

Factors Associated with Unintended Dural Puncture (UDP) and Failed Regional Anesthesia in Obstetric Anesthesia: Targeting Anesthesia Residency Quality Improvement



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Background

- Failure rates for spinal anesthesia (1.7–9.1%) and epidural anesthesia (10–24%) increase risks for conversion to general anesthesia, procedural delays, and patient dissatisfaction [1]
- Unintended dural puncture (UDP) occurs in approximately 1% of obstetric epidural placements and can result in post-dural puncture headache (PDPH) with significant morbidity [2]
- Clinician experience, multiple attempts, anatomical variation, and technical difficulty are modifiable factors reported in the literature

Aim

- Identify specific factors associated with UDP and failed regional at our institution for quality improvement

Study Design and Methods

- One-year (July 2024-July 2025) retrospective de-identified 3:1 matched case controlled (n=126) EMR analysis of UDP (n=41) and failed regional (n=38) quality improvement registered (QIPR) study
- Factors analyzed included demographic data (age, height, weight, BMI, gravidity, parity, gestation) ASA status, trial of labor, anesthesia type (spinal, epidural, CSE, DPE, general), intrathecal catheter placement, conversion to general anesthesia, preeclampsia diagnosis, block attempts, provider status (resident, CRNA, attending), failed regional anesthetic, and PDPH
- Data analyzed using *t*-test (continuous), Chi-square (categorical) including Odds Ratios, Mann-Whitney (non-parametric), $P < 0.05$ is significant

- | Complication | UDP (n=41) | Control (n=126) | P value | OR | 95% CI | |
|--|------------|-----------------|----------|-------|--------|-------|
| Age (yrs) | 28.4 ± 6.9 | 24.3 ± 5.8 | 0.0002 | | | |
| Anesthesia Type (n) | | | 0.02 | | | |
| CSE | 13 (31.7%) | 17 (13.5%) | 0.0083 | 2.98 | 1.29 | 6.85 |
| Epidural | 29 (70.7%) | 96 (76.2%) | 0.48 | 0.76 | 0.34 | 1.66 |
| Block attempts (n) a | 2 (1-2) | 1 (1-1) | < 0.0001 | | | |
| Provider | | | 0.0002 | | | |
| Resident | 26 (63.4%) | 37 (29.4%) | < 0.0001 | 4.17 | 1.98 | 8.76 |
| CRNA | 6 (14.6%) | 61 (48.4%) | 0.0001 | 0.18 | 0.07 | 0.46 |
| SRNA | 6 (14.6%) | 23 (18.3%) | 0.6 | 0.77 | 0.29 | 2.04 |
| Attending b | 3 (7.3%) | 5 (4.0%) | 0.41 | 1.91 | 0.44 | 8.37 |
| ITC placement (Y/N) b | 20 (48.8%) | 0 (0%) | < 0.0001 | | | |
| PDPH (Y/N) b | 5 (12.2%) | 1 (0.8%) | 0.0036 | 17.36 | 1.96 | 153.4 |
| Preeclampsia (Y/N) | 11 (26.8%) | 16 (12.7%) | 0.03 | 2.52 | 1.06 | 6 |
| Legend: a = Mann-Whitney reported. B = Exact p-value reported. | | | | | | |

Complication	Failed Regional (n=38)	Control (n=126)	P value	OR	95% CI	
Age (yrs)	28.1 ± 6.5	24.3 ± 5.8	0.0007			
Gestation (wks) a	36.4 ± 5.0	38.3 ± 2.6	0.0321			
Labor trial (Y/N)	21 (55%)	110 (88%)	< 0.0001	0.17	0.07	0.39
Anesthesia type (n)			< 0.0001			
CSE	5 (8.9%)	17 (13.5%)	0.39	0.63	0.22	1.8
DPE	2 (3.6%)	7 (5.6%)	0.57	0.63	0.13	3.13
Epidural	19 (33.9%)	95 (75.4%)	< 0.0001	0.17	0.08	0.33
Spinal	12 (21.4%)	5 (4.0%)	0.0008	6.60	2.20	19.8
Block attempts (n)a	1 (1-2)	1 (1-1)	0.0108			
Cesarean section (Y/N)	28 (73.7%)	26 (20.3%)	< 0.0001	10.7 7	4.64	24.97
GETA conversion (Y/N) b	25 (65.8%)	4 (3.2%)	< 0.0001	58.6 5	17.66	194.8 2
Preeclampsia (Y/N)	11 (28.9%)	16 (12.7%)	0.0179	2.8	1.17	6.72
Legend: a = Mann-Whitney reported. B = Exact p-value reported.						

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Discussion

- Age, block technique, multiple block attempts, and preeclampsia were commonly observed among patients experiencing both UDP and failed regional

Conclusion

- Structured focus on procedural standardization, closer resident supervision, limiting block attempts, and expanded use of simulation-based training will be key areas for resident quality improvement in labor and delivery

References: 1. Int J Obstet Anesth. 2004 Oct;13(4):227-33. 2. J Clin Anesth. 2015 May;27(3):201-206.