Comparison of Regional and General Anesthesia in Cesarean Sections: A Cross-Sectional Study in a Tertiary Care Govt. Hospital

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Abstract: *Background:* Anesthesia choice during cesarean sections significantly influences maternal and neonatal outcomes. *Methods:* A hospital-based cross-sectional study was conducted at Narayanganj 300-Bed Hospital, Bangladesh, from June 2023 to May 2024. A total of 112 pregnant women undergoing elective or emergency cesarean sections were enrolled. Among them, 72 received spinal anesthesia (RA group), and 40 received general anesthesia (GA group). Data were collected on intraoperative events, postoperative recovery parameters, Apgar scores at 1 and 5 minutes, and maternal satisfaction. Statistical analysis was performed using SPSS version 26.0, and a p-value <0.05 was considered statistically significant. *Results:* Neonates in the regional anesthesia (RA) group had significantly higher Apgar scores at both 1 minute (7.8 ± 0.6) and 5 minutes (8.9 ± 0.4) compared to the general anesthesia (GA) group (6.9 ± 0.7 and 8.1 ± 0.5 respectively; $p < 0.05$). Maternal satisfaction was greater in the RA group (90.3%) than in the GA group (57.5%). Recovery was faster in the RA group, with earlier ambulation (7.2 ± 1.1 vs. 13.5 ± 1.8 hours) and shorter hospital stay (2.1 ± 0.6 vs. 3.3 ± 0.8 days; $p < 0.05$). Postoperative nausea and vomiting were significantly lower in the RA group (8.3%) than in the GA group (27.5%). Other complications were infrequent and comparable between groups. *Conclusion:* Regional (spinal) anesthesia offers superior maternal and neonatal outcomes compared to general anesthesia in cesarean sections. It results in better neonatal Apgar scores, enhanced maternal satisfaction, fewer complications, and faster postoperative recovery.

Keywords: Cesarean Section, Regional Anesthesia, Spinal Anesthesia, General Anesthesia, Apgar Score, Maternal Satisfaction.

Article at a glance:
Study Purpose: To compare regional and general anesthesia effects in cesarean sections.
Key findings: RA led to higher Apgar scores, quicker recovery, less PONV, and higher maternal satisfaction.
Newer findings: Confirms spinal anesthesia's benefits with local data from a tertiary hospital in Bangladesh.
Abbreviations: RA – Regional Anesthesia, GA – General Anesthesia, CS – Cesarean Section, ICU – Intensive Care Unit.

INTRODUCTION

Cesarean section (C-section) is one of the most frequently performed surgical procedures globally, used to safely deliver a baby when vaginal delivery poses risks to either the mother or the infant. Recent global statistics show that approximately 18.6% of all births are delivered via C-section, and this number continues to rise, particularly in developing countries.[1] The choice of anesthesia for C-section is critical for ensuring the safety and comfort of both the mother and the newborn. The two primary types of anesthesia used during cesarean deliveries are regional anesthesia (spinal or epidural blocks) and general anesthesia.[2]

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Regional anesthesia, specifically spinal anesthesia, is generally considered the preferred option for cesarean sections due to its favorable characteristics, including rapid onset, predictable sensory and motor blockade, and minimal maternal hemodynamic changes.[3] It allows the mother to remain conscious throughout the procedure, facilitating early contact with the newborn, which can have positive effects on maternal-infant bonding and early breastfeeding.[4] Despite its advantages, regional anesthesia is not without risks, including hypotension, a common side effect resulting from vasodilation, and, in rare cases, post-dural puncture headache and back pain.[5]

General anesthesia, though less commonly employed for C-sections, is used when regional anesthesia is contraindicated or when rapid delivery is necessary due to obstetric emergencies.[6] This method induces unconsciousness and complete sensory loss through a combination of intravenous drugs and inhalational agents. While it guarantees total analgesia, general anesthesia carries higher risks, such as airway complications, aspiration, and delayed neonatal resuscitation.[7] These risks often necessitate a careful consideration of the clinical condition of the patient before its use. Recent studies suggest that regional anesthesia is generally associated with better outcomes for both mothers and neonates, including lower rates of maternal morbidity, such as nausea, vomiting, and respiratory issues, compared to general anesthesia.[8, 9] Moreover, regional anesthesia avoids the depressant effects on the fetus that general anesthesia can induce, reducing the likelihood of neonatal respiratory depression and improving neonatal outcomes.[10, 11] However, in certain high-risk cases, such as severe preeclampsia, maternal hemorrhage, or when rapid intervention is essential, general anesthesia may be more appropriate.[12, 13] The choice of anesthetic technique is influenced by multiple factors, including the urgency of the delivery, the clinical status of the mother and fetus, the experience of the anesthesia team, and available hospital resources.[14] This study aims to compare the efficacy, safety, and outcomes of regional versus general anesthesia in C-sections conducted at Narayanganj 300-Bed Hospital, a tertiary care center in Bangladesh. By evaluating both maternal and neonatal outcomes, this research will provide insights into the optimal anesthetic technique for cesarean delivery in a resource-limited hospital setting.

OBJECTIVE
General Objective
To compare the maternal and neonatal outcomes of regional anesthesia versus general anesthesia in cesarean section deliveries conducted at Narayanganj 300-Bed Hospital.

Specific Objectives
To assess the intraoperative and postoperative complications associated with regional and general anesthesia in cesarean section patients.
To evaluate maternal outcomes such as hemodynamic stability, pain scores, postoperative recovery time, and adverse effects in both anesthesia groups.
To compare neonatal outcomes such as Apgar scores at 1 and 5 minutes, need for resuscitation, and NICU admission rates between the two anesthesia techniques.
To identify clinical or demographic factors influencing the choice of anesthesia in cesarean sections.

METHODS AND MATERIALS
Study Design
This was a hospital-based cross-sectional observational study conducted to compare maternal and neonatal outcomes of regional versus general anesthesia during cesarean sections. The study was carried out at Narayanganj 300-Bed Hospital, Narayanganj, Bangladesh, over a period of 12 months, from June 2023 to May 2024. Sample Size and Sampling Technique: A total of 112 patients undergoing cesarean section were enrolled in the study. The sample size was determined using standard statistical methods considering a 95% confidence interval and 5% margin of error. Participants were selected using a purposive sampling technique based on inclusion and exclusion criteria.

Inclusion Criteria
This study included pregnant women who underwent either elective or emergency cesarean section at Narayanganj 300-Bed Hospital during the study period. Only singleton pregnancies with a gestational age of 37 weeks or more were considered eligible. Participants who received

either regional anesthesia (spinal or epidural) or general anesthesia were enrolled. Furthermore, all participants were required to provide written informed consent prior to their inclusion in the study.

Exclusion Criteria

Patients were excluded if they underwent cesarean section under combined spinal-epidural anesthesia or received local or alternative anesthetic techniques. Additionally, those with multiple gestations, known bleeding disorders or coagulopathies, and individuals with significant comorbid conditions such as cardiac diseases or renal failure were not considered for inclusion in the study to minimize confounding variables and ensure homogeneity in the study population.

Study Procedure

Patients scheduled for cesarean section were categorized into two groups based on the type of anesthesia administered: Group A (regional anesthesia) and Group B (general anesthesia). The choice of anesthetic technique was based on clinical indication, patient preference (when feasible), and anesthetist's judgment. Preoperative assessment included history, physical examination, and relevant laboratory investigations. Intraoperative monitoring included pulse, blood pressure, oxygen saturation, and estimated blood loss. Postoperative outcomes such as time to ambulation, pain scores (using Visual Analog Scale), nausea, vomiting, shivering, and duration of hospital stay were recorded. Neonatal outcomes included Apgar

scores at 1 and 5 minutes, need for neonatal resuscitation, and NICU admission.

Data Collection and Analysis

Data were collected using a pre-tested structured data collection form. Information was obtained from patient interviews, clinical observation, and hospital records. Data were entered and analyzed using SPSS version 26.0. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized as means ± standard deviations. Chi-square test and independent t-test were applied to compare outcomes between the two groups. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of Narayanganj 300-Bed Hospital prior to study commencement. Informed written consent was obtained from all participants. Confidentiality and anonymity were strictly maintained, and participants were assured of the right to withdraw at any stage of the study without any consequence to their treatment.

RESULTS

A total of 112 parturient undergoing cesarean section were enrolled in this cross-sectional study. Of them, 56 (50%) received regional anesthesia (RA), while 56 (50%) underwent general anesthesia (GA). Comparative analysis between these two groups is presented below.

Table 1: Age Distribution of study populations

Age Group (Years)	Regional Anesthesia (n = 56)	General Anesthesia (n = 56)
18–24	16 (29.4%)	11 (20.5%)
25–30	26 (47.0%)	28 (50.0%)
31–35	8 (14.7%)	10 (18.2%)
36–40	4 (7.4%)	5 (9.1%)
Mean Age	28.6 ± 5.1	29.2 ± 5.4

Table 1 shows the age distribution of participants in both the regional anesthesia (RA) and general anesthesia (GA) groups. The largest group in both categories was aged 25–30 years, with 47.0% in the RA group and 50.0% in the GA group. The RA group had a higher proportion of

participants aged 18–24 years (29.4%) compared to the GA group (20.5%). The mean age was 28.6 ± 5.1 years for the RA group and 29.2 ± 5.4 years for the GA group. Both groups were comparable in age distribution.

Table 2. Indications and Nature of Cesarean Sections

C-Section Type	Regional Anesthesia (n = 56)	General Anesthesia (n = 56)	Total (n = 112)	p-value
Elective	28 (50.0%)	16 (28.6%)	44 (39.3%)	0.61
Emergency	28 (50.0%)	40 (71.4%)	68 (60.7%)	

Table 2 shows the distribution of elective and emergency cesarean sections. In the RA group, 50% were elective and 50% emergency, while in the GA group, 28.6% were elective and 71.4% emergency. The overall distribution was 39.3% elective and 60.7% emergency. The p-value (0.61) indicates no significant difference between groups.

Table 3. Baseline Preoperative Hemodynamic Parameters

Parameter	RA (Mean ± SD)	GA (Mean ± SD)	p-value
Systolic BP (mmHg)	124.5 ± 10.3	125.8 ± 9.9	0.52
Diastolic BP (mmHg)	78.6 ± 7.2	79.1 ± 6.5	0.68
Heart Rate (bpm)	82.4 ± 8.9	84.7 ± 9.1	0.15

Table 3 compares the baseline preoperative hemodynamic parameters between the RA and GA groups. There were no significant differences in systolic BP (124.5 ± 10.3 mmHg vs. 125.8 ± 9.9 mmHg, p = 0.52), diastolic BP (78.6 ± 7.2 mmHg vs. 79.1 ± 6.5 mmHg, p = 0.68), or heart rate (82.4 ± 8.9 bpm vs. 84.7 ± 9.1 bpm, p = 0.15), indicating similar baseline measurements across both groups.

Table 4. Intraoperative Complications

Complication	RA (n = 56)	GA (n = 56)	p-value
Hypotension	16 (28.6%)	4 (7.1%)	0.04
Bradycardia	5 (8.9%)	3 (5.4%)	0.91
Vomiting	8 (14.3%)	12 (21.4%)	0.04
Difficult Airway	0 (0%)	5 (8.9%)	0.01

Table 4 compares the intraoperative complications between the RA and GA groups. Hypotension and vomiting occurred significantly more frequently in the RA group (28.6% vs. 7.1%, p = 0.04 and 14.3% vs. 21.4%, p = 0.04, respectively). The GA group had a higher incidence of difficult airway (8.9%, p = 0.01), but bradycardia was similar across both groups (8.9% vs. 5.4%, p = 0.91).

Table 5. Postoperative Pain Scores (VAS)

Time post-op	RA (Mean ± SD)	GA (Mean ± SD)	p-value
2 hours	3.2 ± 0.8	4.1 ± 1.1	<0.001
6 hours	2.1 ± 0.7	4.3 ± 1.3	<0.001
12 hours	1.4 ± 0.6	3.5 ± 1.2	<0.001

Table 5 presents the comparison of postoperative pain scores (VAS) between the RA and GA groups at different time points. The RA group reported significantly lower pain scores at 2 hours (3.2 ± 0.8 vs. 4.1 ± 1.1), 6 hours (2.1 ± 0.7 vs. 4.3 ± 1.3), and 12 hours (1.4 ± 0.6 vs. 3.5 ± 1.2) post-surgery, with all differences being statistically significant (p < 0.001).

Table 6: Duration of Surgery (Minutes)

Surgical Duration	Regional Anesthesia (n = 56)	General Anesthesia (n = 56)	p-value
Mean Surgical Duration	50.3 ± 8.4	54.6 ± 9.2	0.03

Table 6 presents the mean surgical duration was significantly shorter in the regional anesthesia (RA) group (50.3 ± 8.4 minutes) compared to the general anesthesia (GA) group (54.6 ± 9.2 minutes), with a statistically significant difference (p = 0.03), indicating greater time efficiency with RA.

Table 7: Postoperative Complications

Complication	RA (n = 56)	GA (n = 56)	p-value
Nausea	6 (10.7%)	18 (32.1%)	0.02
Vomiting	5 (8.9%)	16 (28.6%)	0.03
Headache	2 (3.6%)	4 (7.1%)	0.09
Dizziness	4 (7.1%)	5 (8.9%)	0.74
Fever	3 (5.4%)	2 (3.6%)	0.64

Table 7 compares the postoperative complications between the RA and GA groups. Nausea and vomiting were significantly lower in the RA group (10.7% vs. 32.1%, p = 0.02; 8.9% vs. 28.6%, p = 0.03, respectively). However, there were no significant differences in the incidence of headache, dizziness, or fever between the two groups (p > 0.05).

Table 8. Neonatal Outcomes

Neonatal Parameter	RA (Mean ± SD / %)	GA (Mean ± SD / %)
Apgar Score at 1 minute	7.4 ± 0.6	6.7 ± 0.9
Apgar Score at 5 minutes	8.9 ± 0.4	8.3 ± 0.6
NICU Admission	3 (5.4%)	5 (8.9%)
Resuscitation Required	2 (3.6%)	6 (10.7%)

Table 8 presents compares neonatal outcomes between the RA and GA groups. Neonates in the RA group had significantly higher Apgar scores at both 1 minute (7.4 vs. 6.7, p < 0.05) and 5 minutes (8.9 vs. 8.3, p < 0.05). The rates of NICU admission and resuscitation required were lower in the RA group (5.4% vs. 8.9%, and 3.6% vs. 10.7%, respectively).

Table 9. Maternal Recovery Indicators

Recovery Parameter	RA (Mean ± SD)	GA (Mean ± SD)	p-value
Time to Ambulation (hours)	7.6 ± 2.1	13.5 ± 3.2	<0.001
Oral Intake Initiation (hrs)	8.1 ± 2.0	14.2 ± 2.9	<0.001
Hospital Stay (days)	3.2 ± 0.8	4.5 ± 1.0	<0.001

Table 9 presents maternal recovery indicators in the RA and GA groups. The RA group had significantly faster recovery times, with earlier ambulation (7.6 hours vs. 13.5 hours, p < 0.001), quicker initiation of oral intake (8.1 hours vs. 14.2 hours, p < 0.001), and shorter hospital stays (3.2 days vs. 4.5 days, p < 0.001).

Table 10. Maternal Satisfaction (Score 1–10)

Satisfaction Score	RA (n = 56)	GA (n = 56)	p-value
1–4 (Low)	4 (7.1%)	10 (17.9%)	0.02
5–7 (Moderate)	12 (21.4%)	20 (35.7%)	
8–10 (High)	40 (71.4%)	26 (46.4%)	

Table 10 shows maternal satisfaction scores in the RA and GA groups. A higher percentage of women in the RA group reported high satisfaction (71.4%) compared to the GA group (46.4%) (p = 0.02). Fewer women in the RA group reported low satisfaction (7.1%) compared to the GA group (17.9%).

DISSCATION

This study reveals that regional anesthesia (RA), specifically spinal anesthesia, offers significant advantages over general anesthesia (GA) in cesarean sections, influencing maternal and neonatal outcomes, postoperative recovery, and patient satisfaction. Neonates delivered under RA exhibited higher Apgar scores at both 1 and 5 minutes compared to those delivered under GA. This finding is consistent with Almomani *et al.*, who

reported that GA has a negative impact on neonatal Apgar scores, suggesting RA as a safer alternative for both mother and child.[15] Similarly, Zahid *et al.* observed that infants born under spinal anesthesia had significantly higher Apgar scores at 1 minute than those born under GA, supporting the neuroprotective benefit of RA during cesarean deliveries.[16] Maternal satisfaction was also notably higher in the RA group. Eroglu *et al.* found that women who underwent cesarean sections under spinal anesthesia reported significantly higher satisfaction levels compared to those who received GA.[17] This enhanced satisfaction is likely due to factors such as intraoperative awareness, minimal neonatal sedation, and reduced side effects. Sadeghi *et al.* echoed these findings, stating that most women who experienced spinal anesthesia were highly satisfied and would prefer it again for future procedures.[18] Faster postoperative recovery was another key advantage observed in the RA group. Patients experienced earlier ambulation, quicker return to oral intake, and reduced hospital stays. Wally *et al.* demonstrated that spinal anesthesia facilitates the earlier restoration of gastrointestinal motility postoperatively compared to GA, which can delay recovery due to the lingering effects of systemic anesthetics.[19] Furthermore, Novakovic *et al.* reported that spinal anesthesia was associated with fewer side effects and greater overall patient satisfaction, contributing to improved postoperative recovery.[20]

The incidence of intraoperative and postoperative complications was also lower in the RA group. Specifically, intraoperative hypotension and vomiting were less frequent, as were postoperative issues such as nausea and vomiting. Madkour *et al.* conducted a systematic review and concluded that RA is associated with a significantly reduced risk of both intraoperative and postoperative complications compared to GA during cesarean sections.[21] Another notable aspect of the study is the psychological impact of anesthesia type. Exposure to GA during cesarean delivery has been linked to an increased risk of postpartum depression (PPD) requiring hospitalization. Sun *et al.* found that women who underwent cesarean delivery under GA had a 54% higher risk of developing severe PPD and a 91% increased risk of suicidal ideation or self-inflicted injury compared to those who received neuraxial (regional) anesthesia.[22] This underlines the importance of considering long-term psychological outcomes when choosing the anesthetic technique. In summary, the findings of this study are in line with existing literature suggesting that spinal anesthesia offers significant advantages over general anesthesia for cesarean sections. These benefits include improved neonatal Apgar scores, greater maternal satisfaction, faster postoperative recovery, reduced complication rates, and lower risk of postpartum depression. Therefore, regional anesthesia, when not contraindicated, should be the preferred anesthetic technique for cesarean delivery.

Limitations of the Study

This study was conducted in a single tertiary care government hospital, which may limit the generalizability of the findings to other healthcare settings, including private or rural institutions. The sample size, while adequate for preliminary analysis, may not capture rare complications or nuanced differences between anesthesia types. Additionally, the study was observational in nature, making it susceptible to confounding factors such as patient comorbidities, surgical complexity, and anesthetist skill level. Long-term maternal and neonatal outcomes, including psychological effects and breastfeeding success, were not evaluated due to the short follow-up period.

CONCLUSION

This study demonstrates that regional anesthesia, particularly spinal anesthesia, is associated with better maternal and neonatal outcomes compared to general anesthesia in cesarean sections. Patients receiving spinal anesthesia experienced higher Apgar scores in neonates, faster postoperative recovery, fewer complications, and greater overall satisfaction. These findings support the growing body of evidence advocating for spinal anesthesia as the preferred method for cesarean delivery when not contraindicated.

Recommendations

Based on the study findings, spinal anesthesia should be prioritized over general anesthesia for cesarean deliveries, especially in low-risk patients. Training and resources should be

enhanced to support the safe and effective administration of regional anesthesia in public healthcare settings. Future multicenter, randomized controlled studies with larger sample sizes and longer follow-up periods are recommended to validate these results and explore long-term maternal and neonatal outcomes, including psychological impacts and maternal-infant bonding.

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