Original Article

Risk Factors for Epidural Anesthesia Blockade Failure in Cesarean Section

Epidural Anesthesia Blockade Failure in C-Section

Abid Haleem Khattak, Muhammad Sheharyar Ashraf, Amjid Ali, Jawad Hameed, Samar Naeem and Kashaf Noor

ABSTRACT

Objective: To identify and assess the risk factors associated with epidural failure during cesarean section anesthesia.
Study Design: Prospective study
Place and Duration of Study: This study was conducted at the Anesthesia, Lady Reading Hospital, Peshawar November 2022 to October, 2023.
Methods: A total of 400 patients were included in the study. In 2022, at Lady reading Hospital, Peshawar. Data of patients who had cesarean sections with epidural anesthesia (EA) and catheterization were collected. EA failure was identified as the need for intravenous anesthetics during the cesarean section, resulting in conversion to general anesthesia (GA).
Results: Most of the epidural failure patients 82.5% was applied method of loss of resistance to air. Further, catheter depth, resident, obstetric anesthesiologist, emergency surgery, rupture of membrane and parity in epidural failure and non-failure patients were almost equal, ($p>0.050$). Whereas, the mean waiting time in epidural failure patients was less than the non-failure patients as13.23±2.19 minutes and 15.22±3.38 minutes, respectively.
Conclusion: Patients who have a previous epidural catheterization, experience inadequate waiting time, and are younger in age may face a higher risk of epidural analgesia (EA) failure. Specifically, the risk of EA failure increases by 2.6-fold for individuals with a previous epidural catheterization compared to those without catheterization history.
Key Words: Epidural Anesthesia, Risk Factors, Blockade Failure, Cesarean Section, Catheter Depth

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INTRODUCTION

Epidural anesthesia is favored technique of regional anesthesia for cesarean section in pregnant women due to the challenges associated with difficulty in airway management and the potential systemic effects of general anesthesia (GA) on both the fetus and uterine tone[1]. Epidural anesthesia (EA) offers the advantage of prolonging anesthesia duration through the administration of additional local anesthetics[2]. In patients who require pain control care after surgery use of catheter is effective, techniques such as programmed epidural bolus and epidural morphine can provide sufficient analgesia[3].

In contrast, spinal anesthesia (SA) may require supplemental approaches like nerve blocks or intravenous patient-controlled analgesia for extended pain control post-operatively[4]. It's worth noting that EA, particularly in cesarean sections, has a higher average failure rate ranging from 13.4% to 22.1%, compared to the lower range of 0.9% to 2.5% observed with SA[5]. Risk factors of epidural failure include prolonged labor, BMI, cesarean section urgency, labor analgesic breakthrough, maternal height and top ups of analgesics.[6].

Risk factors of procedure, such as anesthesia administered by non-obstetric anesthesiologists, the use of air for loss of resistance, and the flexibility of the catheter, have been identified[7,8]. In cases where epidural analgesia (EA) fails, necessitating some extra IV anesthesia for sedation to attain a sufficient level of anesthesia or even requiring a conversion to general anesthesia (GA) with endotracheal intubation, potential hazards arise, particularly during sedation or GA conversion due to the possibility of encountering difficult airways[9,10].

Despite the widespread use of epidural anesthesia for C-sections, there is a paucity of comprehensive studies specifically focused on the risk factors associated with blockade failure in this population. Filling this research gap will contribute to the field of obstetric anesthesia

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and perioperative care, guiding clinicians in refining their practices for better patient outcomes.

METHODS

The study conducted at Lady Reading Hospital in Peshawar from November 2022 to October, 2023. Study approved by Ethical committee and consent form patients was obtained. This study included patients who underwent c-section with epidural anesthesia and catheterization in the operating room, excluding those with specific criteria such as alternative epidural anesthetics, trainees with limited experience, short time intervals between anesthesia and incision, history of uncertain neuraxial anesthesia, history of spine abnormalities and surgical intervention, change from labor analgesia in epidural, and a history of spine surgery or abnormalities. The retrospective analysis involved dividing the 400 enrolled participants into two groups: those with epidural failure and those without.

Epidural anesthesia and with cauterization was performed with 18-gauge needle and a 20-gauge catheter by positioning the patient in the right and lateral position. Following the loss of resistance (via air or saline), a catheter of 20-gauge was inserted into the epidural space, and testing dose of 3–5 mL was given. Subsequently, checks for signs of intrathecal and intravascular injections were conducted, and if none were observed, catheter was fixed. Mixture of anesthesia contain Sodium bicarbonate 2.8g, lidocaine 400 mg, epinephrine 0.1mg and fentanyl 100 mcg totally 15-24 ml was administered through the catheter into the epidural space. Anesthesia induction time was recorded. Following preparation for cesarean section, surgeons initiated the surgery after confirming pinprick sensation. In patients of blockade failure, the decision to continue with EA or switch to general anesthesia (GA) was determined based on the anesthesiologist's expertise.

SPSS version 27 was used for data analysis. Test of significance were t-test and chi square test and p value below 0.05 was taken as significant.

RESULTS

Out of 400 patients, 63 (15.8%) patients had epidural failure. (Figure. I). The mean age and BMI of epidural failure patients was 39.02±11.69 years and 28.57±3.82 kg/m^2. There were 37 (58.7%) epidural failure patients who had previous epidural analgesia than the non-failure patients 147 (43.6%), (p=0.027). The most common puncture site in epidural failure patients was L3-4, 48 (76.2%). Most of the epidural failure patients 52 (82.5%) was applied method of loss of resistance to air. Further, catheter depth, resident, obstetric anesthesiologist, emergency surgery, rupture of membrane and parity in epidural failure and non-failure patients were almost equal, (p>0.050). Whereas, the mean waiting time in epidural failure patients was less than the non-failure patients as13.23±2.19 minutes and 15.22±3.38 minutes, respectively. (Table. I).

Table No.1: Association of baseline characteristics according to epidural outcome

Characteristic	Epidural failure		p-value
	Yes 63 (15.8%)	No 337 (84.2%)	
Age (years)	39.02±11.69	39.16±11.80	0.929
BMI (kg/m^2)	28.57±3.82	28.40±3.13	0.713
Previous epidural analgesia	37 (58.7)	147 (43.6)	0.027
Puncture site			
L2-3	13 (20.6)	43 (12.8)	0.186
L3-4	48 (76.2)	273 (81.0)	
L4-5	2 (3.2)	21 (6.2)	
Loss of resistance methods			
Air	52 (82.5)	293 (86.9)	0.352
Saline	11 (17.5)	44 (13.1)	
Catheter depth(cm)	5.26±1.18	5.32±1.91	0.697
Resident	46 (73.0)	272 (80.7)	0.165
Obstetric anesthesiologist	8 (12.7)	61 (18.1)	0.298
Emergency surgery	26 (41.3)	149 (44.2)	0.666
Rupture of membrane	10 (15.9)	51 (15.1)	0.8881
Parity			
Nulliparous	23 (36.5)	152 (45.1)	0.207
Parous	40 (63.5)	185 (54.9)	
Waiting time (minute)	13.23±2.19	15.22±3.38	<0.001
N (%), Mean ± S.D			

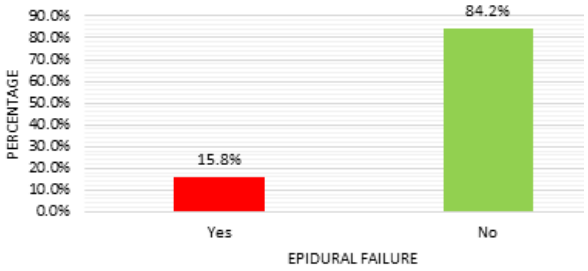

Figure No.1: Distribution of epidural failure among the study patients

DISCUSSION

In this study, we investigated the factors contributing to the failure of converting labor analgesia to cesarean delivery anesthesia, identifying key risk factors such as procedures conducted by trainees, parturients with elevated BMI, and the utilization of air for the loss of resistance test, as reported in prior studies[11]. The mean age and BMI of epidural failure patients was 39.02±11.69 years and 28.57±3.82 kg/m^2 and there was no significant difference among epidural failure and non failures.

Studies by Bauer et al[12] and Grap et al[13] have consistently highlighted a correlation between age and the risk of epidural failure, with a noteworthy trend indicating that younger patients may face a higher likelihood of experiencing this complication. The literature consistently reports a positive association between younger age and the incidence of epidural failure, suggesting that age should be considered as a significant risk factor in assessing the effectiveness of epidural procedures.

Previous studies conducted by Kula et al[14] and Eley et al[15] have provided evidence suggesting that an elevated Body Mass Index (BMI) is associated with increased technical difficulties and a higher likelihood of failure in neuraxial anesthesia. Additionally, these studies have indicated that obese parturients face an elevated risk of extension failure to surgical anesthesia, highlighting the challenges and complications that obesity can introduce in the administration and effectiveness of anesthesia procedures during childbirth.

Most of the epidural failure patients 82.5% were applied method of loss of resistance to air as compare to saline 17.5%. Beilin et al[16] reported in their study that the loss of resistance to air, as opposed to saline, may elevate the risk of epidural failure, a conclusion supported by Shenouda et al[17], who also observed that air could potentially impact the spread of local anesthetic, leading to an incomplete "patchy block" and consequently an increased reliance on intraoperative intravenous anesthetics.

In this study epidural failure rate was higher 58.7% patients who experienced previous epidural analgesia than non failures. Shimada et al[18] in a study revealed notable inflammatory adhesions and changes in individuals with a history of epidural anesthesia (EA) utilizing an epidural scope, as puncture of the flavum ligament and congestion due to catheterization within the epidural space, ultimately causing disruptions in the proper spread of local anesthetic within the epidural compartment.

The mean waiting time in epidural failure patients was less than the non-failure patients as 13.23±2.19 minutes and 15.22±3.38 minutes, respectively. The administration of epidural anesthetics indicated a nearly identical trajectory before the 12-minute mark[19], implying that the primary cause of failure was predominantly attributed to insufficient waiting time for the lidocaine-bicarbonate-epinephrine-fentanyl combination to achieve surgical anesthesia at the T7 level[20].

CONCLUSION

Patients who have a previous epidural catheterization, experience inadequate waiting time, and are younger in age may face a higher risk of epidural analgesia (EA) failure. Specifically, the risk of EA failure increases by 2.6-fold for individuals with a previous epidural catheterization compared to those without catheterization history.

Author's Contribution:

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