



Obstetric and anesthetic management in parturients with peri-partum neurovascular abnormalities: a case series.

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Background

- No definite guidelines exist for obstetric and anesthetic management of peri-partum neurovascular disorders.
- This case series offers a comparative approach to gravid patients with arteriovenous and cavernous malformations, aneurysms and other less frequently encountered central nervous system (CNS) vascular abnormalities.

Results

- A total of twenty-three patients were included, of which twenty presented for evaluation before or during pregnancy. Individuals presented often with symptoms – seizure, severe headache, neurological deficit – whereas two were asymptomatic undergoing routine examination.
- Thirty-five percent (n=8) were diagnosed with cavernous malformation, thirty percent (n=7) with cerebral arteriovenous malformation (AVM), and the remainder with aneurysm (n=3), dural AV fistula (n=2), venous angioma (n=1), carotid dissection (n=1), or moyamoya (n=1). Fourteen patients had a vaginal delivery and nine had cesarean delivery (CD).

- The presence of neurovascular abnormality was an indication for induction of labor in three individuals and for CD in twenty-two percent (n=5) of all deliveries. Parturients who labored received epidural (n=12), combined spinal-epidural (n=1) and no neuraxial (n=1) for labor analgesia.

- Parturients who had CD had a spinal (n=7), preexisting labor epidural (n=1), and general anesthesia (n=1) for neurologic indications. There were no complications from neuraxial anesthesia.

Methods

- Information was gathered from a secure institutional database to include all pregnant patients evaluated by neurology and/or neurosurgery at a single institution between January 2000 and October 2019 for any central nervous system vascular abnormality.
- Patients were included if evaluation by neurology or neurosurgery occurred either before, during pregnancy or up to 6 months post-partum. Individual profiles were analyzed to collect unique neurovascular, obstetric and anesthetic considerations for each case.

Table 1: Patient Characteristics

Patient	Gravity/Parity	Age at evaluation, delivery (years)	Race/Ethnicity	BMI (kg/m²)	ASA class	Gestation (weeks)
All	-	24 ± 8, 28 ± 6	-	28 ± 4	2 ± 0.4	38 ± 1.5
1	G4P3	30, 32	White	29	2	39
2	G2P0	15, 25	White	31	3	39
3	G1P0	25, 26	White	28	2	38
4	G1P0	16, 18	White	23	3	36
5	G1P0	33, 33	White	25	3	37
6	G1P0	20, 19	White	27	2	39
7	G1P0	24, 33	White	22	3	39
8	G3P2	29, 30	Not disclosed	37	3	39
9	G1P0	25, 30	White	33	2	39
10	G1P0	29, 30	White	32	2	39
11	G1P0	10, 27	White	28	3	35
12	G2P1	26, 29	White	27	2	39
13	G2P1	37, 37	White	21	2	38
14	G4P3	30, 29	White	20	2	37
15	G2P3	38, 39	White	27	2	39
16	G4P3	31, 32	White	26	2E	39
17*	G1P0	14, 19	White	27	2	41
17	G2P1	14, 20	White	27	2	40
18	G3P2	32, 34	White	27	2	39
19	G3P1	19, 33	White	30	2	38
20	G4P3	20, 23	White	42	2	39
21	G4P3	21, 29	Hispanic or Latino	34	3	35
22	G1P0	10,25	White	26	2	41
23	G1P0	35, 40	Not disclosed	26	2	37

Data are number or mean ± SD
*Patient with more than one pregnancy during the study period; ASA: American Society of Anesthesiologists Physical Status Classification

Table 2: Neurovascular Characteristics

Patient	Symptoms					Evaluation	
	Headache n=12 (52%)	Hearing change n=4 (17%)	Paresthesia n=3 (13%)	Seizure n=2 (9%)	Vision change n=5 (22%)	None n=2 (9%)	Specialty (N, NS or Both)
1	-	+	-	-	-	-	Pre Both
2	-	-	+	-	-	-	Pre Both
3	+	-	-	-	-	-	Both
4	-	-	-	-	-	+	Pre Both
5	-	-	-	-	-	+	Intra N
6	-	-	+	-	-	-	Post Both
7	-	-	-	+	-	-	Pre Both
8	-	-	-	+	-	-	Pre Both
9	+	+	-	-	-	-	Pre Both
10	+	-	-	-	+	-	Pre N
11	-	+	-	-	+	-	Pre Both
12	-	-	-	-	+	-	Pre Both
13	+	-	-	-	-	-	Post Both
14	-	+	-	-	-	-	Post Both
15	+	-	-	-	+	-	Pre Both
16	-	-	+	-	+	-	Intra NS
17	+	-	-	-	-	-	Pre NS
18	+	-	-	-	-	-	Pre Both
19	+	-	-	-	-	-	Pre Both
20	+	-	-	-	-	-	Pre Both
21	+	-	-	-	-	-	Pre Both
22	+	-	-	-	-	-	Pre Both
23	+	-	-	-	-	-	Pre Both

Data are number or (%)
N: Neurology; NS: Neurosurgery

Table 3: Neurovascular Diagnosis and Intervention

Patient	Imaging	Diagnosis							Intervention	
		Cavernous malformation (n=8)	AVM (n=7)	Aneurysm (n=3)	AV fistula (n=2)	Venous angioma (n=1)	Carotid dissection (n=1)	Moyamoya (n=1)	Timing (Pre-, Intra- or Post-partum)	Type (Medical, Surgical, Observation)
1	Angiogram				✓				Pre	Crossed carotid compression
2	MRA							✓	Post	Surveillance MRI, aspirin, STA-MCA bypass
3	MRI	✓							Intra	Decompressive hemicraniectomy with resection
4	MRI		✓						Post	Gamma knife radiosurgery, two stages
5	MRI/MRA	✓							-	Surveillance MRI
6	MRI			✓					-	Surveillance MRI
7	MRI	✓							Pre	Increased dose AED
8	MRI	✓							Pre	Craniotomy with resection, surveillance imaging, AED
9	MRI/MRA/MRV				✓				Pre	Gamma knife radiosurgery, one stage
10	MRI/MRA	✓					✓		Pre	Warfarin for 3 months then daily aspirin
11	MRI	✓							Pre	Craniotomy with resection
12	MRI	✓							Pre	Craniotomy with resection
13	CT no contrast		✓						Post	Emergent craniotomy with resection
14	MRI, CT angiogram			✓					Post	Surgical coil embolization, surveillance MRI
15	CT angiogram			✓					Pre	Surgical coil embolization
16	MRI/MRA	✓							Pre	Surveillance MRI
17*	MRI/MRA		✓						Pre	Gamma knife radiosurgery, one stage
17	-		-						Pre	Gamma knife radiosurgery, one stage
18	MRI/MRA					✓			Pre	Surveillance MRI
19	MRI/MRA		✓						Pre	Gamma knife radiosurgery, one stage
20	MRI/MRA		✓						Pre	Gamma knife radiosurgery, one stage
21	CT no contrast	✓							Pre	Craniotomy with resection
22	MRI/MRA		✓						Pre	Craniotomy with resection
23	CT angiogram		✓						Pre	Craniotomy with resection

*Patient with more than one pregnancy during the study period
AED: anti-epileptic drug; AVM: arteriovenous malformation; MCA: middle cerebral artery; STA: superficial temporal artery

Table 4: Obstetric and Anesthetic Management

Patient	Induction of labor			Mode of delivery			Anesthesia/Analgesia
	Yes n=9 (37.5%) No n=15 (62.5%)	Indication	Type	Spontaneous vaginal n=12 (50%)	Assisted vaginal n=3 (12.5%)	Cesarean, indication n=9 (37.5%)	
1	Y	History stroke	AROM, O		✓		Epidural
2	N	-	-			✓ Neurofibromatosis	Spinal
3	N	-	-			✓ IPH	General
4	N	-	-			✓ AVM	Spinal
5	N	-	-			✓ Cavernous malformation	Epidural
6	Y	ICA aneurysm	AROM, FB, MP, O		✓		Epidural
7	N	-	-			✓ Cavernous malformation	Spinal
8	N	-	-	✓			None
9	N	-	-	✓			Epidural
10	N	-	-	✓			Epidural
11	Y	Pre-eclampsia	AROM, MP, O	✓			Epidural
12	Y	Non-reassuring FHT	AROM, O	✓			CSE
13	N	-	-	✓			Epidural
14	N	-	-			✓ Repeat Cesarean	Spinal
15	N	-	-			✓ Repeat Cesarean	Spinal
16	N	-	-			✓ Cavernous malformation	Spinal
17*	Y	Post-dates	MP, O	✓			Epidural
17	N	-	-	✓			Epidural
18	Y	Fetal abnormality	AROM, O	✓			Epidural
19	N	-	-			✓ Repeat Cesarean	Spinal
20	Y	AVM	AROM, O				Epidural
21	N	-	-	✓			Epidural
22	Y	Post-dates	AROM, FB, MP, O	✓			Epidural
23	Y	Oligohydramnios	MP		✓		Epidural

Data are number or (%)
*Patient with more than one pregnancy during the study period
AROM: artificial rupture of membranes; AVM: arteriovenous malformation; CSE: combined spinal epidural; FB: foley bulb; FHT: fetal heart tracing; ICA: internal carotid artery; IPH: intraparenchymal hemorrhage; MP: misoprostol; O: oxytocin

Table 5: Anesthetic Management with Maternal and Fetal Outcomes

	Mode of delivery			
	Spontaneous vaginal n=12 (50%)	Assisted vaginal n=3 (12.5%)		Cesarean delivery n=9 (37.5%)
		Forceps	Vacuum	
Anesthesia				
CSE	1 (4%)	0	0	0
Epidural	10 (42%)	1 (4%)	2* (8%)	1 (4%)
General	0	0	0	1 (4%)
Spinal	0	0	0	7 (29%)
None	1 (4%)	0	0	0
Invasive monitoring peri-partum				
Arterial line	0	0	0	3
Use of vasoactive medications				
Ephedrine (mg)	15 ± 5	0	0	35 ± 28
Phenylephrine (µg)	500	0	300	498 ± 615
Esmolol (mg)	0	0	0	40
ICU admission	1	0	0	2
Estimated blood loss (mL)	440 ± 156	400	450 ± 71	836 ± 280
Peri-partum complications*				
Episiotomy	0	1	1	0
Intracranial hemorrhage	0	0	0	1
Pulmonary embolism	1	0	0	0
Chorioamnionitis	1	0	0	0
Fetal measures				
Birthweight (g)	3204 ± 559	3620	3425 ± 757	3030 ± 441
Apgar score (1' – 5')	8 ± 1 – 9 ± 0.6	9, 9	9 ± 0.7 – 9	9 ± 0.4 – 9 ± 0.4

Data are number (%) or mean ± SD
CSE: combined spinal-epidural
*Complications within 30 days postpartum
*Includes failed epidural

Conclusions

- Diagnosis of CNS vascular abnormality in the peri-partum period is infrequent and poses unique challenges to obstetric and anesthetic management.
- Induction of labor or cesarean delivery may be indicated to prevent further complications; however, the decision to proceed with either is proposed on an individual basis.
- Neuraxial anesthesia and analgesia can be offered to women with CNS vascular abnormalities without abnormal neurologic symptoms.
- This case series demonstrates the largely untapped potential for future studies to establish practice guidelines for managing gravid patients with similar neurovascular abnormalities.