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Original Research Article

Per-operative anesthetic complications during lower segment caesarean section and their management

Sabrin Farhad^{1*}, Tahmina Akter¹, M. Ridwanul Ferdous²

¹Department of Obstetrics and Gynecology, Uttara Adhunik Medical Hospital, Dhaka, Bangladesh

²Department of Cardiology, Continental Hospital PLC, Dhaka, Bangladesh

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*Correspondence:

Dr. Sabrin Farhad,

E-mail: sabrinfarhad1983@gmail.com

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ABSTRACT

Background: Lower uterine segment caesarean section (LUCS) is one of the most frequently performed surgical procedures worldwide. Both spinal anesthesia (SA) and general anesthesia (GA) are commonly employed, each carrying a distinct profile of per-operative complications. Prompt recognition and management of these complications, including rare but serious events, are critical for maternal safety. Objective was to determine the frequency, types, and management outcomes of per-operative anesthetic complications during LUCS under spinal and general anesthesia.

Methods: A prospective cohort study was conducted at the department of gynecology and obstetrics, Uttara Adhunik Medicak College Hospital, Dhaka, Bangladesh, from January 2025 to December 2025. A total of 163 pregnant women undergoing LUCS were enrolled using purposive sampling. Data on intraoperative complications under SA (n=112) and GA (n=51) were recorded. Management strategies and immediate outcomes were analyzed using SPSS version 23.0.

Results: Complications occurred in 48 patients (29.4%). Under SA, hypotension (32.1%), bradycardia (12.5%), and rare complications, including high spinal (1.8%) and transient radicular irritation (0.9%), were observed. Under GA, desaturation (7.8%), failed intubation (3.9%), and one case of anaphylaxis to rocuronium (2.0%) occurred. All complications were managed successfully without maternal mortality.

Conclusions: Per-operative anesthetic complications during LUCS are not uncommon. While hypotension under spinal anesthesia predominates, rare complications such as high spinal and anaphylaxis require high vigilance. Protocol-driven management ensures favorable outcomes.

Keywords: Cesarean section, General anesthesia, Hypotension, Peroperative complications, Spinal anesthesia

INTRODUCTION

Lower uterine segment caesarean section (LUCS) is the most commonly performed major surgical procedure worldwide, with rising incidence rates over the past two decades.¹ Globally, caesarean section rates range from 15% to over 35% depending on geographic region and healthcare infrastructure.^{2,3} In Bangladesh, the prevalence of LUCS has increased substantially, particularly in private tertiary care hospitals, where it now accounts for a significant proportion of all deliveries.⁴ Anesthesia for

LUCS presents unique challenges because the anesthesiologist must ensure maternal safety and optimal surgical conditions while minimizing fetal drug exposure and maintaining uteroplacental perfusion.⁵ Two primary anesthetic techniques are employed: spinal anesthesia (SA) and general anesthesia (GA). Spinal anesthesia is the preferred technique for elective and most emergency LUCS due to its rapid onset, reliable blockade, and avoidance of airway manipulation.⁶ However, SA is associated with several per-operative complications, most notably maternal hypotension resulting from

sympathectomy-induced vasodilation, which occurs in up to 70-80% of cases if untreated.⁷ General anesthesia is reserved for situations where regional anesthesia is contraindicated, has failed, or in cases of extreme maternal or fetal compromise, such as massive hemorrhage, severe fetal distress, or coagulopathy.⁸ While GA provides rapid airway control and surgical conditions, it carries risks including difficult or failed intubation, aspiration of gastric contents, awareness under anesthesia, and adverse drug effects on the neonate.⁹ The incidence of failed intubation in obstetrics, though rare, remains higher than in the general surgical population, with an estimated rate of 1:250 to 1:500.¹⁰ Beyond these common complications, anesthesiologists must be prepared for uncommon and rare per-operative events that, though infrequent, carry significant morbidity if not recognized and managed promptly. Under spinal anesthesia, rare complications include high or total spinal block (incidence <1%), transient radicular irritation (0.5-2%), and post-dural puncture headache following inadvertent dural puncture.¹¹ Under general anesthesia, rare but life-threatening complications include anaphylaxis to induction agents or muscle relaxants, malignant hyperthermia, and intraoperative fire.¹² Effective management of per-operative complications requires a systematic approach: early recognition, immediate intervention, ongoing monitoring, and documentation. Management strategies for hypotension under SA include prophylactic and therapeutic vasopressors (phenylephrine, ephedrine), adequate left uterine displacement, and cautious intravenous fluids.⁷ For complications under GA, preparedness includes a pre-induction difficult-airway checklist, availability of emergency drugs (e.g., adrenaline for anaphylaxis), and adherence to fasting guidelines to reduce the risk of aspiration.¹³ Despite the availability of clinical guidelines, prospective data from low- and middle-income countries documenting the real-world frequency and outcomes of per-operative anesthetic complications during LUCS remain limited.

This study aimed to address this gap by prospectively evaluating anesthetic complications under both spinal and general anesthesia at a tertiary care hospital in Dhaka, Bangladesh, with special attention to rare but critical events and their management outcomes.

METHODS

The study included 163 pregnant women undergoing lower uterine segment cesarean section (LUCS) at the department of gynecology and obstetrics, Uttara Adhunik Medical College Hospital, Dhaka, Bangladesh, from January 2025 to December 2025.

Both elective and emergency LUCS procedures were included. An anesthesia technique (spinal or general) was

selected by the attending anesthesiologist based on clinical indication.

Inclusion criteria

Pregnant women aged 18-45 years undergoing LUCS under either spinal anesthesia or general anesthesia were included. All participants provided written informed consent. Both primiparous and multiparous women were eligible. Singleton and multiple gestations were included.

Exclusion criteria

Pregnant women with pre-existing severe cardiac disease (New York Heart Association class III or IV), uncorrected coagulopathy, overt maternal sepsis, known allergy to local anesthetics or muscle relaxants, and those who refused consent were excluded from the study. Women transferred to the operating room with an existing neuraxial block from the labor ward were also excluded.

Study procedure

A prospective cohort design was employed. Data were collected using a pre-designed structured case record form. Per-operative complications were documented immediately by the attending anesthesiologist. Management strategies and maternal outcomes within 24 hours post-delivery were recorded. Rare complications were defined as those with an expected incidence <1% based on published literature.

Data analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Categorical variables were presented as frequencies and percentages. Comparative analysis between spinal and general anesthesia groups was performed using the Chi-square test. A p value <0.05 was considered statistically significant.

RESULTS

A total of 163 pregnant women undergoing LUCS were included in this prospective cohort study. Of these, 112 (68.7%) received spinal anesthesia (SA), and 51 (31.3%) received general anesthesia (GA). The mean age of participants was 28.4±5.2 years (range 19-42 years). Elective LUCS accounted for 121 procedures (74.2%), while emergency LUCS accounted for 42 procedures (25.8%). There was no statistically significant difference in baseline demographic characteristics between the two anesthesia groups. Per-operative anesthetic complications occurred in 48 out of 163 patients (29.4%).

Table 1: Baseline demographic and obstetric characteristics of study participants (n=163).

Characteristic	Anesthesia groups		Total (n=163)	P value
	Spinal (n=112)	General (n=51)		
Mean age (years±SD)	28.2±5.1	28.8±5.4	28.4±5.2	0.487
Primiparous, N (%)	48 (42.9)	21 (41.2)	69 (42.3)	0.839
Multiparous, N (%)	64 (57.1)	30 (58.8)	94 (57.7)	0.839
Elective LUCS, N (%)	89 (79.5)	32 (62.7)	121 (74.2)	0.025
Emergency LUCS, N (%)	23 (20.5)	19 (37.3)	42 (25.8)	0.025
Gestational age (weeks±SD)	38.1±1.4	37.8±1.6	38.0±1.5	0.216

Statistical analysis: Independent t-test for continuous variables; Chi-square test for categorical variables. SD = Standard deviation.

Table 2: Overall, per-operative anesthetic complications stratified by anesthesia type.

Complication status	Spinal anesthesia	General anesthesia	Total	P value
Any complication, N (%)	39 (34.8)	9 (17.6)	48 (29.4)	0.024
No complication, N (%)	73 (65.2)	42 (82.4)	115 (70.6)	0.024

Statistical analysis: Chi-square test (p = 0.024, 95% confidence interval for difference: 2.8% to 31.6%).

Table 3: Frequency of complications under spinal anesthesia (n=112).

Complications	N (%)	Category
Hypotension	36 (32.1)	Common
Bradycardia	14 (12.5)	Common
Nausea and vomiting	10 (8.9)	Common
Post-dural puncture headache	6 (5.4)	Uncommon
High spinal (total spinal)	2 (1.8)	Rare
Transient radicular irritation	1 (0.9)	Rare

Note: Some patients had more than one complication; percentages calculated from the total spinal anesthesia group (n=112).

Table 4: Frequency of complications under general anesthesia (n=51).

Complications	N (%)	Category
Desaturation (SpO ₂ <92%)	4 (7.8)	Common
Failed intubation (first attempt)	2 (3.9)	Uncommon
Bronchospasm	1 (2.0)	Uncommon
Anaphylaxis to rocuronium	1 (2.0)	Rare

Note: Percentages calculated from the total general anesthesia group (n=51).

The overall complication rate was significantly higher in the spinal anesthesia group (34.8%, 39/112) compared to the general anesthesia group (17.6%, 9/51), p=0.024. Under spinal anesthesia, the most common complication was hypotension, observed in 36 patients (32.1%), followed by bradycardia in 14 patients (12.5%) and post-dural puncture headache in 6 patients (5.4%). Nausea and vomiting occurred in 10 patients (8.9%), predominantly secondary to hypotension.

Among rare complications under SA, high spinal block was encountered in 2 patients (1.8%) and transient radicular irritation in 1 patient (0.9%). All patients with high spinal required transient vasopressor support and supplemental oxygen; none required endotracheal intubation. Under general anesthesia, desaturation

(SpO₂<92%) occurred in 4 patients (7.8%), failed intubation (first attempt) in 2 patients (3.9%), and bronchospasm in 1 patient (2.0%). One rare case of anaphylaxis to rocuronium (2.0%) was successfully managed with intravenous adrenaline and antihistamines. No case of maternal mortality or permanent neurological deficit occurred in either group. Management outcomes were favorable across both groups.

Among the 48 patients who developed complications, 42 (87.5%) resolved completely before the end of surgery, 5 (10.4%) required extended post-anesthesia care unit stay beyond 4 hours, and 1 patient (2.1%) required intensive care unit admission (the anaphylaxis case). No patient required readmission within 48 hours due to anesthetic complications.

Table 5: Management strategies and immediate outcomes.

Complication	Management strategy	Resolved intraoperatively	Required	
		N (%)	Extended PACU stay	ICU
			N (%)	N (%)
Hypotension (n=36)	I.V. phenylephrine/ephedrine, fluids, left uterine displacement	36 (100)	0 (0)	0 (0)
Bradycardia (n=14)	I.V. atropine/glycopyrrolate	14 (100)	0 (0)	0 (0)
Nausea/vomiting (n=10)	I.V. ondansetron/metoclopramide	10 (100)	0 (0)	0 (0)
Post-dural puncture headache (n=6)	Conservative (bed rest, hydration, caffeine)	0 (0)	4 (66.7)	0 (0)
High spinal (n=2)	Vasopressors, O ₂ , airway support	2 (100)	0 (0)	0 (0)
Transient radicular irritation (n=1)	Observation, simple analgesics	1 (100)	0 (0)	0 (0)
Desaturation (n=4)	Jaw thrust, increased FiO ₂ , ventilation assistance	4 (100)	0 (0)	0 (0)
Failed intubation (n=2)	Changed to spinal (n=1); LMA insertion (n=1)	2 (100)	0 (0)	0 (0)
Bronchospasm (n=1)	Salbutamol inhalation, IV hydrocortisone	1 (100)	0 (0)	0 (0)
Anaphylaxis (n=1)	I.v. adrenaline, chlorpheniramine, hydrocortisone	0 (0)	1 (100)	1 (100)
Total (N=48)		42 (87.5)		

PACU = Post-Anesthesia Care Unit, ICU = intensive care unit.

Table 6: Comparison of outcomes between spinal and general anesthesia groups.

Outcome	Anesthesia groups		Total	P value
	Spinal	General		
Complete resolution before end of surgery, N (%)	36/39 (92.3)	6/9 (66.7)	42/48 (87.5)	0.058
Extended PACU stay (>4 hours), N (%)	3/39 (7.7)	2/9 (22.2)	5/48 (10.4)	0.201
ICU admission required, N (%)	0/39 (0)	1/9 (11.1)	1/48 (2.1)	0.074
Maternal mortality, N (%)	0 (0)	0 (0)	0 (0)	–

Statistical analysis: Fisher's exact test for all comparisons among patients with complications (n=48).

DISCUSSION

The present prospective cohort study of 163 pregnant women undergoing LUCS demonstrated that per-operative anesthetic complications occur in nearly one-third of cases (29.4%), with a significantly higher incidence under spinal anesthesia (34.8%) compared to general anesthesia (17.6%). This finding is consistent with previously reported data from similar settings.¹⁴ The predominance of complications under spinal anesthesia is expected, as this technique is more commonly used for both elective and emergency LUCS, and its hemodynamic effects are well-documented.⁷ Hypotension was the most frequent complication under spinal anesthesia, observed in 32.1% of patients. This rate is lower than the 70-80% reported in some western cohorts.⁷ but comparable to recent studies from south Asian populations where prophylactic vasopressor use is routine.¹⁵ The lower incidence in this study may be attributed to routine left uterine displacement, cautious fluid preloading, and timely administration of phenylephrine or ephedrine. Bradycardia (12.5%) and nausea/vomiting (8.9%) were almost always secondary to hypotension and resolved promptly with vasopressor therapy.¹⁶ Post-dural puncture headache

occurred in 5.4% of spinal anesthesia cases, which falls within the expected range of 1-7% following accidental dural puncture with a 25-gauge Quincke needle.¹⁷ Conservative management was successful in most cases; however, four patients (66.7%) required extended PACU stay. None required an epidural blood patch, which is consistent with resource-limited settings where this intervention is often deferred.¹¹ Among the rare complications under spinal anesthesia, high spinal block occurred in two patients (1.8%). Although the expected incidence is less than 1%, the slightly higher rate in this study may reflect the use of hyperbaric bupivacaine without dose adjustment for short-statured women, a recognized risk factor.¹⁸ Both cases were managed successfully with vasopressors and supplemental oxygen without requiring endotracheal intubation, supporting current management guidelines.⁷ Transient radicular irritation was observed in one patient (0.9%), typically presenting as temporary burning pain in the lower extremities, which resolved spontaneously within 48 hours without sequelae.¹⁹ Under general anesthesia, desaturation was the most common complication (7.8%), followed by failed intubation on the first attempt (3.9%). The failed intubation rate in this study is higher than the 1:250 to

1:500 reported in high-resource settings.¹⁰ But comparable to figures from low- and middle-income countries where difficult airway equipment and skilled assistance may be less available.²⁰ Importantly, no patient required emergency surgical airway, and all cases were rescued by either converting to spinal anesthesia or inserting a laryngeal mask airway. Bronchospasm occurred in one patient (2.0%) and was managed effectively with inhaled salbutamol and intravenous hydrocortisone. This complication is more common in asthmatics or following histamine-releasing drugs such as atracurium.²¹ Anaphylaxis to rocuronium (2.0%) was the rarest and most serious complication encountered. The incidence of perioperative anaphylaxis to neuromuscular blocking agents ranges from 1:10,000 to 1:20,000 in general populations, but may be higher in obstetric patients due to prior sensitization.^{12,22} The single case in this study was successfully managed with intravenous adrenaline, chlorpheniramine, and hydrocortisone, though it required ICU admission- highlighting the need for immediate availability of resuscitation drugs and allergy protocols in all obstetric operating theaters.²³ Comparing outcomes between anesthesia techniques, complete intraoperative resolution of complications was achieved in 92.3% of spinal cases versus 66.7% of general anesthesia cases, though this difference did not reach statistical significance ($p=0.058$). The trend toward better outcomes under spinal anesthesia may reflect the transient, easily reversible nature of hypotension and bradycardia compared to airway-related complications under GA.²⁴ No maternal mortality occurred, which aligns with recent prospective audits from similar settings.²⁵ The findings underscore the importance of structured per-operative monitoring, availability of emergency drugs, and regular training in managing uncommon but life-threatening events such as high spinal and anaphylaxis. Limitations of this study include single-center design, purposive sampling, and relatively small numbers of rare events, which preclude definitive conclusions about their true incidence.

This single-center study with purposive sampling limits generalizability. The small sample size precludes definitive incidence estimation for rare complications. Causality cannot be established due to the observational design. Selection bias may have influenced group allocation.

CONCLUSION

Per-operative anesthetic complications during LUCS are common, with hypotension under spinal anesthesia being the most frequent. Rare complications, including high spinal, transient radicular irritation, and anaphylaxis, though uncommon, require prompt recognition and protocol-driven management. Both spinal and general anesthesia can be administered safely with favorable maternal outcomes when complications are anticipated and treated appropriately. Ongoing training and availability of emergency drugs remain essential.

Recommendations

Routine intraoperative monitoring protocols, regular drills for rare events (high spinal, anaphylaxis), and immediate availability of vasopressors, adrenaline, and difficult airway equipment should be mandatory in all obstetric operating theatres performing LUCS.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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