

Complications Associated with Spinal Anesthesia in Caesarean Section: A Retrospective Review of Maternal Outcomes

Rajni Kalia¹, Shuchi²

¹Senior Resident, Department of Anesthesiology, Government Medical College and Hospital, Chandigarh, India.

²Attending Consultant, Department of Anaesthesia and Intensive Care, Max Superspeciality Hospital, Mohali, India

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Corresponding Author: Dr. Shuchi

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Abstract:

Background: Spinal anesthesia is the most popular anesthetic technique used for caesarean section because of its rapid onset, simplicity, cost effectiveness and favorable mother and newborn outcomes. However, it is associated with a number of maternal problems that might impact perioperative recovery and patient satisfaction. Continuous evaluation of these problems is necessary to improve the quality and safety of obstetric anesthesia care.

Objective: To study the complications of spinal anesthesia in women undergoing caesarean section and to study the maternal outcome following the procedure.

Methodology: A descriptive observational study was carried out on retrospective basis in Department of Anesthesiology, Government Medical College and Hospital, Chandigarh, India. Methods We analyzed the medical records of 120 women who had an elective or emergency caesarean section under spinal anesthesia over a one-year period. Demographic information, parity, mode of admission, anesthesia-related problems and maternal outcomes were gathered and analyzed by descriptive statistical methods.

Results: The majority of patients belonged to the reproductive age group and were booked prenatal cases. Hypotension was the most common consequence followed by intra-operative nausea and vomiting and post-dural puncture headache. A large number of patients experienced at least one complication; however, most adverse events were moderate, temporary and well handled by routine peri-operative care. No significant life-threatening or lasting neurological consequence reported.

Conclusion: Spinal anesthesia is still a safe and effective technique for anesthesia for caesarean delivery. Maternal problems are relatively common but mostly controllable with adequate monitoring and quick management. Spinal anesthesia should continue to be in obstetric practice.

Keywords: Spinal Anesthesia, Caesarean Section, Maternal Outcomes, Hypotension, Post-Dural Puncture Headache, Nausea And Vomiting, Obstetric Anesthesia, Retrospective Study.

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Introduction

Caesarean section (CS) is one of the most frequent surgical operations performed globally and is an important part of modern obstetric treatment. The worldwide rate of caesarean birth has increased dramatically over the last few decades due to changing obstetric practice, better access to health care facilities and increasing indications for operational delivery in the mother and fetus. The choice of anesthetic approach has become more and more crucial to providing good mother and newborn outcomes with the increasing rate of caesarean sections. Spinal anesthesia has been recommended over other anesthetic procedures in elective and emergency caesarean deliveries due to its rapid onset, reliability, simplicity and favorable safety compared with general anesthesia [1,2].

There are various advantages of regional anesthesia, especially spinal anesthesia during caesarean section. This allows the woman to remain conscious and participate in the birth experience while avoiding the hazards associated with airway manipulation and aspiration that are often seen with general anesthesia [3]. There are physiological changes associated with pregnancy including airway oedema, increased oxygen consumption, decreased functional residual capacity, delayed gastric emptying and relaxation of the gastro-esophageal sphincter which increase the risk of difficult intubation and pulmonary aspiration during general anesthesia [4]. Therefore, spinal anesthesia has become the preferred anesthetic technique for most caesarean deliveries in industrialized and developing countries.

Spinal anesthesia offers good surgical circumstances with good sensory and motor blockage while reducing fetal drug exposure. Furthermore, it provides efficient postoperative analgesia, minimizes maternal stress responses to surgery, minimizes intraoperative blood loss and allows for early maternal newborn bonding [5,6]. Suppression of pain-mediated neuroendocrine responses helps to preserve hemodynamic stability and may lead to enhanced placental perfusion when maternal physiology is well regulated [7]. Spinal anesthesia is economical, takes less drugs and is easier to give. Therefore, it is particularly appropriate in high-volume maternity centers and low-resource health care environments [8].

These have been seen as advantages, although spinal anesthesia is not without complications. Maternal hypotension is still the most frequent and clinically important complication of spinal anesthesia in caesarean section [9]. Sympathetic blockades following administration of intrathecal local anesthetics leads to vasodilation, lower systemic vascular resistance and decreased venous return. This results in a substantial drop in maternal blood pressure. Maternal hypotension not promptly identified and managed might jeopardize uteroplacental perfusion and fetal oxygen supply, resulting in fetal acidosis and poor neonatal outcomes [10]. In severe situations, substantial hypotension may contribute to maternal cardiovascular instability and occasionally cardiac arrest [11].

Apart from hypotension, a host of additional problems can arise following spinal anesthesia. These include nausea and vomiting, shivering, bradycardia, high spinal block, post dural puncture headache, inadequate anesthesia requiring conversion to general anesthesia, respiratory depression, neurological problems and urine retention [12,13]. Most of these problems are temporary and controllable but they can impact greatly on mother comfort, perioperative satisfaction and overall surgical result. The prevalence and severity of these problems may be dependent on patient characteristics, anesthetic method, drug dosage, intraoperative monitoring and institutional policy.

It is important to understand the pattern and frequency of problems related to spinal anesthesia to improve perioperative treatment and increase patient safety. Continuous study of maternal outcomes can allow anesthesiologists to detect risk factors, take preventive measures and enhance treatment procedures. Retrospective reviews in obstetric populations provide important information on actual clinical practice and help to support evidence-based advances in anesthetic care. These findings are particularly pertinent in tertiary care teaching institutions where a high volume of caesarean sections is performed and where there are different patient demographics.

Rates of caesarean birth in India have been increasing steadily, and the need for further study of anesthetic techniques and mother outcomes is warranted. However, differences in patient population, institutional regulations and availability of healthcare resources demand region-specific data on safety and problems of spinal anesthesia. Limited research is available from North Indian tertiary care hospitals examining maternal problems related to spinal anesthesia during caesarean deliveries. Therefore, a complete evaluation of such problems is important to direct therapeutic decisions and improve maternal care.

The present study is undertaken in Department of Anesthesiology, Government Medical College and Hospital, Chandigarh, India. Aim of the study is to retrospectively analyze the complications of spinal anesthesia in women undergoing caesarean section and to assess their maternal outcome. The study is aimed at contributing to the body of knowledge and providing data to improve practice of obstetric anesthesia. The perioperative records are analyzed to determine the frequency and nature of anesthesia-related problems. The findings could help anesthesiologists create techniques for early recognition, prevention and management of problems, and so improve the safety and quality of maternal healthcare.

Methodology

Study Design: The present retrospective descriptive observational study was conducted to examine the maternal complications of spinal anesthesia in patients undergoing caesarean section. An examination of hospital medical records was carried out to determine the incidence and pattern of problems arising after spinal anesthesia.

Study Area: The study was conducted in the Department of Anesthesiology, Govt. Medical College and Hospital, Chandigarh, India.

Study Duration: The investigation was conducted over a period of one year.

Sample Size: The sample for the study was 120 patients. Sample size was established based on the availability of complete medical records of caesarean section under spinal anesthesia during the study period.

Study Population: The study population comprised of pregnant women undergoing elective or emergency caesarean section under spinal anesthesia, at Government Medical College and Hospital, Chandigarh. Maternal demographic data, anesthetic information, intraoperative findings and postoperative outcomes were acquired from hospital records.

Data Collection: Retrospective data was acquired from patient case records, anesthesia charts, operation theatre registration and postoperative monitoring records. Data obtained included; maternal age,

parity, indication for caesarean section, type of operation (elective/emergency), anesthetic technique, intraoperative vital signs and post-operative problems.

The main maternal adverse events associated to spinal anesthesia assessed were hypotension, nausea, vomiting, post-dural puncture headache, shivering, bradycardia and other known maternal bad outcomes.

Inclusion Criteria

- Women aged 20 to 40 years undergoing elective or emergency caesarean section.
- Patients with spinal anesthesia as the single anesthetic approach.
- Availability of full anesthesia and post-operative records
- Caesarean sections conducted throughout the research period.

Exclusion Criteria

- Patients who need conversion from spinal to general anesthesia due to protracted or extensive surgery.
- Patients have a history of coagulopathy or thrombocytopenia.
- Patients with severe hypovolemia or hemodynamic instability prior to surgery.
- Patients with spinal abnormalities and contraindication to spinal anesthesia.
- Patients with pre-existing neurological diseases.
- Patients with severe anemia (Hb <7 g/dL).
- Patients with established pre-operative headache or persistent migraines.
- Medical records are incomplete or missing.

Procedure: individuals was performed. In standard clinical practice, spinal anesthesia had been given in sitting or lateral position with aseptic precautions. A 25-gauge spinal needle was placed in the subarach-

noid space, usually at the L3–L4 or L4–L5 intervertebral area, and hyperbaric bupivacaine was injected as per institutional protocol.

Pulse rate, blood pressure, oxygen saturation and electrocardiogram were continuously monitored during the operation. Anaesthesia records were examined for episodes of hypotension and bradycardia, and blood pressure and heart rate recordings were reported. Intraoperative nausea, vomiting and shivering were recorded from anesthesia charts. Postoperative records were checked for post-dural puncture headache and other maternal problems during the postoperative surveillance period.

Statistical Analysis: The data gathered were imported into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics were employed to summarize data. Continuous variables such as age were expressed as mean $\pm$ standard deviation (SD) while categorical variables such as hypotension, nausea, vomiting, headache, shivering and bradycardia were expressed as frequencies and percentages. Associations between maternal variables and complications were examined by Chi-square test or Fisher's exact test as applicable. Statistical significance was defined as a p-value less than 0.05".

Result

Table 1 shows the age distribution of the participants in the study. The age range of 25–30 years accounted for the most patients receiving caesarean section under spinal anesthesia (73 individuals=60.8%). Next was the 20–25 years age group with 27 (22.5%) patients. The patients aged 31–35 years were 14 (11.7%) of the study group, whereas only 6 (5.0%) patients were between the ages of 36–40 years. The mean age of the participants was 26.8 ± 3.1 years, and this implies that most women were in their late twenties at the time of delivery.

Table 1: Age Distribution of Patients (N = 120)

Age (Years)	Number of Patients	Percentage (%)
20–25	27	22.5
25–30	73	60.8
31–35	14	11.7
36–40	6	5
Total	120	100

Distribution of patients by manner of admission is shown in Table 2. Out of 120 patients, 94 (78.3%) were booked cases who had regular antenatal treatment and follow up and 26 (21.7%) were un-booked

cases. The higher number of booked patients shows improved utilization of ante natal health care in the studied group.

Table 2: Distribution of Cases by Mode of Admission (N = 120)

Mode of Admission	Number of Patients	Percentage (%)
Booked	94	78.3
Un-booked	26	21.7
Total	120	100

The parity distribution of the subjects is shown in Table 3. Of total patients 72 (60.0%) were primigravida and 48 (40.0%) were multigravida. The increased number of primigravida women indicates

that spinal anesthesia was more often used in first pregnancies needing caesarean section in the present study.

Table 3: Distribution of Cases by Parity (N = 120)

Parity	Number of Patients	Percentage (%)
Multigravida	48	40
Primigravida	72	60
Total	120	100

Complications related to spinal anesthesia among the study participants are summarized in Table 4. Hypotension was the most prevalent complication in 43 (35.8%) subjects. Thirty-eight patients (31.7%) had nausea and vomiting intra-operatively. Twelve (10.0%) patients complained of headache, four (3.3%) acquired the symptoms within 12 hours and

eight (6.7%) within 72 hours after operation. Of note, 27 (22.5%) patients did not have any issues connected to spinal anesthesia. These findings demonstrate that despite the overall safety of spinal anesthesia, transitory maternal problems nevertheless occur somewhat frequently.

Table 4: Complications of Spinal Anaesthesia (N = 120)

Complications	Number of Patients	Percentage (%)
Hypotension	43	35.8
Nausea/Vomiting (Intra-operative)	38	31.7
Headache (Total)	12	10
• Within 12 Hours	4	3.3
• Within 72 Hours	8	6.7
No Complications	27	22.5

Table 5 shows the overall maternal outcome following spinal anesthesia. Of the 120 individuals included in the study, 93 (77.5%) had at least one problem and 27 (22.5%) had no recorded issues.

Though difficulties were seen in a considerable number of patients, most of them were mild and controllable. Spinal anesthesia is still a recommended approach for caesarean section.

Table 5: Maternal Outcome Following Spinal Anaesthesia (N = 120)

Outcome	Number of Patients	Percentage (%)
At Least One Complication	93	77.5
No Complications	27	22.5
Total	120	100

Discussion

Spinal anesthesia is the recommended approach for caesarean section due to its rapid start, simplicity, cost-effectiveness and better maternal and newborn outcomes compared to general anesthesia. It offers superior surgical conditions, avoids airway manipulation and reduces the danger of aspiration, particularly well-suited for obstetric procedures. However, spinal anesthesia has various maternal problems that may affect the perioperative results and need quick detection and management, despite these advantages. The present retrospective study was done to examine maternal problems linked with spinal anesthesia among 120 women receiving caesarean sec-

tion and to determine their overall maternal outcomes".

The age distribution of the study population showed that most patients (60.8%) were in the age category of 25–30 years, followed by 22.5% in the age group of 20–25 years. The patients aged 31–35 years and 36–40 years were only 11.7% and 5.0%. These findings show that the majority of women who had caesarean section under spinal anesthesia were within the peak reproductive age group and this is in agreement with the obstetric demographic trend documented in prior studies. In addition, 78.3% of the women were booked cases and 21.7% were un-booked, which indicates superior antenatal surveil-

lance and planned obstetric management in most of the patients. In terms of parity, 60.0% of the study population were primigravida and 40.0% were multigravida. Several obstetric anesthesia studies revealed similar findings with first-time moms comprising a large proportion of caesarean deliveries due to increasing rates of obstetric interventions and elective surgical delivery.

In this study the most common consequence of spinal anesthesia was hypotension, which was seen in 43 participants (35.8%). Hypotension is a well-recognized consequence of sympathetic blockades generated by spinal anesthesia and remains one of the most prevalent intraoperative complications following caesarean delivery. Our results are quite similar to those reported by Somboonviboon et al., [14] who found hypotension in 52.6% of 722 parturient after caesarean surgery under spinal anesthesia. The incidence reported in their study was higher than ours, but both studies demonstrate that hypotension is the most common maternal problem associated with spinal anesthesia. Differences in patient characteristics, vasopressor regimens, fluid management tactics and definitions of hypotension may explain difference in incidence between studies. However, the prevalence of hypotension in more than one-third of our patients underscores the significance of close hemodynamic monitoring and quick intervention in spinal anesthesia.

The second most frequent complication found in our study was intraoperative nausea and vomiting, which occurred in 38 patients (31.7%). Nausea and vomiting are common during spinal anesthesia and are frequently related to hypotension, manipulation of the viscera, or the effects of intrathecal medicines. The incidence seen in the present study is strikingly comparable to that reported in the base study in which roughly 32% of patients had nausea and vomiting during caesarean section under spinal anesthesia. Our results are consistent with the study of Cappelleri et al. who compared general and spinal anesthesia for caesarean delivery and showed that nausea and vomiting were observed more often in women who had spinal anesthesia. These results closely correspond, and further emphasize the importance of preventive interventions, such as sufficient hydration, vasopressor usage, and antiemetic prophylaxis, to increase maternal comfort and perioperative satisfaction.

Another noteworthy problem observed in our study was post-spinal headache in 12 participants (10.0%). Of these, 3.3% had headaches within 12 hours and 6.7% had headaches within 72 hours after the surgery. The incidence noted in our study is less than that reported by L'ubusky et al. [15], who found post-dural puncture headache in 16.7% of women undergoing spinal anesthesia for caesarean section. Our results, however, are in close agreement with another study referenced in the literature that indi-

cated an overall incidence of roughly 11% and that almost 90% of headaches arose within three days after the surgery [16]. The timing pattern of our study also indicated that most headaches occurred within the first 72 hours after spinal anesthesia. The variation in headache incidence between the trials may be due to variations in needle type, needle gauge, patient characteristics, and procedural technique. Post-dural puncture headaches are usually self-limiting but can have a substantial impact on mother wellbeing and delay recovery if not effectively addressed.

The most relevant finding of the present study was that 77.5% of patients developed at least one complication after spinal anesthesia and only 22.5% of patients were free of issues. Most problems were low to moderate in severity and amenable to routine care. However, the need for rigorous perioperative surveillance is emphasized despite the relatively high overall complication rate. Fortunately, there were no serious adverse events reported such as spinal shock, cardiac arrest, subdural hematoma or procedure-related infections. Similar findings were described in other investigations, in which serious neurological and infectious problems were extremely rare in the setting of spinal anesthesia conducted under rigorous aseptic circumstances and by competent anesthesiologists [17].

In general, the results of the present study suggest that spinal anesthesia is still a safe and effective approach for caesarean section despite the incidence of expected maternal problems. The most prevalent adverse events were hypotension, nausea/vomiting and post-spinal headache and their incidence rates were similar to those seen in earlier literature. The absence of serious life-threatening problems also favors the use of spinal anesthesia as the anesthetic modality of choice for caesarean birth, as long as suitable preventive measures and close monitoring are taken in the perioperative phase.

Conclusion

This present study found spinal anesthesia as safe, effective and most recommended technique of anesthesia for caesarean section due to its good mother outcomes and convenience of administration. Though problems were observed in a large proportion of patients, most of these adverse events were moderate, foreseeable and easily managed by proper perioperative monitoring and quick intervention. The most often seen problems were hypotension, nausea and vomiting and post-dural puncture headaches, which are consistent with the recognized physiologic effects of spinal anesthesia in obstetric patients. Importantly, no serious life-threatening or irreversible neurological problems were found, indicating safety in general of the surgery when conducted according to normal clinical standards. The results highlight the significance of close monitoring of the mother, prompt identification of difficulties

and the application of preventive measures for the safety and comfort of the patient. Spinal anesthesia is still a reliable anesthetic technique for caesarean birth generally and is essential for good maternal outcomes in obstetric practice.

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