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Original Research Article

Comparative Safety of Spinal vs Epidural Anaesthesia in Cesarean Section

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Abstract:

Background: The two most popular regional procedures are spinal anesthesia (SA) and epidural anesthesia (EA), each of which has advantages and disadvantages of its own. Their pharmacological characteristics, therapeutic uses, and complication histories vary greatly.

Objectives: In terms of maternal hemodynamic stability, perioperative complications, neonatal outcomes, and postoperative analgesia, the study sought to assess the safety, effectiveness, and maternal satisfaction of spinal versus epidural anesthesia in women having cesarean sections.

Materials and Methods: It was a retrospective, observational study. The study was carried out at a tertiary care centre. The study data that was retrieved was for one year. Data from 194 participants were retrieved for the study. Women who were 18 years of age or older who had either spinal or epidural anesthesia after an elective or emergency cesarean section at the study center were included in the study. Full medical and anesthesia records were available for these women.

Results: The onset of sensory block was considerably quicker with SA (4.2 ± 1.1 min) than with epidural (12.6 ± 3.2 min; $p < 0.001$). was statistically significant ($p = 0.01$) and occurred more frequently in the spinal group (32.8%) than in the epidural group (16.7%). Although it was more prevalent in the spinal group (9.0% vs. 2.8%), there was no statistically significant difference ($p = 0.092$).

Conclusion- For cesarean sections, spinal and epidural anesthesia are both safe and efficient methods that produce similar results for the mother and the newborn. Technically simpler and offering a quicker onset of sensory block, spinal anesthesia is appropriate for brief elective treatments.

Recommendations: Spinal anaesthesia is preferred for short elective cesarean sections, while epidural anaesthesia may be used for longer surgeries or extended postoperative analgesia.

Keywords: Caesarean Section, Spinal Anesthesia, Maternal Outcomes, Epidural Anesthesia, SA, Safety Outcomes, EA.

Introduction

Avoiding general anesthesia reduces maternal mortality associated with anesthesia [1, 2]. Between the late 1970s and the late 1980s, maternal mortality from anesthesia decreased from 12.8 to 1.7 per million live births in the UK and from 4.3 to 1.9 per million live births in the US. The growing use of regional anesthesia for cesarean deliveries is thought to be partially to blame for this [3].

When weighing the risks and advantages to the mother and her fetus, caregivers frequently choose regional anesthesia, such as spinal or epidural anesthesia, during elective cesarean sections. Nonetheless, some women opt to be put to sleep during the procedure because they prefer a general anesthetic than a regional one. For elective cesarean sections, general anesthesia could also be necessary if regional anesthesia is not appropriate [1, 3].

Parent-child bonding may be improved by allowing the mother and partner to participate in the birth process under regional anesthesia [4]. When vaginal delivery presents a risk, a cesarean section (C-section) is an essential obstetric surgery used to protect the health of the mother and fetus. The rate of caesarean deliveries has skyrocketed in recent decades; according to recent data, over 21% of births globally are caesarean, and by 2030, that number is predicted to rise to about 30% [5].

This worldwide trend is especially noticeable in India's urban and rural locations, such as Dausa in Rajasthan, where increased access to institutional births and changing healthcare infrastructure have led to an increase in cesarean rates [6]. The mother's safety and comfort during the cesarean section, as well as the results for the newborn, are greatly

influenced by the anesthetic approach used. Because regional anesthesia is linked to lower maternal morbidity, a decreased risk of aspiration, better infant Apgar scores, and higher maternal satisfaction, it has supplanted general anesthesia as the preferred option for elective cesarean sections [7, 8].

The two most popular regional procedures are spinal anesthesia (SA) and epidural anesthesia (EA), each of which has advantages and disadvantages of its own. Their pharmacological characteristics, therapeutic uses, and complication histories vary greatly. A single local anesthetic injection into the subarachnoid space causes spinal anesthesia, which has a quick onset and intense sensory and motor blockage. Its simplicity, dependability, and affordability make it a popular choice for short-duration procedures like elective cesarean sections, especially in environments with low resources like rural India [9, 10].

However, bradycardia, hypotension, and a short postoperative analgesia duration are among the problems that are frequently linked to spinal anesthesia [11]. Contrarily, epidural anesthesia allows for the continuous or sporadic administration of medication by inserting a catheter into the epidural area. It offers regulated analgesia, improved hemodynamic stability, and the potential for prolonged pain management both during and after surgery [12, 13].

In terms of maternal hemodynamic stability, perioperative complications, neonatal outcomes, and postoperative analgesia, the study sought to assess the safety, effectiveness, and maternal satisfaction of spinal versus epidural anesthesia in women having cesarean sections.

Methodology

Study Design: It was a retrospective, observational study.

Study Settings: The study was carried out at a tertiary care centre. The study data that was retrieved was for one year.

Study Population: Data of 194 participants were retrieved for the study. Women who were 18 years of age or older who had either spinal or epidural anesthesia after an elective or emergency cesarean section at the study center were included in the study. Full medical and anesthesia records were available for these women. Women with coagulopathy, injection site infections, or severe hypovolemia—conditions that exclude the use of regional anesthesia—were not included. Multiple pregnancies, high-risk obstetric issues requiring general anesthesia, missing or inadequate medical records, and a documented allergy to local anesthetics were among the other restrictions.

Data Collection: Pre-existing medical issues, obstetric history, indications for cesarean birth, and demographic information were all documented. Anaesthesia-related parameters were extracted, such as the type of regional anesthesia (either spinal or epidural), the use of vasopressors, the start of sensory block, intraoperative hemodynamic changes, and perioperative complications. newborn outcomes, including Apgar scores, NICU admission, and newborn mortality, as well as maternal satisfaction levels and postoperative analgesic needs, were also obtained.

Study Procedure: Depending on whether they had undergone SA or EA regional anesthesia, the participants were split into two groups. A single local anesthetic injection was given into the subarachnoid space for spinal anesthesia, and a catheter was inserted into the epidural space for either continuous or intermittent administration for epidural anesthesia. Maternal heart rate, blood pressure, and oxygen saturation were monitored during the procedure, and any complications—such as bradycardia, hypotension, nausea, vomiting, or headache from a post-dural puncture—were noted. Records were kept on the onset and length of sensory and motor block, the need for vasopressors, and the need for postoperative analgesia. Neonatal outcomes were also recorded, including mortality, NICU hospitalization, and Apgar scores at 1 and 5 minutes. Using the information that were accessible, maternal satisfaction with the anesthesia experience was evaluated.

Statistical Analysis: SPSS version 26.0 was used for statistical analysis. Data were initially entered in Microsoft Excel. The data have been presented as either the number of participants (n) with percentages (%), or mean±SD.

The independent t-test was used for statistical analysis. Statistical significance was defined as a p-value of less than 0.05.

Results

Women under spinal anesthesia had a mean age of 27.8 ± 4.6 years, while those in the epidural group had a mean age of 28.4 ± 5.2 years, with a p-value of 0.412. With a p-value of 0.583, the BMI values for the two groups were also similar at 24.6±3.8 and 24.9±3.5. With a p-value of 0.721, the distribution of gravidity was likewise comparable, with primigravida patients making up 44.3% of the spinal group and 41.7% of the epidural group. The study participants' baseline demographics are shown in Table 1.

Table 1: Baseline Demographics among Study Participants

Parameters	Spinal Anaesthesia (n=122)	Epidural Anaesthesia (n=72)	p-value
Age (in years)	27.8±4.6	28.4±5.2	0.412
BMI (kg/m²)	24.6±3.8	24.9±3.5	0.583
Gravidity			
Primigravida	54 (44.3%)	30 (41.7%)	0.721
Multigravida	68 (55.7%)	42 (58.3%)	
Gestational age at delivery (in weeks)	38.1±1.2	38.3±1.3	0.398
Indication for cesarean section			
Previous CS	45 (36.9%)	28 (38.9%)	0.782
Fetal distress	31 (25.4%)	18 (25.0%)	0.951
Cephalopelvic disproportion	22 (18.0%)	12 (16.7%)	0.826
Other maternal indications	24 (19.7%)	14 (19.4%)	0.962
Pre-existing medical conditions			
Hypertension	14 (11.5%)	8 (11.1%)	0.934
Diabetes mellitus	9 (7.4%)	6 (8.3%)	0.812
Anemia	17 (13.9%)	11 (15.3%)	0.794

48 participants were in the spinal anesthesia group and 27 were in the epidural anesthesia group, indicating that the majority of study participants were between the ages of 26 and 30. The second most represented age group was 21–25 years old, with 20 epidural and 34 spinal participants. The age categories of <20 years (8 spinal, 5 epidural), 31–35 years (23 spinal, 14 epidural), and >35 years (9 spinal, 6 epidural) had fewer participants. Figure 1 shows the age distribution of research participants.

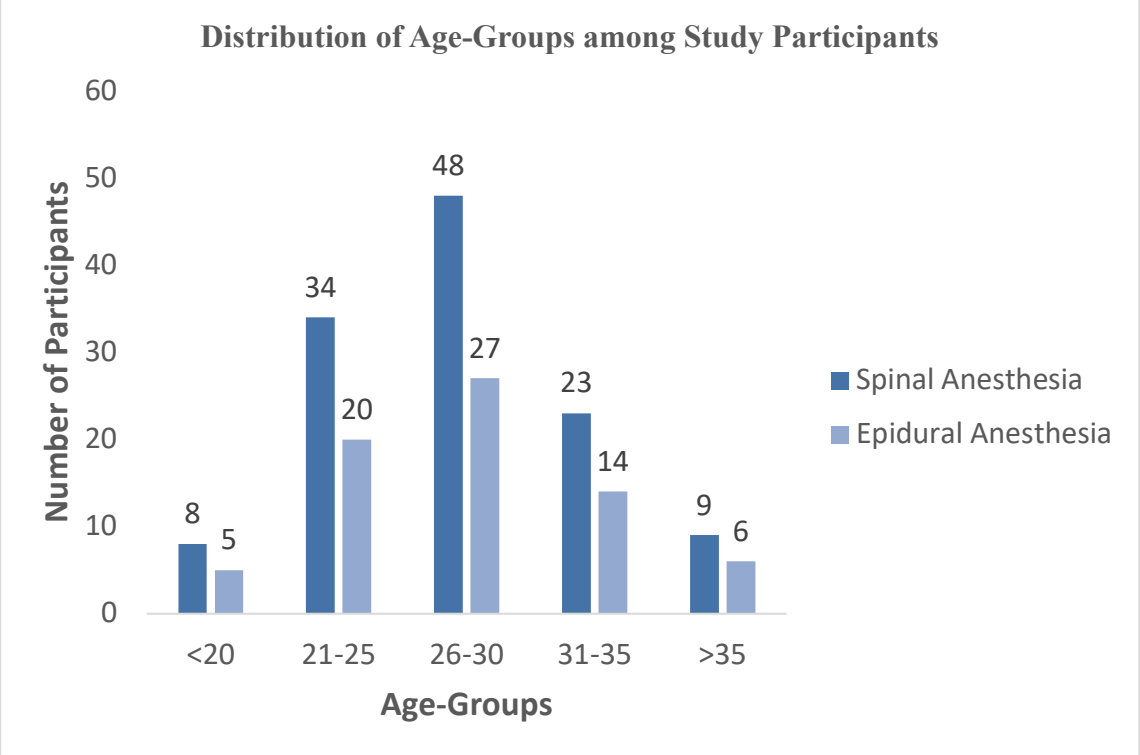

Figure 1: Distribution of Age-Groups among Study Participants

The onset of sensory block was considerably quicker with SA (4.2 ± 1.1 min) than with epidural (12.6 ± 3.2 min; $p < 0.001$). was statistically significant ($p = 0.01$) and occurred more frequently in the spinal group (32.8%) than in the epidural group (16.7%). Although it was more prevalent in the spinal group (9.0% vs. 2.8%), there was no statistically significant difference ($p = 0.092$). Comparative safety results between spinal and epidural anesthesia during caesarean sections are shown in Table 2.

Table 2: Comparative Safety Outcomes of Spinal vs Epidural Anaesthesia in Cesarean Section

Parameter	Spinal Anaesthesia (n = 122)	Epidural Anaesthesia (n = 72)	p-value
Onset of sensory block (in mins)	4.2 ± 1.1	12.6 ± 3.2	<0.001
Intraoperative hypotension	40 (32.8%)	12 (16.7%)	0.01
Bradycardia	11 (9.0%)	2 (2.8%)	0.092
Vasopressor requirement	35 (28.7%)	9 (12.5%)	0.01
Postoperative analgesia within 6 hrs	75 (61.5%)	24 (33.3%)	0.001
Nausea & vomiting	18 (14.7%)	6 (8.3%)	0.196
Headache (post-dural puncture)	7 (5.7%)	0 (0%)	0.048
Apgar score <7 at 1 min	9 (7.4%)	4 (5.6%)	0.672
Apgar score <7 at 5 min	2 (1.6%)	0 (0%)	0.423
Mean operative time (in mins)	52.3 ± 9.1	54.1 ± 8.7	0.271
Mean hospital stay (in days)	5.1 ± 1.4	5.3 ± 1.6	0.496

Figure 2 shows maternal satisfaction rate among study participants. Most of the participants were very satisfied among the outcomes.

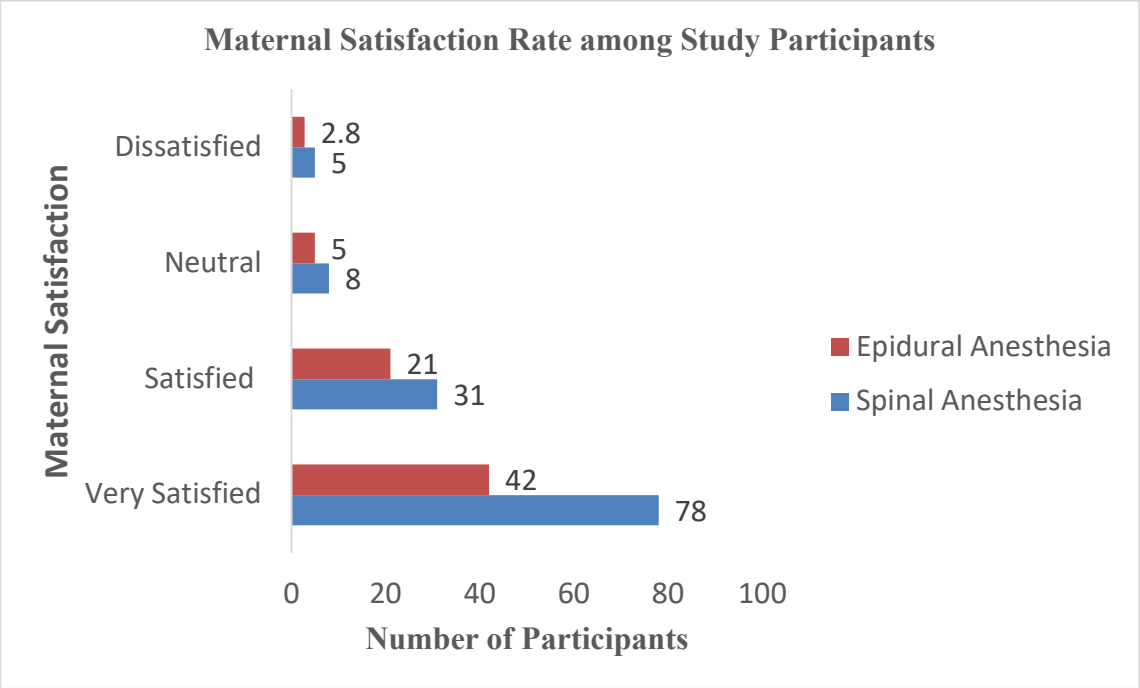

Figure 2: Maternal Satisfaction Rate among Study Participants

4.2 ± 1.1 min for spinal anesthesia and 12.6 ± 3.2 min for epidural anesthesia, which is much faster ($p < 0.001$). Statistically significant, with a p-value of 0.01; more common in spinal group 40 (32.8%) than in epidural group 12 (16.7%). A p-value of 0.001 indicates that the spinal group 75 (61.5%) was more necessary than the epidural group 24 (33.3%). Maternal outcomes under spinal anesthesia as opposed to epidural anesthesia are shown in Table 3.

Table 3: Maternal Outcomes in Spinal vs Epidural Anaesthesia

Maternal Parameter	Spinal Anaesthesia (n = 122)	Epidural Anaesthesia (n = 72)	p-value
Onset of sensory block (in mins)	4.2 ± 1.1	12.6 ± 3.2	<0.001
Intraoperative hypotension	40 (32.8%)	12 (16.7%)	0.01
Bradycardia	11 (9.0%)	2 (2.8%)	0.092
Vasopressor requirement	35 (28.7%)	9 (12.5%)	0.01
Postoperative analgesia within 6 hours	75 (61.5%)	24 (33.3%)	0.001
Nausea & vomiting	18 (14.7%)	6 (8.3%)	0.196
Headache (post-dural puncture)	07 (5.7%)	0 (0%)	0.048

With a p-value of 0.672, the difference between the spinal group 09 (7.4%) and the epidural group 04 (5.6%) is not statistically significant. p-value was 0.271; same between groups, 52.3±9.1 min for spinal and 54.1±8.7 min for epidural. Preoperative and neonatal results for spinal versus epidural anesthesia are displayed in Table 4.

Table 4: Neonatal and Perioperative Outcomes in Spinal vs Epidural Anaesthesia

Outcome Parameter	Spinal Anaesthesia (n=122)	Epidural Anaesthesia (n=72)	p-value
Apgar score <7 at 1 min (%)	09 (7.4%)	04 (5.6%)	0.672
Apgar score <7 at 5 min (%)	02 (1.6%)	0 (0%)	0.423
Mean operative time (min)	52.3 ± 9.1	54.1 ± 8.7	0.271
Mean hospital stay (days)	5.1 ± 1.4	5.3 ± 1.6	0.496
Neonatal ICU admission (%)	06 (4.9%)	03 (4.2%)	0.841
Neonatal mortality (%)	0	0	–

Discussion

The safety and effectiveness of SA and EA in women having cesarean sections were compared in this study. The results indicate that SA and EA have similar neonatal outcomes and are both safe, effective, and linked to high maternal satisfaction.

The study found that the onset of sensory block under spinal anesthesia was substantially faster (4.2 ± 1.1 min) than under epidural anesthesia (12.6 ± 3.2 min; $p < 0.001$). This is consistent with earlier research because spinal anesthesia produces quick, dense sensory and motor blockage appropriate for brief elective treatments by delivering local anesthetic directly into the subarachnoid area [9, 10, 13]. Contrarily, epidural anesthesia depends on the anesthetic's slow diffusion via the spinal space, which results in a longer onset but permits continuous titration for lengthy procedures and postoperative pain relief [12, 13].

The SA group experienced intraoperative hypotension more often (32.8%) than the EA group (16.7%), with a p-value of 0.01, which is in line with studies that spinal anesthesia might result in sympathetic blocking, which causes vasodilation and hypotension [11,13]. Similarly, beneficiaries of spinal anesthesia had a greater vasopressor demand (28.7% vs. 12.5%), with a p-value of 0.01. Although bradycardia was more common with SA, there was no statistically significant difference. These results highlight the importance of closely monitoring the mother's hemodynamics while under spinal anesthesia, especially in parturients who already have cardiovascular risk factors.

The SA group (61.5%) needed postoperative analgesia more frequently than the EA group (33.3%; $p = 0.001$) within the first six hours following surgery. In contrast to continuous or intermittent epidural methods, which offer prolonged analgesic coverage postoperatively, single-shot spinal anesthesia has a shorter duration [11, 12]. 5.7% of spinal cases had post-dural puncture headaches, which is within the range predicted by the literature [11]. The incidence of nausea and vomiting were similar in each group.

Regional anesthesia is generally safe for the fetus, as confirmed by the equivalent neonatal outcomes between SA and EA, including Apgar scores at 1 and 5 minutes, NICU admission, and death, which is in line with earlier meta-analyses [7, 8, 13]. Both groups' high maternal satisfaction levels were a result of their comfort, decreased worry, and ability to take part in the delivery process—all of which are advantages over general anesthesia [4, 7].

Overall, these findings suggest that factors such as the length of the procedure, the requirement for postoperative analgesia, the comorbidities of the mother, and the availability of resources should drive the decision between spinal and epidural anesthesia. While epidural anesthesia is better suited for longer procedures or situations where continuous analgesia is required, spinal anesthesia is better for brief elective cesarean sections because of its quick onset and ease of use [9, 12].

Conclusion

For cesarean sections, spinal and epidural anesthesia are both safe and efficient methods that produce similar results for the mother and the newborn. Technically simpler and offering a quicker onset of sensory block, spinal anesthesia is appropriate for brief elective treatments. While epidural anesthesia provides superior hemodynamic stability and longer-lasting analgesia, it is linked to a higher rate of intraoperative hypotension and the need for analgesia in the early postoperative period.

Limitations

Since this study was conducted in a single urban tertiary care facility, it may not be feasible to extrapolate the findings to the broader population. Additionally, the study's sample size was too small to draw conclusions and extrapolate findings.

Recommendations: Spinal anaesthesia is preferred for short elective cesarean sections, while epidural anaesthesia may be used for longer surgeries or

extended postoperative analgesia. Careful maternal monitoring and patient counselling are essential.

List of Abbreviations

SA- Spinal Anestehsia

RA- Regional Anesthesia

EA- Epidural Anesthesia

C-section- Caesarean Section

BMI- Body Mass Index

NICU- Neonatal Intensive Care Unit

References

1. Hawkins JL, Koonin LM, Palmer SK, Gibbs CP. Anesthesia-related deaths during obstetric delivery in the United States, 1979-1990. Obstetrical & gynecological survey. 1997 Jul 1;52(7):408-9.
2. Emmett RS, Cyna AM, Andrew M, Simmons SW. Techniques for preventing hypotension during spinal anaesthesia for caesarean section. Cochrane Database Syst Rev. 2002 Jul 22;3:0.
3. Ezri T, Szmuk P, Evron S, Geva D, Hagay Z, Katz J. Difficult airway in obstetric anesthesia: a review. Obstetrical & Gynecological Survey. 2001 Oct 1;56(10):631-41.
4. Reisner LS. Anesthesia for cesarean delivery. Clinical Obstetrics and Gynecology. 1987 Sep 1;30(3):539-51.
5. Betran AP, Ye J, Moller AB, Souza JP, Zhang J. Trends and projections of caesarean section rates: global and regional estimates. BMJ global health. 2021 Jun 1;6(6):e005671.
6. BMC Public Health (2023). Rural maternal care in India: challenges and innovations. https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-023-15520-1.
7. Sahiledengle B, Atlaw D, Kumie A, Tekalegn Y, Woldeyohannes D, Agho KE. Menstrual hygiene practice among adolescent girls in Ethiopia: a systematic review and meta-analysis. PloS one. 2022 Jan 4;17(1):e0262295.
8. Shi X, Xu C, Wen Y, Jiang M, Yu H, Wang X, Yuan H, Feng S. Perinatal outcome of emergency cesarean section under neuraxial anesthesia versus general anesthesia: a seven-year retrospective analysis. BMC anesthesiology. 2024 Jan 19;24(1):33.
9. Parness G, Underhill S. Regional anaesthesia for intraocular surgery. Continuing Education in Anaesthesia, Critical Care & Pain. 2005 Jun 1;5(3):93-7.
10. Verywell Health (2024). Epidural vs. Spinal Block: How Are They Different? Verywell Health. https://www.verywellhealth.com/epidural-vs-spinal-block-8703799.
11. Alanazi, M. Q., et al. (2022). Comparative analysis of spinal and epidural anesthesia for cesarean section: impact on postoperative analgesia and complications. Journal of Pharmaceutical Research International, 34(45), 27–34.
12. Li J, Chen AE, Ye R. Comparison of three neuraxial anesthesia approaches in parturient women with obesity and pregnancy-induced hypertension who underwent cesarean section. Journal of International Medical Research. 2021 Dec;49(12):03000605211066433.
13. Sng, B. L., Leong, W. L., & Zeng, Y. (2021). A comparison of spinal and epidural anesthesia for cesarean delivery: maternal and neonatal outcomes. Anesthesia & Analgesia, 132(5), 1371–1379. https://doi.org/10.1213/ANE.0000000000005260.