgical field
  - Uterus exteriorization or not
- **Anxiety separate Rx**
- Chloroprocaine 3% IP rescue#
- Acknowledge pain/discomfort
- Sensory level
- Quality of block
- Adjuvants
  - Opioid
  - Alpha$_2$ adrenergic agonist
  - Local anesthetic
- Shared decision making
- Replace/supplement

ASA Domain 3

ASA Statement on Pain during Cesarean 2023, #Togioka BM. Anesth Analg 2022:135:777-86

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Neuraxial adjuvant	Onset	Comments
Local Anesthetics		
Lidocaine 2%/Epi 5mcg/ml± bicarb	5.2 - 9.7 min	Epidural
Chloroprocaine 3% ± bicarb	2.7- 4.2 min	Epidural
Lipophilic opioids		
Fentanyl 50-100 mcg		Epidural, IT ≤ 25 mcg
Sufentanil 10-20 mcg		Epidural, IT ≤ 10 mcg
Alpha$_2$ adrenergic agonists		↓ BP, HR, ↑ sedation, motor block
Clonidine 75-200 mcg 75 mg IT, 150 mg	5-10 min	
Dexmedetomidine 0.5-1 mcg/kg 5 mg IT, 10 mg	10 min peak effect	Sedation 2-3 h, ↓BP, CO 15-20%
Alpha$_{1+2}$ adrenergic agonist Epinephrine. 100-200 mcg IT		Improved intraop analgesia Increases duration analgesia, motor block
Surgical field		
Chloroprocaine 3% , 20-40 ml	1-2 min	Intraperitoneal, as rescue; duration 20 min

Modified from ASA Statement on the use of adjuvant medications and management of intraoperative pain during cesarean delivery ASA HOD 2024, Belleville JP. Dexmedetomidine, Anesthesiology 1992:77:1125-33, 1134-42, Togioka BM. IP Chloroprocaine cesareanAnesth Analg 2022:135:777-786

Off label uses FDA

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ASA 4 - Conversion to General Anesthesia

- RA failure -> GA 4.9%
- Scheduled cases 0.06%
- Pain/discomfort – acknowledge, manage
- Situational awareness
- Shared decision making
- Pause surgical stimulus when intubating

ASA Domain 4

ASA Statement on Pain during Cesarean 2023

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ASA 5 - Conduct of General Anesthesia

- Optimal positioning
  - Raise head/back 20-30 degrees
  - Ramped – morbidly obese
- High Flow NC O2
- Rapid sequence
- Video laryngoscopy available
- Multi-modal analgesia
  - TAP/QL block

ASA Domain 5

ASA Statement on Pain during Cesarean 2023

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ASA 6 - Follow-up and Referral

- Pain underestimated by others (OB, Anesthesiologist)
- Psychologic distress
- Potential long-term effects
- Follow up post-op if significant pain intra-op
- **Acknowledge, discuss, feedback**
  - Improves patient satisfaction
- Needs assessment
- **Referral to mental health professional**
- **Anesthetic complications – risk factor PTSD**

ASA Domain 6

ASA Statement on Pain during Cesarean 2023
Vogel TM BJA Educ 2020:20:89-95

31

Consequences of Traumatic Experience: PTSD

- **OB related - OR 4.7**
  - PPH
  - Emergencies
  - Severe maternal complication
- Anesthesia Related -OR 4.3
  - Inadequate anesthesia cesarean
  - Difficult neuraxial/paresthesia
  - Neurologic complication
- Neonatal
  - Staff assist/intrapartum emergency
  - Loss of child
- Factors
  - Loss of control
  - Lack of support labor
  - Fear
  - Anxiety
  - h/o abuse/traumatic experience
  - Distrust

Lopez U. Health Qual Life Outcomes 2017:15:118, Vogel TM BJA Educ 2020:20:89-95

32

ASA Psychological Support Oct 2024

The Why
- 1/3 – h/o personal trauma
- 44% prior childbirth traumatic

- Childbirth related-PTSD
  - 6% CR-PTSD
  - 12% CR-stress
  - 1.2% partner CR-PTSD, 1.3% stress

- Complicated births higher
- Disparities risk black
  - 2x PP Depression
  - 3x PP Stress

ASA Key Points
- Risk factors & Prevention
- Trauma-informed care
- Pain management & anxiolysis
- Systems of care
- Patient experience & empowerment

https://www.asahq.org/standards-and-practice-parameters/statement-on-providing-psychological-support-for-obstetric-patients

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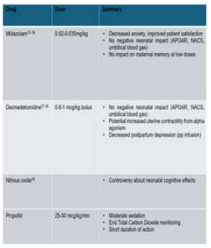
ASA Psychological Support Oct 2024

- Screening & Planning
- Anxiolysis and Manage acute stress
- Pain management Labor & Cesarean
- Postpartum Pain & Follow-up
- Systems of care
- Patient Experience



https://www.asahq.org/standards-and-practice-parameters/statement-on-providing-psychological-support-for-obstetric-patients

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ASA Psychological Support Oct 2024

- Sovereignty
  - Patient autonomy
  - Shared decision making
  - Psychologic safety
- Support
  - Efficacy neuraxial
  - Respect modesty
  - Support person
- Sharing
  - Listen, Explain, Share
  - Transparency complications
  - Feedback – PPD1

Obstetric/Delivery	Communication	Complications	Postpartum
Cesarean Delivery (unplanned or planned)	Perceived Pressure for Induction of Labor	Hemorrhage	Depression
Pain during Cesarean	Perceived Pressure for Epidural	Preeclampsia	Life Stressors
Instrumented Vaginal Delivery	Negative Subjective Feelings	Neonatal Complications (preterm birth, stillbirth, ICU admission)	Diminished Coping
Long Duration of Labor or Prolonged Second Stage	Dissociation	Nerve Injury	
Manual Extraction of Placenta		Post-Dural Puncture Headache	

https://www.asahq.org/standards-and-practice-parameters/statement-on-providing-psychological-support-for-obstetric-patients

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Conclusion

- ASA CObA and SOAP - working closely together
- ASA CObA has been very active
- Multiple statements 2021-24
- Guidance
- Helpful handouts average member and non-member
- Updated OB Anesthesia Guideline development coming

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Send your thoughts - #1 problem to address

https://www.surveymonkey.com/r/cobasurveysoap2025

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Sol Shnider Clinical Track #3

1

Totally Epic Enhancements for Obstetric and Perinatal Anesthesia

Alice Lam O'Brien
UTHealth Houston

2

Speaker Disclosures

Epic Systems
Steering Board
elected members:

Alice O'Brien
Thomas Klumpner

3

United States academic medicine
Market Share
90% of US medical students and residents have trained on Epic

Epic
Cerner
ORACLE Health

SOAP Society for Obstetric Anesthesia and Perinatology

4

Electronic Documentation pain points

- Needing a computer/phone vs multi-access whiteboard
- Record Linker issues
- Tricky with back and forth to OR workflows
- Easier to do post-OB anes rounds on paper
- Documentation: quick boluses, changes in epidural infusion, or non-continuous epidural infusions, ROS, situational awareness
- Not easy to follow-up complications
- Shift handoff may be faster with paper

SOAP Society for Obstetric Anesthesia and Perinatology

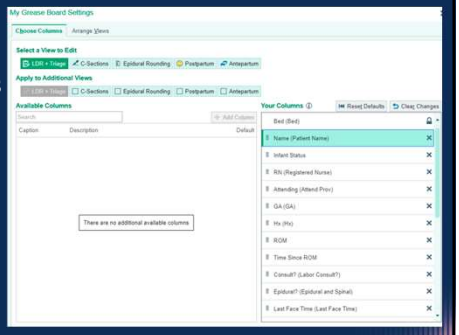
5

Recent updates for OB Anesthesia

SOAP Society for Obstetric Anesthesia and Perinatology

6

Choose columns for GreaseBoard



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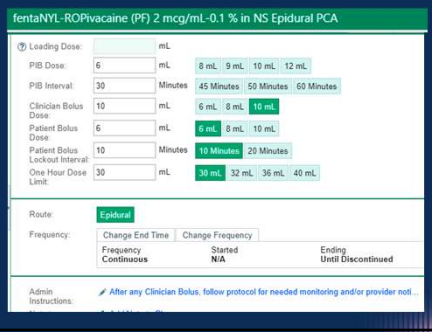
Color coding/ blinking border

8

PIB order

IntraProcedure PCA Meds



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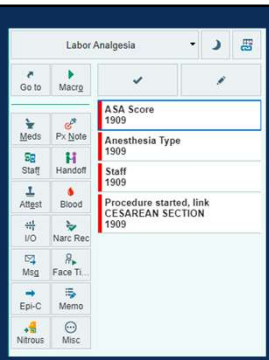
Labor epidural to C-section



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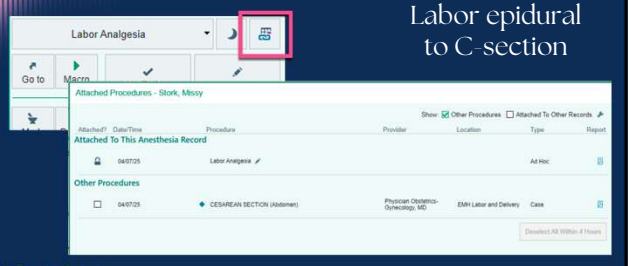

Labor epidural to C-section

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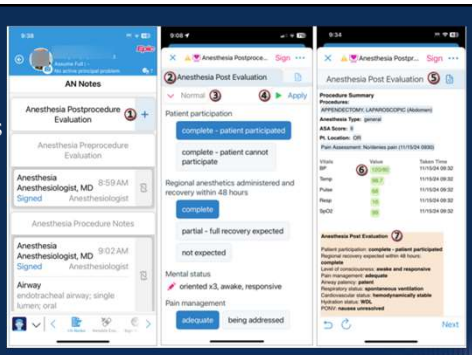
Postop notes in Haiku



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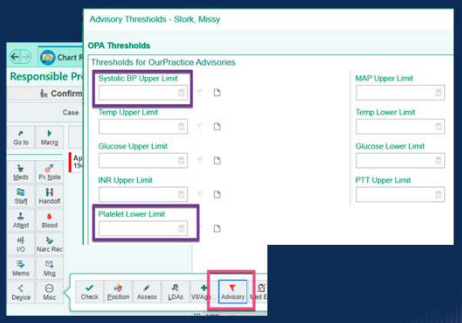
Custom thresholds for advisories



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Guardian

14

Admission Vitals / SVE / pain score

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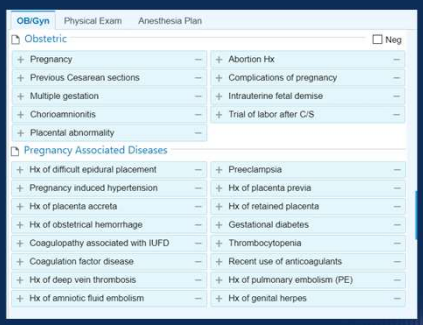
Ob/Gyn ROS in Pre note



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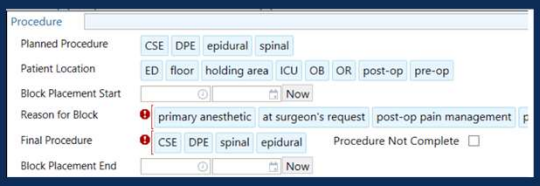
one type of Neuraxial Px Note



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Follow up Rounding
Status Boards (can see discharged pts)

Complications list
Reporting

Consults
high -risk OB. MultiD
Post-delivery pain
BTLs
ECV in OR or scheduled Csection, then L&D
Fetal Surgeries

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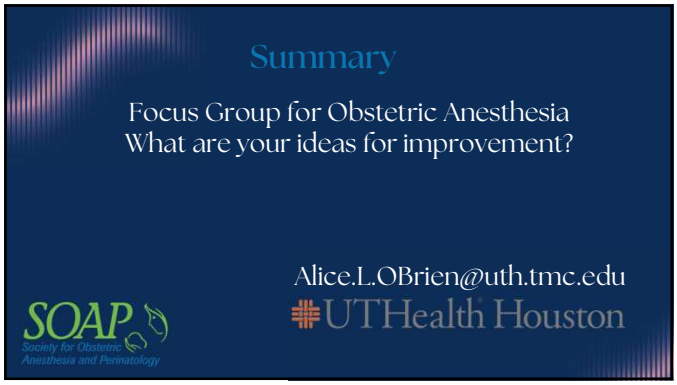
Summary
Focus Group for Obstetric Anesthesia
What are your ideas for improvement?
Alice.L.OBrien@uth.tmc.edu
UTHealth Houston
SOAP
Society for Obstetric Anesthesia and Perinatology

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Reducing Emergency Release Blood Product Ordering on Labor and Delivery: A Quality Improvement Initiative

Chloe Stanwyck, MD
Obstetric Anesthesiology Fellow

Kelly Fedoruk, MD
Assistant Professor

Stanford MEDICINE School of Medicine
Division of Obstetric Anesthesiology and Maternal Health

SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
HILTON PORTLAND DOWNTOWN HOTEL • PORTLAND, OR

SPEAKER DISCLOSURE

I have nothing to disclose.

The Problem

>50% of blood products sent to L&D are MTP / emergency release

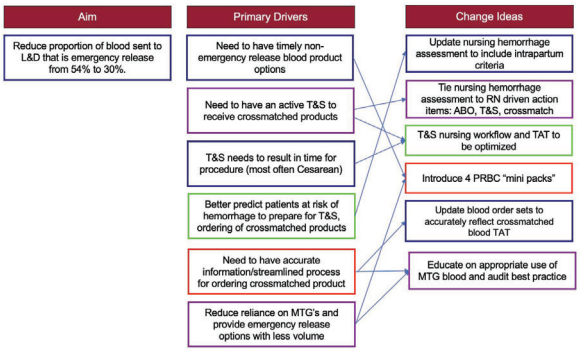
Waste

>95% of patients on L&D receiving blood receive <=4 units pRBC
84% of patients only require 1-2 units pRBC

Goal

Implement a quality improvement (QI) initiative to improve hemorrhage preparedness in order to reduce emergency release MTP blood utilization on our L&D unit to ≤30%.

Key Drivers



Interventions

Completed

- Corrected quoted turnaround times for crossmatched blood products in Epic order sets
- Education: 3 nursing staff meetings, OB anesthesia division meeting and Grand Rounds, 2 M&M presentations, 4 LIT meetings and 4 L&D MTD meetings

In Process

- Updating nursing hemorrhage risk assessment protocols
- Implementing a 4-unit pRBC "mini-pack" as an alternative to MTP

Implications

- Nursing time spent returning unused blood products costs $10,710-$12,600 annually
- Intangible costs of wasting donated blood products / goodwill of donors

Antepartum point-of-care gastric ultrasound in fasted obstetric patients undergoing non-delivery surgical procedures

Department of Anesthesiology, Pain and Perioperative Medicine
Brigham and Women's hospital, Harvard Medical School

Saranya Lertkovit MD, Bushra W. Taha MD, Jean M. Carabuena MD, Noor Raheel MD, Michaela K. Farber MD MS

Introduction: Aspiration Risk During Pregnancy

- Enlarging uterus → compresses the stomach
- Hormone changes → relaxation of lower esophageal sphincter, gastroesophageal reflux

What is the risk of aspiration in obstetric patients undergoing anesthesia for non-delivery procedures?

Goal: evaluate gastric contents in *fasted obstetric patients* undergoing non-delivery procedures.

Materials and Methods

Prospective cohort study

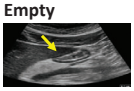
- ≤ 24 weeks' gestation
- Scheduled, non-delivery obstetric procedures

Fasting Definition

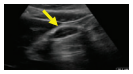
6-8 hours for solid food

2 hours for liquids

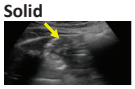
Empty



Fluid



Solid



Calculations:

Gastric Antral Cross-Sectional Area (CSA)
Gastric Volume (GV)

$$CSA\ (cm^2) = \frac{\pi\ x\ D1\ x\ D2}{4}$$

GV (ml/kg) = 27 + 14.6*(RLD-CSA) – 1.28*(age)

LOW RISK (LR)
GV ≤ 1.5 mL/Kg

HIGH RISK (HR)
GV >1.5 mL/kg
Solid food

Reliability? Inter-observer variability

Associated factors? Logistic regression

Results

99 patients enrolled
- 78 dilatation and evacuation or curettage
- 19 cerclage placement

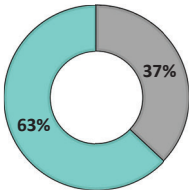
Intra-observer variability 16% ± 15

	Grade 0 n= 18	Grade 1 n = 28	Grade 2 n = 10	Solids n = 41	All n = 97
Age, years	32 (6)	33 (5)	33 (5)	32 (6)	33 (6)
BMI ≥ 40, kg·m²	2 (22)	2 (22)	2 (22)	2 (22)	9 (9)
Gest. age, weeks	11.2 (3)	12.8 (5)	11.5 (5)	**10.9 (5)**	11.6 (4)
1st trimester	10 (17)	14 (24)	7 (12)	**27 (47)**	58 (60)
2nd trimester	8 (21)	14 (36)	3 (7)	14 (36)	39 (40)

	Grade 0 n= 18	Grade 1 n = 28	Grade 2 n = 10	Solids n = 41	All n = 97	P-value
Fasting, solids (hours)	14 (3.7)	14 (2.6)	17 (4.1)	14 (3.1)	14 (3.3)	0.049
Fasting, liquids (hours)	7 (5.4)	8 (5)	7 (3.8)	9 (5.2)	8 (5)	0.493
Gastric antral CSA (cm²)	4.9 (1.4)	8.9 (3.2)	12.2 (4.5)	NA	8.2 (3.9)	***<0.0001***
Predicted GV (mL)	55.7 (19.1)	114.9 (46.0)	163.1 (66.4)	NA	104.5 (57.7)	***<0.0001***
Predicted GV (mL/kg)	0.8 (0.3)	1.5 (0.5)	2.0 (0.8)	NA	1.4 (0.7)	***<0.0001***

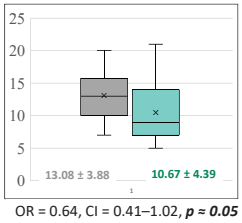
Results: Aspiration Risk

Overall



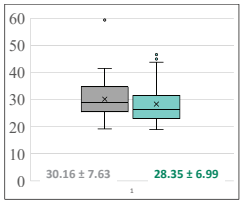
Low Risk (GV ≤ 1.5 mL/kg
High Risk (GV > 1.5 mL/kg or solid contents

Gestational Age (weeks)



OR = 0.64, CI = 0.41–1.02, ***p ≈ 0.05***

Body Mass Index (kg/m²)



OR = 0.32, CI = 0.109–0.95, ***p < 0.05***

Conclusions: Pre-procedural Gastric Ultrasound

1. A majority of patients had 'full stomach' by current GUS guidelines, **despite compliance with preoperative fasting guidelines.**

2. Gastric ultrasound may allow us to **plan our anesthetics with increased safety** for fasted obstetric patients who are at higher risk for aspiration.

Comparative Thromboelastography on Peripheral vs Uterine Blood as an Early Marker of Postpartum Coagulation Changes

Tyler Guidugli DO, Allison A. Mootz MD, Noor Raheel MBChB, Sebastian Seifert MD,
John J. Kowalczyk MD, Michaela K. Farber MD, MS

Introduction

Postpartum hemorrhage (PPH): Leading cause of maternal mortality worldwide[1]
Early prediction of systemic coagulopathy may facilitate prompt treatment

Viscoelastic Testing (TEG & ROTEM): Rapid detection of coagulopathy, targeted therapy[2]
Prior case series of ROTEM during early PPH → coagulopathy in vaginal vs peripheral blood[3]

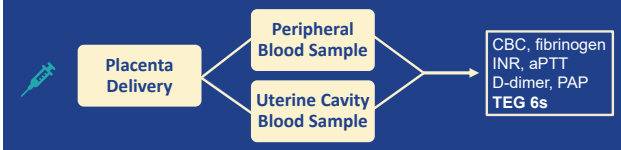
AIM: Compare **peripheral** and **uterine** blood using TEG in routine cesarean delivery (CD)

1. Say et al. 2014. 2. Collins et al, 2022. 3. Ma'ayeh et al, 2021

Methods

Inclusion: Non-urgent intrapartum or scheduled CD at term gestation

Exclusion: Known coagulopathy, anticoagulation therapy, or general anesthesia



A priori power analysis for paired comparison: n=7 to detect a 30% reduction in TEG maximum amplitude between peripheral and uterine samples

Results

n=10

Peripheral TEG samples ➡ n=10, normal coagulation for pregnant patients

Uterine cavity TEG samples ➡ n=5, rapid clotting, unable to perform TEG
➡ n=5, clot in citrated tube, TEG showed profound coagulopathy

No association between PPH & uterine TEG coagulopathy (p=0.524)
Unable to compare traditional labs – all uterine samples rejected due to clot

Discussion

Ma'ayeh *et al.* demonstrated profound **coagulopathy of vaginal blood** compared to **normal peripheral coagulation** in 3 patients with PPH.

Confounders: Amniotic fluid, cervical mucosa, vaginal fluid, vaginal flora, and clot

Some similarity with our TEG results …

Figure 1: Peripheral blood TEG normal coagulation.

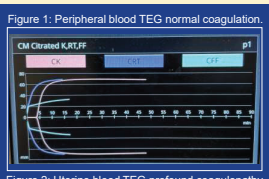
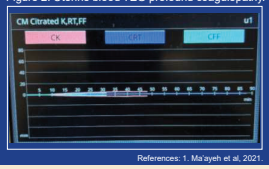


Figure 2: Uterine blood TEG profound coagulopathy.



References: 1. Ma'ayeh et al, 2021.

Discussion

Formation of **clot despite citrate**. Likely unable to inhibit since clotting cascade already initiated.

Limitations:
- Applies only to uterine samples
- TEG 6s uses microfluidic channels to transport sample

Figure 3: Citrated vacutainer of uterine blood sample.

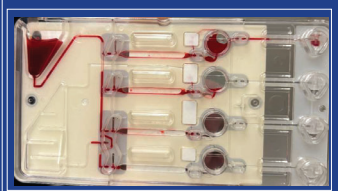


Figure 4: Clotted TEG cartridge from uterine blood sample.

Comparative Thromboelastography on Peripheral vs Uterine Blood as an Early Marker of Postpartum Coagulation Changes

Tyler Guidugli DO, Allison A. Mootz MD, Noor Raheel MBChB, Sebastian Seifert MD,
John J. Kowalczyk MD, Michaela K. Farber MD, MS

Discussion

Uterine vs peripheral blood coagulation at time of delivery, prior to PPH, demonstrates **immediate clotting** of the **uterine** samples.

No correlation between PPH and ability to run TEG on uterine blood samples.

Uterine blood appears to be a **non-viable** method of assessing **early coagulopathy** at the time of hysterotomy closure.

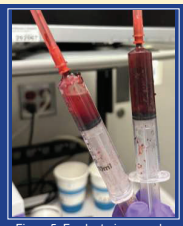


Figure 5: Fresh uterine sample, immediate clot formation.

Improving Postpartum Hemorrhage Risk Prediction: Integration of Time-Based Anesthesia Factors

Introduction

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Beth Israel Deaconess Medical Center
HARVARD MEDICAL SCHOOL

Postpartum Hemorrhage (PPH)

Definition: Blood Loss ≥ 1,000 mL (ACOG)

- Leading cause of maternal morbidity & mortality
- Early risk identification improves outcomes

Improving PPH Risk Prediction: Integration of Time-Based Anesthesia Factors

Preparation and Prediction

Kelly Li, BS, Yunping Li, MD, Philip E Hess, MD, Amnon A Berger, MD, PhD*
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Preparation

1. **Risk assessment**
2. **Blood bank** orders
3. Additional **personnel**
4. **Transfer** of high-risk patients

PPH risk assessment tools

Stratify patients as low- / medium- / high- risk:

- ACOG Safe Motherhood Initiative
- California Maternal Quality Care Collaborative
- Association of Women's Health, Obstetric and Neonatal Nurses

Is **dysfunctional labor**, which may be indicated by **labor analgesia patterns**, associated with **PPH**?

Hypothesis:

Anesthetic factors can indicate increased PPH risk and enhance risk stratification.

Improving PPH Risk Prediction: Integration of Time-Based Anesthesia Factors

Methods

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Population

37,287 delivery encounters from 01/2017 – 05/2024

→ Exclude encounters without labor (7218)

Encounters in which patients labored (30,069)

→ Exclude placental disorders & coagulopathies (1022)

Encounters without placental & bleeding conditions (29,047)

→ Exclude encounters missing outcomes (717)

28,330 delivery encounters

Analysis Pipeline

Database development & enrichment

↓

Univariate analysis & variable screening

↓

Regression analysis

↓

Model evaluation

Variables

Age, Gravidity/Parity, BMI, Gestational age, Gestation, Delivery weight, Cesarean section, Induction, Augmentation, Platelet count, Heart rate, Hematocrit, ...

Labor stages, Diabetes, Breech, Hypertension, Preeclampsia, Eclampsia, HELLP, Infection, Polyhydramnios, Vaginal laceration, Fibroids, History of PPH, ...

\+

Anesthetic factors

Improving PPH Risk Prediction: Integration of Time-Based Anesthesia Factors

Results

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Descriptive statistics *of laboring population*

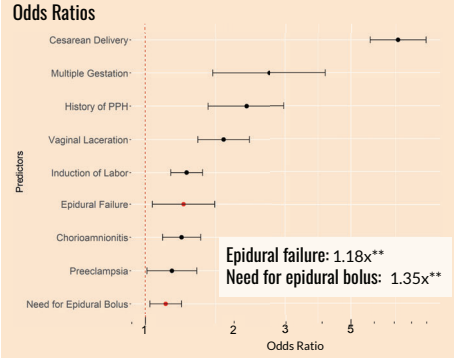
	mean ± SD, or %
PPH rate	8.1% (2,305 / 28,330)
Age range	32.9 ± 4.77
BMI	30.5 ± 6.2
Nulliparous	54.5% (15,448 / 28,330)
Multiple gestation	1.4% (393 / 28,330)
CS rate	17% (4,853 / 28,330)
Neuraxial rate	83% (23,409 / 28,330)

Multivariate model

Outcome: PPH by EBL
Model: Logistic regression
30 variables

Baseline AUC 0.784 → *+ epidural factors* → Augmented AUC 0.786

Odds Ratios



Improving PPH Risk Prediction: Integration of Time-Based Anesthesia Factors

Results: Another Model...

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Vanderbilt model (Ende et al., 2024)

Outcome: PPH by EBL, with transfusion

No exclusion criteria
(included placental conditions as predictors)

21 variables

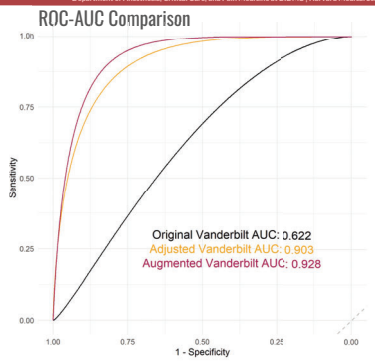
Original VB model: AUC 0.622

↓ *Re-fit variables to our data*

Adjusted VB model: AUC 0.903

↓ *Incorporated anesthetic factors*

Augmented VB model: AUC 0.928



Improving PPH Risk Prediction: Integration of Time-Based Anesthesia Factors

Conclusions and Future Directions

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Department of Anesthesia, Critical Care, and Pain Medicine at BIDMC | Harvard Medical School

Conclusions:

- **PPH risk is a dynamic measure** that changes during labor
- **Epidural failure** and **bolus requirements** are associated with increased PPH risk
- Integration of anesthesia factors can **enhance PPH prediction** in combination with obstetric predictors

Future directions:

- Validate findings externally
- Explore interaction effects
- Investigate mechanism of action

Citations

Ende HB, Domenico HJ, Polic A, Wesolecki A, Zuckerwise LC, Mccoy AB, Weytash AR, Moore RP, Byrne DW. Development and Validation of an Automated, Real-Time Predictive Model for Postpartum Hemorrhage. Obstet Gynecol. 2024 Jul 1;144(1):109-117.
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Hess, P. E., Pratt, S. D., Soni, A. K., Sarna, M. C., & Orasi, N. E. (2000). An association between severe labor pain and cesarean delivery. Anesthesia & Analgesia, 90(4), 881–886.

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A Retrospective Study of Associations between Antepartum Psychiatric Medications and Hypertensive Disorders of Pregnancy in Patients with Mood and Anxiety Disorders

Heather Acuff, MD, PhD[1]; Matthew Fuller, MS[1]; Ashraf S. Habib, MBBCh, MSc, MHSc, FRCA[1]; Jennifer J. Stuart, ScD[2,3]; Johanna Quist-Nelson, MD[4]; Marie-Louise Meng, MD[1]

Disclosures:
ASH has received research funding from Pacira Biosciences, Inc., Haisco USA, Inc., and Heron Therapeutics, Inc.; consulting fees from Heron Therapeutics, Inc., and Merck & Co., Inc. JJS is a salaried employee of Merck Sharp & Dohme LLC, a subsidiary of Merck & Co., Inc., Rahway, NJ, United States.

Background & Hypothesis

1

4-14

Antidepressants: 2-3%[2,3]

Anxiolytics: <1%

Antepartum Antidepressants & Anxiolytics → ? → Hypertensive Disorders of Pregnancy

Antidepressant or anxiolytic prescription is associated with greater risk of hypertensive disorders of pregnancy

1. Uralak R. *Res Social Adm Pharm* 2023; 19(9):1243-1255.
2. Dubovicky M. *Interdiscip Toxicol* 2017; 10(1):30-4.
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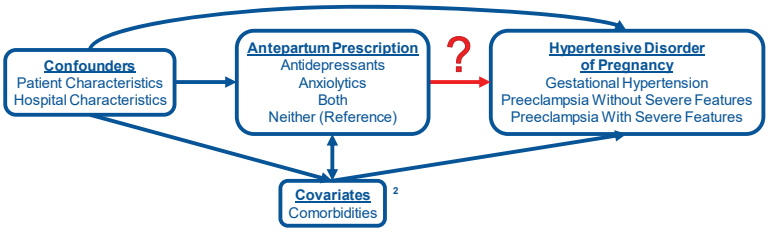
9. Sahlman H. *Br J Clin Pharmacol* 2019; 85(12):2848-55.
10. Palmsten K. *Paediatr Perinat Epidemiol* 2020; 34(5):597-606.
11. Newport D. *J Clin Psychiatry* 2016; 77(11):1538-45.
12. Lupattelli A. *Pharmacoepidemiol Drug Saf* 2017; 26(10):1266-76.
13. Uguz F. *J Clin Psychopharmacol* 2017; 37(1):72-77.
14. Gumusoglu S. *Pregnancy Hypertens* 2022; 30:36-43.

Methods

Study Design:
- Retrospective cohort
- Premier Healthcare Database [1]

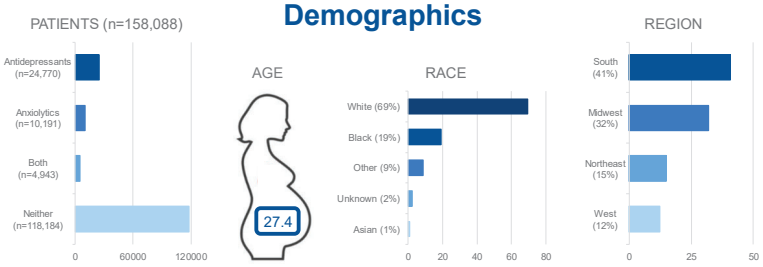
Inclusion Criteria:
- Obstetric patients ≥18y
- Pregnancy & birth encounter (2016-2020)
- ICD-10 code for mood and/or anxiety disorder

Statistical Analyses:
- Multivariable logistic regression model



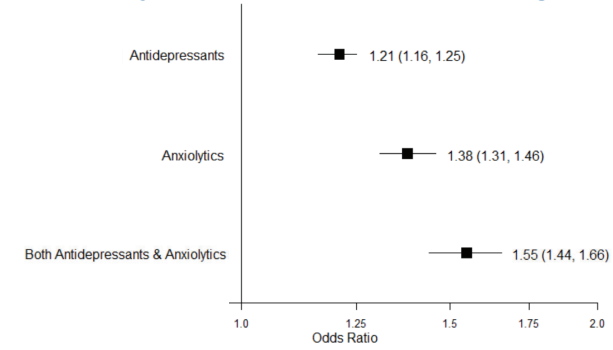
1. Meng ML. *Anesth Analg* 2023; 136(4):728-737.
2. Leonard SA. *Obstet Gynecol* 2020; 136(3):440-449.

Demographics



Substance Use Disorder	Prior Preterm Birth	Prior Cesarean Birth	Preexisting Anemia	Asthma	GI Disease	Advanced Maternal Age
24.2%	22.5%	22.5%	17.5%	15.0%	14.2%	12.3%

Odds of Hypertensive Disorders of Pregnancy



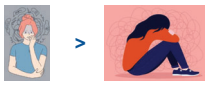
Discussion

Main Findings:

Anxiolytics +/- Antidepressants > Antidepressants Alone

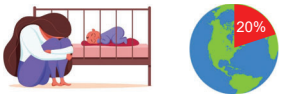
Interpretation:

Medications = Indicators of Disease Severity



Limitations: Reasons for Prescription | Medication Adherence

Significance:



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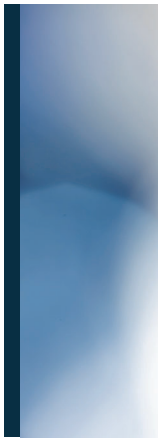
BC WOMEN'S HOSPITAL+ HEALTH CENTRE
Provincial Health Services Authority
DEPARTMENT OF ANESTHESIA

Duration of Urinary Catheterization and Barriers to Early Catheter Removal after Cesarean Deliveries – *A Mixed Methods Study*

Aislynn Sharrock, Eduardo Sutherland, Thomas Yang, Juliana Barrera, Marianne Vidler, Anton Chau



Background

- **SOAP ERAC Consensus Statement** recommends early urinary catheter removal to facilitate ambulation, lower rates of UTI, reduce urethral pain.
- We observed catheters are being left in much longer than the recommended **6 to 12 hours postpartum**.
- **Hypothesis:** the median duration of urinary catheterization after neuraxial anesthesia is significantly greater than 12 hours.

Bollag et al. Anesth Analg 2020

Methods

Inclusion: **149 pregnant patients** undergoing scheduled or unscheduled cesarean deliveries under spinal or epidural anesthesia from May to July 2023.

Time to urinary catheter removal and ambulation were retrospectively collected from the electronic health records.
Time 0 = time of neuraxial anesthesia.

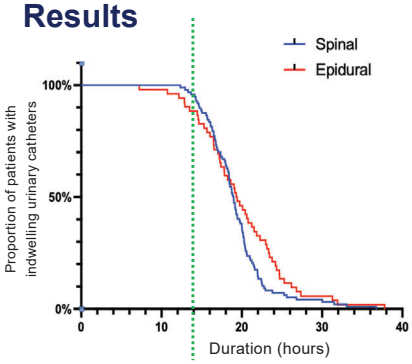
10 postpartum nursing staff were invited to participate in a semi-structured interview to elicit their perception of barriers to early catheter removals.

Outcomes

Primary Outcome: Median time to urinary catheter removal by anesthetic technique (Kaplan Meier & Wilcoxon test)

Secondary Outcomes:
- Nursing perception of barriers to early catheter removal (thematic analysis)
- Median time to ambulation
- Median time to complete motor block recovery

Results



Primary Outcome:
- 19.1 h vs. 12 h, $p < 0.0001$
- Only 2% removed by 12 h

Secondary Outcomes:
- Median time to ambulation: 12.4 h
- Median time to complete motor block recovery: 8.0 h
- Patient anxiety and timing of nursing shift changes were primary factors delaying catheter removal

Discussion

Clinical Implications
- Significant gap between guidelines and current practice
- Qualitative analysis - nursing culture & patient anxiety

Future Implications
- Explore factors that could be influencing timing of catheter removal

UCSF Health

Title: Leveraging a 3D-Printed Spine Model to Study Medication Spread in Spinal Anesthesia

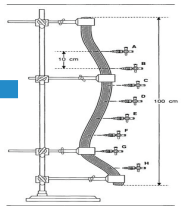
Presenting Author: Jaber Hanhan, MD

Co-Authors: Scott Drapeau Mdes, Alexander Butwick M.D, Pedram Aleshi M.D, Stephanie Lim M.D, Peter Yeh M.D, Jeremy Juang - M.D, PhD

Background: How Does the Medication Spread within the CSF to achieve Effective Block?

Glass tubing

Curved Tygon tubing

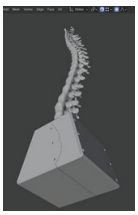


Adams, C. N. (2005). Arthur Barker and the 'glass spine'. *Anaesthesia & Intensive Care Medicine*, *6*(8), I. https://doi.org/10.1383/anes.2005.6.8.I

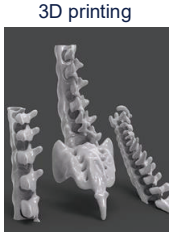
Lui, A. C., Munhall, R. J., Wimie, A. P., & Selander, D. (1991). Baricity and the distribution of lidocaine in a spinal canal model. *Canadian Journal of Anaesthesia*, *38*(4 Pt 1), S22–S26. https://doi.org/10.1007/BF03007592

The Creation of the 3D Spine Model

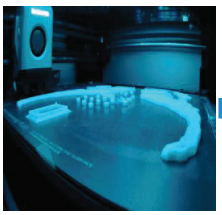
Modeling in Blender



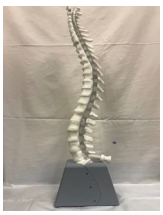
Preparing for 3D printing



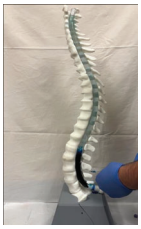
Manufacturing

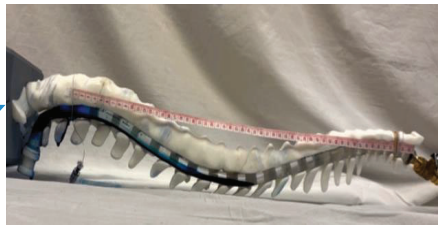


Final



The Experiment…





The results…

Figure 1: Spread of medication (cm) over time with corresponding vertebral levels.

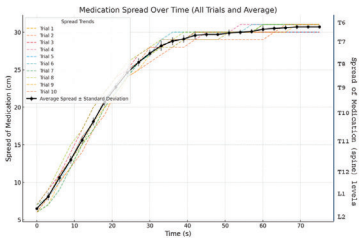
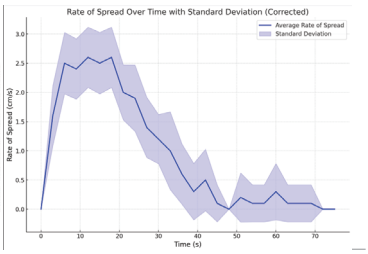


Figure 2: The rate of medication spread over time.



Conclusions and further studies…

-In all 10 trials, the methylene blue solution spread proximally to a mean distance of 30.7 cm ± 0.316 cm, corresponding to the T6–T7 interspace.
-The average time it took to reach T6-T7 interspace was 42 seconds post injection
-The most rapid spread occurred within the first 30 seconds post-injection (Figure 1), with a peak rate of spread of approximately 2.5 cm/s between 6 and 18 seconds which can be attributed to the lumbar lordosis

- Future investigations could explore how different volumes, positions, and vertebral anatomy influence anesthetic spread after intrathecal injection.

How Do Abortion Laws Affect Where Residents and Fellows Accept Their First Post-Training Jobs?

Rachel Douglas, D.O.

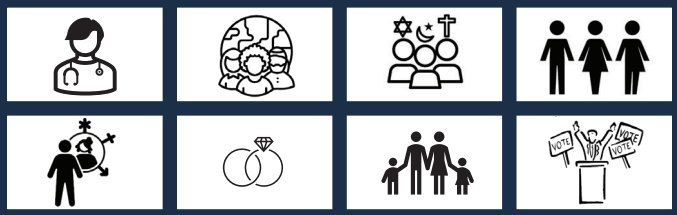
Benjamin Brakke, DO
Layne Bettini, M.D., J.D.
Andrew Hanson, M.S.
Amy Vinson, M.D.
Alyssa Burgart, M.D.

MAYO CLINIC

Aims

- Influence of state abortion laws on job choice
- Migration trend
- Well-being

Demographics



Reflecting on the job you accepted, or may accept, how likely is it that the following factors did (or will) influence your decision? n = 301

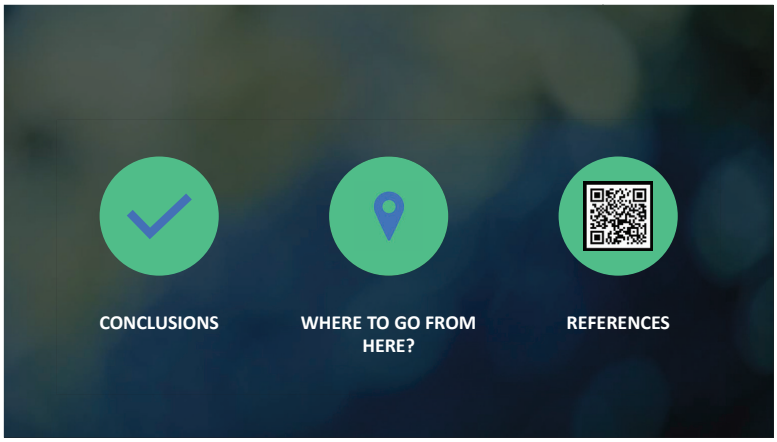
State's abortion laws	65.6%
Abortion access for you or family members	59.5%
Abortion access for patients	67.5%
Potential legal repercussions	74.0%
Contraceptive access	77.0%
In Vitro Fertilization (IVF) access	69.0%
Reproductive health services for yourself/others	76.6%

Trends in migrations among physicians who accepted a job n = 31

	Abortion law in state where they are training			
Abortion law in state of accepted job	Protections n = 16	Restrictions n = 3	Near/Total ban n = 12	Total
Protections	12/16	1/3	3/12	16
Restrictions	0/16	1/3	0/12	1
Near/Total ban	2/16	1/3	5/12	8
Missing	2/16	0/3	4/12	6

Has your physical health, mental health, or overall sense of well-being been impacted by the Dobbs decision? n = 262 (%)

	Yes	No	P value
	148 (56.5)	114 (43.5)	
Specialty			
Anesthesiology	54 (47.8)	59 (52.2)	< 0.001
Emergency medicine	27 (42.9)	36 (57.1)	
Ob-gyn	67 (77.9)	19 (22.1)	
State abortion law type			
Protections	96 (60.8)	62 (39.2)	0.147
Restrictions	14 (58.3)	10 (41.7)	
Near/total ban	38 (47.5)	42 (52.5)	
not given	0 (0.0)	0 (0.0)	
Gender			
cis-gender female	107 (77.8)	32 (23.0)	< 0.001
cis-gender male	39 (36.4)	68 (63.6)	
non-cis gender	2 (28.6)	5 (71.4)	



The Effect of Sugammadex Administration on Fetal Outcomes in Pregnant Patients Who Underwent Non-Obstetric Surgery Under General Anesthesia

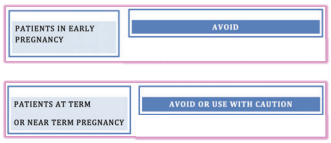
Jacob Niab MD MA,[1] Hande Bilen MD,[2] Ines Debbiche,[1] Preet Mohinder Singh MD,[3] Adithya Bhat MD[1]
[1]Department of Anesthesiology, Northwestern University Feinberg School of Medicine
[2]Department of Anesthesiology, Emory University School of Medicine
[3]Department of Anesthesiology, Washington University School of Medicine in St. Louis

Background

The use of sugammadex for neuromuscular blockade reversal in the nonpregnant population results in a **30% reduction in major postoperative pulmonary complications**.[1]

Despite its safety in the nonpregnant population, there remain **concerns about the safety** of sugammadex for pregnant individuals, especially during **early pregnancy.**

SOAP Statement on Sugammadex.[2]



Introduction

Simulation-based pharmacokinetic/pharmacodynamic model: **4 mg/kg of sugammadex** can decrease **progestogen** levels by **34%**.[3]
- **Progestogen** is a synthetic progesterone with a distinct chemical structure from progesterone.[4]
- **Progesterone** is an endogenous hormone responsible for maturation of the uterus and prevention of premature contractions.

FDA does not approve sugammadex use in the obstetric population.[4]

Noguchi et al. 2022[5]
- 123 patients; 73 received GA with sugammadex, 53 received GA without sugammadex.
- **No difference** in rate of miscarriage or preterm birth.

There are no case reports describing preterm labor within 2 weeks of sugammadex administration.[4]

Morbidity and mortality associated with incomplete neuromuscular blockade reversal after surgery.
- Retrospective review of anesthesia-related maternal deaths in Michigan (1985-2003): **all eight deaths** occurred during **emergence, extubation, or recovery**.[6]

Patient Safety: sugammadex for **rescue** of incomplete reversal of neuromuscular blockade with neostigmine.

Study Design and Methods

Hypothesis
Reversal with sugammadex during **non-obstetric surgery** is not associated with an increased rate of **adverse fetal outcomes** compared to **reversal without sugammadex**.

Design
Retrospective chart review of all pregnant patients undergoing non-obstetric surgery from 1/2019 – 10/2024.
Approved by **institutional IRB**.
Enterprise Data Warehouse identified patients and data.

Outcomes
Primary: need for **emergent cesarean delivery** within 30 days of surgery.
Secondary: intrauterine fetal demise within 30 days of surgery, preterm premature rupture of membranes, and preterm labor.

Exclusion Criteria
- Surgery performed at time of delivery.
- Surgery performed without general anesthesia.
- Surgery for fetal myelomeningocele repair.
- Surgery for planned procedural abortion.

Results

Total Anesthetics Analyzed: 344
- Sugammadex: 87
- No Sugammadex: 257

Total Number of Patients: 340

7 (2%)
Anesthetics that required sugammadex after reversal with neostigmine.

0 cases of intrauterine fetal demise.

		n	X^2	*p*
Cesarean delivery within 30 days	No sugammadex	1	0.39	**0.53**
	Sugammadex	0		
PPROM	No sugammadex	5	0.40	**0.53**
	Sugammadex	1		
Preterm Delivery	No sugammadex	28	0.38	**0.54**
	Sugammadex	13		

Discussion and Conclusions

Take-home Points
- **Largest retrospective study** showing safety of sugammadex with respect to fetal outcomes.
- Only one emergent cesarean delivery was required in this cohort and occurred after **neostigmine and glycopyrrolate**.
- Sugammadex was required for **rescue of incomplete reversal** of neuromuscular blockade.

Limitations
- **Retrospective** observational study design.
- **Confounding factors**:
  - Type of surgery
  - Number of anesthetics
  - Dosing of reversal agents
- **Sample size:**
  - These outcomes are rare events and may require larger sample size to observe an effect.

Future Directions
- Larger **multicenter** study.
- Measure **progesterone levels** after sugammadex administration.
- **Randomized controlled trial**.
- Reconsider recommendations on sugammadex use during pregnancy.

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Machine Learning Analysis of Arterial Stiffness Trends throughout Pregnancy for Early Prediction of the Development of Preterm, Term and Postpartum Preeclampsia

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What is Preeclampsia ?

- A serious disorder of pregnancy[1]: **Hypertension** + **End-organ damage** (Kidney, Liver)
  - Devastating consequences for both the pregnant patient and baby
- Affects **5-8% of pregnancies globally**[1] and **70 000 maternal deaths** yearly
- Current management in most cases = Delivery

Classification based on **time of onset**[2,3]

Preterm *Onset prior 34 wks gestation*

Term *Onset after 34 wks gestation*

Post-Partum *Onset after delivery*

* Term pregnancy = 40 wks

A knowledge gap...

Uterine Artery Doppler (UAD)	**Moderate predictive ability** for term and postpartum PrE [4,5]
Angiogenic Factors (Ex. Placental GF and protein 13)	

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Can we use **arterial stiffness measurements** to better **predict the development of** ***preeclampsia*** – and furthermore, the ***type*** that will develop **(preterm, term, postpartum)** to create an opportunity for personalized prevention plans for each pregnancy?

Filling the knowledge gap...

REVEAL n = 236 MUHC & JGH → **PULSE** n = 2400, 9+ Hospital Institutions incl. MUHC, JGH, CHU Ste-Justine → **Ad hoc analysis**

Pilot Study
Found that arterial stiffness had promising predictive ability of preeclampsia

Validation Study
Ongoing!

Ad hoc analysis
Using data from REVEAL and prospective data from PULSE
5 ML algorithms: *Support Vector Machine (SVM), Random Forest, Logistic Regression, Gradient Boosting, K-nearest Neighbours*

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Filling the knowledge gap...

* Simplified overview of the study protocol

Recruitment of high-risk pregnancies
1 major risk factor OR 2 moderate risk factors

Follow-up Trimester 1
10-14 weeks gestation
Arterial stiffness measurement, questionnaires, blood draw, urine collection

Follow-up Trimester 2
18-22 weeks gestation
Arterial stiffness measurement, questionnaires, blood draw, urine collection

Follow-up Post-Partum
(Substudy, optional)
6-12 weeks post-partum
Arterial stiffness measurement, questionnaires, blood draw, urine collection

Monitoring for the development of PrE...

High Risk Factors	Moderate Risk Factors
• Autoimmune disease • Diabetes Mellitus type 1 or 2 • Chronic hypertension • Hypertensive disorder in a previous pregnancy • Chronic kidney disease • Placental-mediated complications of pregnancy in a previous pregnancy	• Nulliparous • Assisted reproduction (including IVF) • Family history of preeclampsia • African-American race • Sleep apnea • Connective tissue diseases • BMI >30 kg/m2 • Age ≥35 y

Table 1. Screening eligibility factors

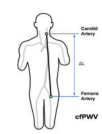

Fig 1. Illustration of the calculation of Pulse Wave Velocity from Sphygmocor Technology

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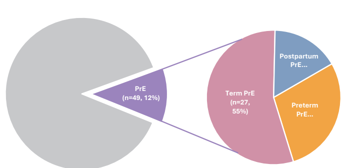
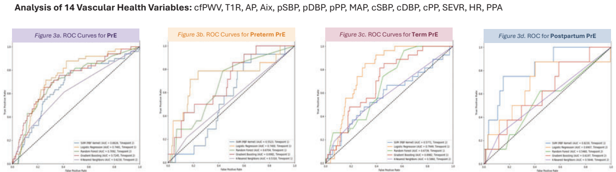


Figure 2. Cohort Statistics

	Best Performing Model (AUC)	
	Trimester 1	**Trimester 2**
PrE	0.75	0.74
Preterm PrE	0.74	0.63
Term PrE	0.79	0.71
Postpartum PrE	0.82	0.69

Table 2. Summary of Best Performing Models' AUC

Analysis of 14 Vascular Health Variables: cfPWV, T1R, AP, Aix, pSBP, pDBP, pPP, MAP, cSBP, cDBP, cPP, SEVR, HR, PPA



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Conclusions

Arterial Stiffness was shown to have **high predictive ability for preeclampsia and its subtypes** as soon as the first trimester in pregnancy with highest values for term and postpartum preeclampsia.

Future Research

- Continue **expanding the cohort**
- Consider the ***additive*** predictive ability of AS measurements in **1st & 2nd trimester**
- Consider the ***additive*** predictive ability of AS with other **clinical, imaging and biological markers**

This study was funded by the **Canadian Institutes for Health Research** (Project# 168918), **Fonds de Recherche du Québec - Santé** (Project# 25045), and the **Heart and Stroke Foundation of Canada** (Project# 000437)

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Measuring Changes In Cardiac Output During Cesarean Section Using Left Ventricular Outflow Tract Velocity Time Integral (LVOT VTI)

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Introduction

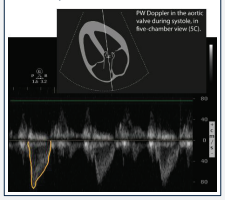
- CVD is a leading cause of maternal mortality
- HR and BP are often unreliable or late markers of cardiac output, especially during C-section
- Echocardiography is an important tool in the diagnosis and management of CVD in pregnancy

What is LVOT VTI?

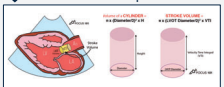
- The LVOT is the portion of the left ventricle that passes blood into the aorta
- LVOT VTI represents the distance that blood travels through the LVOT in one heartbeat

To measure LVOT VTI:

- Obtain A5C view by placing cardiac probe beneath patient's left breast



How is Cardiac Output Calculated?



- The LVOT is roughly a cylinder
  - Height = VTI
  - Area = LVOT area
- Cardiac output can be calculated as the product of:
  - LVOT area (constant for each patient)
  - LVOT VTI (acquired with POCUS)
  - HR

$$SV = A_{LVOT} \times VTI_{LVOT}$$

$$CO = A_{LVOT} \times VTI_{LVOT} \times HR$$

$$MD = VTI_{LVOT} \times HR$$

- **Minute distance (MD)** is the product of LVOT VTI and HR, and is directly correlated to CO

METHODS

Inclusion Criteria:

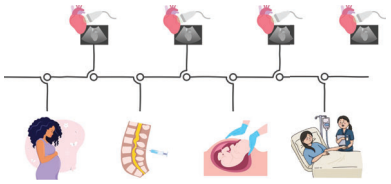
1. Singleton pregnancy.
2. Gestational age 36-42 weeks.
3. Elective caesarean section (CS) done under spinal anesthesia

Exclusion Criteria:

1. Maternal cardiac disease
2. Multiple gestation.
3. BMI > 40
4. Polyhydramnios
5. Obstetrical emergencies
6. CS done under general anesthesia or epidural anesthesia.

SCANNING PROTOCOL

1. 55 full term parturients recruited (in progress)
2. One POCUS-certified anesthesiologist performed serial LVOT VTI measurements at the following timepoints:
   - **T1)** Pre-op holding
   - **T2)** 3-5 minutes after spinal anesthetic is administered, adequate blockade confirmed, and initiation of phenylephrine at 40 mcg/min
   - **T3)** 3-5 minutes post-delivery
   - **T4)** PACU 30-60 minutes post-op



RESULTS

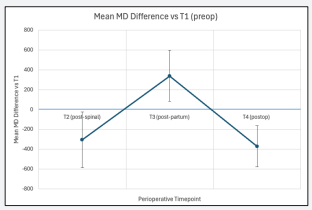
Table 1: Mean MD and LVOT VTI at T1-4

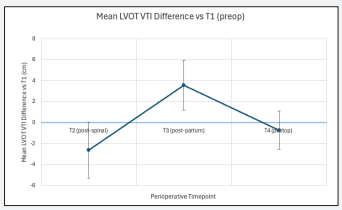
Timepoint	Mean MD (cm/min)	Standard Deviation (MD)	Mean LVOT VTI (cm)	Standard Deviation (LVOT VTI)
T1	2011.39	423.42	24.93	5.54
T2	1705.21	428.00	22.29	4.11
T3	2348.89	621.48	28.49	5.24
T4	1639.81	345.87	24.19	4.75

Table 2: Mean MD and LVOT VTI Difference Between T-4 vs. T1

Timepoint	Mean MD Difference vs T1 (cm/min)	P-value	Lower 95% CI	Upper 95% CI	Mean LVOT VTI Difference vs T1 (cm)	P-value	Lower 95% CI	Upper 95% CI
T2	-306.18	0.0334	-587.62	-24.75	-2.64	0.0547	-5.33	0.055
T3	337.50	0.0109	80.52	594.48	3.56	0.0038	1.19	5.93
T4	-371.59	0.0007	-577.74	-165.44	-0.74	0.418	-2.55	1.078

RESULTS



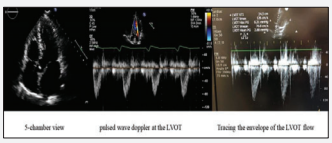


DISCUSSION

- Compared to T1 (pre-op), there was a statistically significant increase in MD (and thus CO) at T3 (post-partum), and a statistically significant decrease at T2 (post-spinal) and T4 (PACU)
- MD increase at T3 is consistent with augmented preload due to maternal autotransfusion and relief of inferior vena cava obstruction immediately after delivery
- MD decrease at T4 fits with the known decline in CO about one-hour post-delivery
- MD decrease at T2 corresponds with the expected sympathectomy and preload drop immediately after spinal anesthesia

CONCLUSIONS

- LVOT VTI via POCUS is feasible to measure at multiple intra-op timepoints during CS, and results reflected expected peripartum CO changes
- Further participant analysis is required to investigate how factors such as blood loss, spinal dose, and glycopyrrolate use affect LVOT VTI and MD
- Findings support future research that will be required to apply this technique in high-risk CS patients



THANK YOU!

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