

Association of patient characteristics with failed activation of labor epidural catheters for intrapartum cesarean deliveries: a retrospective single center study

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Background and Hypothesis

- One prospective study found that 24% of epidural top-ups failed to provide adequate pain relief for unanticipated cesarean delivery (CD)¹
- 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 activation²
- Goals of our study
 - Identify and address the risk factors for failed epidural conversion to reduce the need for general anesthesia in emergent cesareans, improving maternal safety
 - We hypothesized that there is a significant association between the number of rescue analgesia boluses administered and the likelihood of failed activation of the labor epidural catheter

1. American Society of Anesthesiologists (ASA). (2023, October 19). *Statement on pain during cesarean delivery*. American Society of Anesthesiologists (ASA).

2. 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

Study Design and Methods

- Searched electronic medical record (EPIC) from July 1, 2019 to December 31, 2023 to capture all CD
- Included patients who had activation of an indwelling labor epidural catheter for an unscheduled intrapartum CD
- Failed activation was defined as conversion to general anesthesia with an endotracheal tube
- Data Collected via RedCAP
 - Patient demographics including maternal age, weight, height, BMI, gravity, parity, history of depression and/or anxiety, multiple gestation, and gestational age
 - Clinical data of number of epidural attempts, epidural replacement, anesthetics used, training of anesthesia operator, modality of labor epidural analgesia maintenance, number of rescue boluses, operating times, quantitative blood loss, and urgency of CD
 - Anesthetic adjuncts used include IV fentanyl, IV ketamine, inhaled Nitrous oxide, IV propofol
- Data Analysis via SAS
 - 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

- 455 and 415 patients who had activation and removal of labor epidural catheters, respectively
- A multivariate logistic regression found that epidural catheter replacement (adjusted odds ratio (aOR) 3.06, 95% CI 1.23-7.61; p=0.02) and emergency obstetric indication for cesarean delivery (aOR 5.05, 95% CI 2.23-11.44; p< 0.01) were associated with failure of activation.

Table 1. Patient demographic, physical, and clinical characteristics

Variable	Failed activation (N=70)	Successful activation (N=385)	P value
Age (years) (median (IQR))	26 (21-31)	27 (23-32)	0.03*
Height (cm) (median (IQR))	160.0 (154.9-165.2) ^a	160.0 (154.9-165.1) ^b	0.94
Weight (kg) (median (IQR))	94.3 (77.5-108.1) ^c	89.8 (79.1-105.7) ^d	0.39
Body mass index (kg/m ²) (median (IQR))	36.4 (31.0-41.3) ^a	35.8 (31.1-40.2)	0.72
Gravidity (median (IQR))	1 (1-2)	1 (1-3)	0.08
Parity (median (IQR))	0 (0-0)	0 (0-1)	0.01*
Gestational age (weeks) (median (IQR))	38.8 (37.7-39.9)	39.1 (37.4-40.0)	0.29
History of cesarean delivery (yes)	6 (8.6%)	45 (11.7%)	0.45
History of depression	13 (18.6%)	110 (28.9%)	0.08
History of anxiety	16 (22.9%)	104 (27.0%)	0.47
Type of epidural placed			0.92
<i>Regular epidural</i>	63 (90.0%)	345 (89.6%)	
<i>Combined spinal epidural</i>	7 (10.0%)	40 (10.4%)	
Training of operator who performed last epidural placement			0.16
<i>Intern</i>	0	14 (3.6%)	
<i>CA1</i>	49 (70.0%)	276 (71.7%)	
<i>CA2</i>	10 (14.3%)	51 (13.2%)	
<i>CA3</i>	10 (14.3%)	41 (10.6%)	
<i>Attending</i>	1 (1.4%)	3 (0.8%)	
Maintenance			0.97
<i>Continuous infusion</i>	48 (68.6%)	265 (68.8%)	
<i>Programmed intermittent epidural bolus</i>	22 (31.4%)	120 (31.2%)	
Received one or more epidural rescue analgesia boluses (yes)	23 (32.9%)	95 (24.7%)	0.15
Epidural catheter replaced (yes)	9 (12.9%)	16 (4.2%)	<0.01*
Time from placement of last labor epidural catheter to entering operating room (hours) (median (IQR))	8.28 (4.85-13.03)	7.57 (4.38-11.78)	0.24
Time from surgical incision to wound closure (minutes) (median (IQR))	45 (38-59)	46 (38-55)	0.87
QBL (ml) (median (IQR))	781 (560-1157)	705 (504-960)	0.11

a.N=68, b.N=384, c.N=69, d.N=382

Conclusion and Discussion

- We found that previous replacement of an epidural catheter and emergency indication for CD were independently associated with conversion to general anesthesia
- Number of rescue boluses and training of the operator were not associated with conversion to general anesthesia
- Association between prior replacement of a poorly functioning catheter and activation failure may be a surrogate marker for technical difficulty
- Epidural failure rate (15.4%) within the average in literature (0-21%)³
- A limitation of this study is that our practice frequently removes epidural catheters in the operating room and performs a new neuraxial technique
 - Our results may not be generalizable to other institutions