

Postoperative Pain Management in Cesarean Section Delivery with Epidural vs Spinal Anesthesia

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Abstract

Original Research Article

Background: Effective postoperative pain management following cesarean section is essential for promoting early maternal recovery, facilitating breastfeeding, improving patient satisfaction and reducing postoperative complications. Epidural and spinal anesthesia are widely used regional anesthetic techniques, but their effectiveness in postoperative pain control remains an important area of comparison. **Methods:** This prospective comparative observational study was conducted in the Department of Anaesthesiology at MH Samorita Hospital and Medical College, Dhaka, Bangladesh, from January 2024 to December 2024 included 70 women undergoing cesarean section, who were equally allocated to either the epidural (n=35) or spinal (n=35) anesthesia group. Postoperative pain was assessed using the Visual Analog Scale (VAS) at 2, 6, 12 and 24 hours after surgery. Data were analyzed using SPSS version 25.0, with $p < 0.05$ considered statistically significant. **Results:** Baseline demographic and obstetric characteristics were comparable between the groups. The epidural group demonstrated significantly lower VAS pain scores than the spinal group at 2 hours (2.8 ± 1.1 vs. 3.6 ± 1.2), 6 hours (3.4 ± 1.3 vs. 4.8 ± 1.4), 12 hours (3.7 ± 1.2 vs. 5.1 ± 1.5) and 24 hours (2.9 ± 1.0 vs. 3.8 ± 1.2) (all $p \leq 0.004$). Time to first rescue analgesic was longer (7.8 ± 2.1 vs. 4.9 ± 1.7 hours), total analgesic consumption was lower (118.6 ± 29.5 vs. 163.7 ± 35.4 mg) and patient satisfaction was higher (8.8 ± 0.9 vs. 7.3 ± 1.2) in the epidural group (all $p < 0.001$). Post-dural puncture headache occurred more frequently after spinal anesthesia ($p = 0.049$). **Conclusion:** Epidural anesthesia provided superior postoperative pain control, reduced analgesic requirements, higher patient satisfaction and fewer complications than spinal anesthesia following cesarean section.

Keywords: Cesarean section; Epidural anesthesia; Spinal anesthesia; Postoperative pain; Visual Analog Scale; Postoperative analgesia.

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INTRODUCTION

Cesarean section is one of the most frequently performed surgical procedures in obstetric practice and plays a vital role in reducing maternal and neonatal morbidity when vaginal delivery is not feasible or poses significant risks [1]. Although advances in surgical techniques and anesthetic management have improved the safety of cesarean delivery, effective postoperative pain control remains a major component of perioperative care [2]. Inadequate pain management after cesarean section can delay maternal recovery, impair early ambulation, interfere with breastfeeding, reduce mother–

infant bonding, prolong hospital stay and increase the risk of postoperative complications such as thromboembolism and chronic pain [3].

Regional anesthesia is the preferred anesthetic technique for cesarean section because it provides excellent intraoperative analgesia while allowing the mother to remain awake during childbirth [4]. Among regional techniques, spinal and epidural anesthesia are the most commonly used. Both methods offer distinct advantages and limitations with respect to onset of anesthesia, quality of sensory and motor blockade,

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duration of analgesia, hemodynamic stability and postoperative pain control [5]. The selection of the anesthetic technique depends on maternal condition, obstetric factors, surgical requirements, anesthesiologist preference and available resources [6].

Spinal anesthesia is widely favored because it is technically simple, has a rapid onset of action and provides reliable surgical anesthesia [7]. However, its relatively limited duration of analgesia may result in earlier postoperative pain and increased requirement for rescue analgesics [8]. In contrast, epidural anesthesia has a slower onset but offers the advantage of prolonged postoperative analgesia through continuous or intermittent administration of local anesthetics and adjuvant medications via an epidural catheter [9]. This may improve patient comfort, reduce systemic analgesic consumption and enhance postoperative recovery [10].

Optimal postoperative pain management following cesarean section has become an important aspect of enhanced recovery protocols [11]. Adequate analgesia facilitates early mobilization, improves maternal satisfaction, promotes successful breastfeeding and enables mothers to care for their newborns more effectively [12]. At the same time, minimizing opioid consumption is desirable to reduce adverse effects such as nausea, vomiting, excessive sedation and delayed recovery [13]. Therefore, identifying the anesthetic technique that provides superior postoperative pain relief with fewer complications is of considerable clinical importance.

Although numerous studies have compared epidural and spinal anesthesia for cesarean section, variations in patient characteristics, anesthetic protocols and outcome measures have produced inconsistent findings regarding postoperative analgesic efficacy. Further comparative evaluation is necessary to determine which technique provides better pain control and overall postoperative outcomes in routine clinical practice. This study was undertaken to compare postoperative pain management, analgesic requirements, patient satisfaction and postoperative complications among women undergoing cesarean section under epidural and spinal anesthesia.

METHODOLOGY & MATERIALS

This prospective comparative observational study was conducted in the Department of Anaesthesiology at MH Samorita Hospital and Medical College, Dhaka, Bangladesh, from January 2024 to December 2024 to compare postoperative pain management following cesarean section under epidural and spinal anesthesia. A total of 70 pregnant women undergoing cesarean section were enrolled using purposive consecutive sampling and were equally allocated into two groups according to the anesthetic technique received: the epidural group (n=35) and the spinal group (n=35). Women aged 18–40 years with singleton pregnancies, American Society of Anesthesiologists (ASA) physical status I or II and scheduled for elective or emergency lower-segment cesarean section under either epidural or spinal anesthesia were included. Patients with contraindications to neuraxial anesthesia, conversion to general anesthesia, chronic opioid use or chronic pain disorders, severe medical or obstetric complications requiring intensive care, known hypersensitivity to local anesthetics or study analgesics, incomplete clinical records, or refusal to provide informed consent were excluded. Baseline demographic and obstetric data were recorded using a structured data collection form. Postoperative pain intensity was assessed using the Visual Analog Scale (VAS) at 2, 6, 12 and 24 hours after surgery. The time to first rescue analgesic, total postoperative analgesic consumption during the first 24 hours, patient satisfaction with pain management and postoperative adverse effects including nausea, vomiting, pruritus, hypotension, urinary retention and post-dural puncture headache were also documented. Ethical approval was obtained from the Institutional Ethics Committee of MH Samorita Hospital and Medical College and written informed consent was obtained from all participants before enrollment. Data were entered, cleaned and analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0. Continuous variables were expressed as mean $\pm$ standard deviation and compared using the independent-samples t-test, while categorical variables were presented as frequencies and percentages and analyzed using the Chi-square test or Fisher's exact test where appropriate. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table I: Baseline demographic and obstetric characteristics of the study participants (n=70)

Variables	Epidural (n=35)	Spinal (n=35)	p-value
Age (years), Mean $\pm$ SD	27.9 $\pm$ 4.6	28.5 $\pm$ 5.1	0.602
BMI (kg/m ²), Mean $\pm$ SD	28.3 $\pm$ 3.4	28.7 $\pm$ 3.6	0.641
Gestational age (weeks), Mean $\pm$ SD	38.4 $\pm$ 1.1	38.6 $\pm$ 0.9	0.437
Primigravida, n (%)	13 (37.1)	15 (42.9)	0.621
Multigravida, n (%)	22 (62.9)	20 (57.1)	
Elective cesarean section, n (%)	21 (60.0)	19 (54.3)	0.627
Emergency cesarean section, n (%)	14 (40.0)	16 (45.7)	

Variables	Epidural (n=35)	Spinal (n=35)	p-value
Previous cesarean section, n (%)	12 (34.3)	10 (28.6)	0.605
ASA Class I, n (%)	24 (68.6)	23 (65.7)	0.796
ASA Class II, n (%)	11 (31.4)	12 (34.3)	

Table I presents the baseline demographic and obstetric characteristics of the 70 study participants. The mean age was 27.9 ± 4.6 years in the epidural group and 28.5 ± 5.1 years in the spinal group, while the mean BMI was 28.3 ± 3.4 kg/m² and 28.7 ± 3.6 kg/m², respectively. The mean gestational age was comparable between the

groups (38.4 ± 1.1 vs. 38.6 ± 0.9 weeks). Multigravida women constituted the majority in both groups (62.9% vs. 57.1%) and elective cesarean section was slightly more common than emergency procedures. Most participants belonged to ASA Class I (68.6% in the epidural group and 65.7% in the spinal group).

Table II: Comparison of postoperative pain scores (VAS) between the study groups

Time after surgery	Epidural (Mean $\pm$ SD)	Spinal (Mean $\pm$ SD)	p-value
2 hours	2.8 ± 1.1	3.6 ± 1.2	0.004
6 hours	3.4 ± 1.3	4.8 ± 1.4	<0.001
12 hours	3.7 ± 1.2	5.1 ± 1.5	<0.001
24 hours	2.9 ± 1.0	3.8 ± 1.2	0.001

Table II compares the postoperative pain scores assessed by the Visual Analog Scale (VAS) between the epidural and spinal anesthesia groups at different postoperative intervals. The epidural group consistently

demonstrated lower mean pain scores than the spinal group at 2 hours (2.8 ± 1.1 vs. 3.6 ± 1.2), 6 hours (3.4 ± 1.3 vs. 4.8 ± 1.4), 12 hours (3.7 ± 1.2 vs. 5.1 ± 1.5) and 24 hours (2.9 ± 1.0 vs. 3.8 ± 1.2).

Table III: Comparison of postoperative analgesic requirements

Variables	Epidural (n=35)	Spinal (n=35)	p-value
Time to first rescue analgesic (hours), Mean $\pm$ SD	7.8 ± 2.1	4.9 ± 1.7	<0.001
Total analgesic consumption (mg diclofenac equivalent), Mean $\pm$ SD	118.6 ± 29.5	163.7 ± 35.4	<0.001
Patients requiring ≥ 3 rescue doses, n (%)	7 (20.0)	16 (45.7)	0.021
Patient satisfaction score (0–10), Mean $\pm$ SD	8.8 ± 0.9	7.3 ± 1.2	<0.001

Table III compares the postoperative analgesic requirements between the epidural and spinal anesthesia groups. The mean time to first rescue analgesic was significantly longer in the epidural group than in the spinal group (7.8 ± 2.1 vs. 4.9 ± 1.7 hours, $p < 0.001$). The epidural group also had lower total analgesic

consumption (118.6 ± 29.5 vs. 163.7 ± 35.4 mg diclofenac equivalent, $p < 0.001$) and fewer patients requiring three or more rescue doses (20.0% vs. 45.7%, $p = 0.021$). Furthermore, patient satisfaction scores were significantly higher among women who received epidural anesthesia (8.8 ± 0.9 vs. 7.3 ± 1.2 , $p < 0.001$).

Table IV: Postoperative complications among the study participants

Complications	Epidural (n=35)	Spinal (n=35)	p-value
Nausea and vomiting	5 (14.3)	11 (31.4)	0.089
Pruritus	3 (8.6)	5 (14.3)	0.452
Hypotension	4 (11.4)	10 (28.6)	0.074
Post-dural puncture headache	1 (2.9)	6 (17.1)	0.049
Urinary retention	2 (5.7)	3 (8.6)	0.641
No complications	24 (68.6)	17 (48.6)	0.088

Table IV presents the comparison of postoperative complications between the epidural and spinal anesthesia groups. Nausea and vomiting (14.3% vs. 31.4%), pruritus (8.6% vs. 14.3%), hypotension (11.4% vs. 28.6%) and urinary retention (5.7% vs. 8.6%) were more frequent in the spinal group, although these differences were not statistically significant ($p > 0.05$). Post-dural puncture headache occurred significantly more often in the spinal group than in the epidural group (17.1% vs. 2.9%, $p = 0.049$). Overall, a greater proportion of patients in the epidural group experienced no

postoperative complications compared with the spinal group (68.6% vs. 48.6%).

DISCUSSION

Effective postoperative pain control following cesarean section is essential for enhancing maternal recovery, facilitating early ambulation, promoting breastfeeding and improving overall patient satisfaction. The present study compared postoperative pain management between epidural and spinal anesthesia and demonstrated that epidural anesthesia was associated

with superior postoperative analgesia, reduced analgesic requirements, higher patient satisfaction and fewer postoperative complications.

The baseline demographic and obstetric characteristics of the participants were comparable between the two groups. The mean age was 27.9 ± 4.6 years in the epidural group and 28.5 ± 5.1 years in the spinal group, with similar BMI, gestational age, parity and ASA physical status. This homogeneity minimizes the influence of confounding variables and strengthens the validity of the observed differences in postoperative outcomes. Similar comparable baseline characteristics have been reported by Getahun *et al.*, and Stanisic *et al.*, who emphasized the importance of balanced patient characteristics when evaluating postoperative pain after cesarean delivery [14,15].

Our study found significantly lower postoperative pain scores in the epidural group at all assessment intervals. The mean VAS scores were 2.8 ± 1.1 versus 3.6 ± 1.2 at 2 hours, 3.4 ± 1.3 versus 4.8 ± 1.4 at 6 hours, 3.7 ± 1.2 versus 5.1 ± 1.5 at 12 hours and 2.9 ± 1.0 versus 3.8 ± 1.2 at 24 hours. These findings indicate that epidural anesthesia provides more sustained postoperative analgesia than spinal anesthesia. Roofthoof *et al.*, described the ability of epidural techniques to provide prolonged analgesia through continuous administration of local anesthetics, while Korobka *et al.*, also concluded that epidural-based regional analgesic techniques are effective in improving postoperative pain control [16,17]. Furthermore, the systematic review by Jing *et al.*, highlighted that neuraxial analgesic techniques with prolonged postoperative pain management provide superior analgesic efficacy following cesarean section [18].

Postoperative analgesic requirements also differed significantly between the groups. Women receiving epidural anesthesia experienced a longer time to first rescue analgesic (7.8 ± 2.1 vs. 4.9 ± 1.7 hours), lower total analgesic consumption (118.6 ± 29.5 vs. 163.7 ± 35.4 mg diclofenac equivalent) and fewer patients required three or more rescue analgesic doses (20.0% vs. 45.7%). In addition, patient satisfaction scores were significantly higher in the epidural group (8.8 ± 0.9 vs. 7.3 ± 1.2). These observations are consistent with the findings of Bang *et al.*, who demonstrated improved postoperative analgesia and reduced breakthrough pain with optimized epidural analgesic delivery [19]. Likewise, Richards *et al.*, reported that effective multimodal postoperative pain management reduces analgesic consumption while improving maternal comfort and recovery [20]. Rahman *et al.*, also emphasized that adequate postoperative pain management after cesarean section is associated with improved patient satisfaction and enhanced postoperative recovery [21].

Regarding postoperative complications, nausea and vomiting, hypotension, pruritus and urinary retention occurred more frequently among patients receiving spinal anesthesia, although these differences did not reach statistical significance. However, post-dural puncture headache was significantly more common in the spinal group (17.1% vs. 2.9%). Moreover, 68.6% of women in the epidural group experienced no postoperative complications compared with 48.6% in the spinal group. These findings agree with Mohtadi *et al.*, who reported that optimization of neuraxial analgesic techniques can reduce adverse postoperative effects while maintaining adequate pain control [22]. Charles *et al.*, also noted that although neuraxial anesthesia remains the preferred technique for cesarean delivery, careful selection of anesthetic methods is essential to minimize pain-related complications and improve maternal experience [23].

Recent evidence continues to support individualized postoperative pain management strategies after cesarean delivery. Espinós Ramírez *et al.*, demonstrated that effective postoperative pain control improves maternal recovery and patient-reported experience, while Wikkelsø highlighted that multimodal and neuraxial-based analgesic approaches have become standard practice for optimizing post-cesarean pain management [24,25]. Collectively, these reports support the present findings that epidural anesthesia offers clinically meaningful advantages in postoperative pain control.

Limitations of the study

This study had several limitations. It was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. Postoperative pain assessment was limited to the first 24 hours after surgery and long-term pain outcomes; functional recovery and neonatal outcomes were not evaluated. Additionally, differences in individual pain perception and analgesic response could not be completely controlled.

CONCLUSION

The findings of this study suggest that epidural anesthesia provides more effective postoperative pain management than spinal anesthesia following cesarean section. Women receiving epidural anesthesia experienced lower postoperative pain scores, reduced analgesic requirements, higher patient satisfaction and fewer postoperative complications. Epidural anesthesia may therefore be considered a valuable option for optimizing postoperative recovery and improving the quality of maternal care after cesarean delivery.

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