ISSN (Online): 2279-0594 // ISSN (Print): 2589-8752
Journal of Biomedical and Pharmaceutical Research
Available Online at www.jbpr.in
CODEN: - JBPRAU (Source: - American Chemical Society)
Index Copernicus Value-2018: 88.52
NLM (National Library of Medicine): ID: (101671502)
Volume 7, Issue 6: November-December: 2018, 135-144

Research Article

# A Comparative Study of Spinal Versus General Anesthesia in Emergency Cesarean Delivery

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**Article Info:** Received 15 November 2018; Accepted 22 December. 2018
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**Conflict of interest statement:** No conflict of interest

**Abstract**

**Background:** Anesthesia in haste and safety is needed in the case of emergency Cesarean delivery. Spinal anesthesia and general anesthesia are the most common ones with their advantages and disadvantages that affect the maternal and neonatal outcomes.

**Aim:** To make comparisons between the maternal and neonatal outcomes of spinal and general anesthesia in emergency cesarean delivery.

**Methodology:** The study setting was the department of Anaesthesiology, Gouri Devi Institute of Medical Sciences and Hospital, Durgapur and the retrospective observational study was conducted on one year basis. A total of a hundred emergency cases of cesarean were examined and half of the patients received spinal anesthesia with the remaining half receiving general anesthesia. Data regarding maternal hemodynamics, intraoperative complications, postoperative outcomes and neonatal APGAR scores were collected and compared using statistics.

**Results:** Better neonatal outcomes such as increased APGAR scores at 1 and 5 minutes were observed with the use of spinal anesthesia. Nonetheless, hypotension occurred more common in the spinal group (30%). General anesthesia had increased cases of airway complications and reduced neonatal APGAR scores. Mothers who were in the spinal group recovered faster.

**Conclusion:** Spinal anesthesia is believed to be more beneficial and safer in a situation that requires emergent cesarean section as it is safer despite the close observation that has to be made on the hypotension. In some emergency situations general anesthesia is required.

**Keywords:** Emergency cesarean section, Spinal anesthesia, General anesthesia, APGAR score, Maternal outcomes, Neonatal outcomes

## Introduction

Emergency cesarean section is a life saving obstetric operation done in cases where the life or well being of the mother, the fetus or both is at risk. Symptoms such as fetal distress, placental abruption, uterine rupture, cord prolapse, and absence of progress in delivery necessitate an emergency procedure. In this time-sensitive scenario, the method of anesthetic technique becomes a matter of utmost concern as it directly affects the safety of the mother, fetus, and general perioperative care.

The optimal anesthetic method used during emergent cesarean section must be able to provide rapid onset, sufficient surgical

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anesthesia, and minimal maternal and fetal complications and early postoperative recovery. The two most widely used methods of anesthesia in an emergency environment include spinal anesthesia and general anesthesia among the existing methods. Both methods have their benefits, drawbacks, and exposure to risk and it will be up to the clinical situation, patient condition, and expertise at hand to select the method.

Spinal anesthesia has been extensively used as the method of choice in cesarean section because of its ease, quick attainment of deep nerve paralysis, and limited exposure of the fetus to anesthetics. It enables the mother to be awake during the procedure, enables prompt attachment of the newborn to the mother and prevents the manipulation of airways, which can result in aspiration and hard intubation. Moreover, spinal anesthesia is linked to lower rates of maternal morbidity and mortality as compared to general anesthesia. But it does not come without its complications. Hypotension due to sympathetic blockade is the most frequent side effect that can lead to poor uteroplacental blood supply unless addressed immediately. There are other possible complications such as nausea, vomiting, post-dural puncture headache and in very rare cases, high spinal block.

General anesthesia is however mostly used when there is need to deliver a rapid response or anytime regional anesthesia is contraindicated, e.g. in cases of coagulopathy, severe hypovolemia, infection at the injection site, or patient refusal. It offers quick induction and full control of the airway and the ventilation which can be beneficial during critical emergencies. Nevertheless, there are a number of risks that are related to general anesthesia, among them: hard airways, gastric contents aspiration, hemodynamic instability, and maternal morbidity. Moreover, anesthetic agent use can cause neonatal respiratory depression, which causes low APGAR scores and increased probability of admission to the neonatal intensive care unit (NICU).

Over the past few years, there has been a localized focus on advancing regional anesthesia methods in obstetrics as they have a positive safety profile and better outcomes in neonatal care. Nevertheless, during an emergency situation, the urgency of delivery and the clinical condition of the patient may often be the determinant of anesthesia.

Considering the current controversy and clinical significance of making the right choice regarding the type of anesthetic method, the proposed study is going to compare and contrast spinal and general anesthesia in emergency cesarean section. It is aimed at evaluating changes in maternal hemodynamics, intraoperative events, neonatal outcomes, and postoperative recovery. This type of comparative analysis is essential in the optimization of clinical protocols and the overall maternal and neonatal outcomes in emergency obstetric care.

## Methodology

### Study Design

This was intended to be a retrospective observational comparative study to be used to assess and compare maternal and neonatal outcomes of spinal anesthesia and general anesthesia in emergency cesarean deliveries. The retrospective design was chosen since it allows to perform a systematic study of already registered clinical data during a certain period and offers a possibility, as well as readily available access, to a sufficient number of cases in a real-life clinical setting.

### Study Area

This study was conducted in the Department of Anaesthesiology at Gouri Devi Institute of Medical Sciences and Hospital at Durgapur, West Bengal, India.

### Study Duration

The research was done within one year.

### Study Participants

The study population was the pregnant women who underwent emergency cesarean section in the study center during the mentioned study period.

### Inclusion Criteria

- Women who are pregnant and in the age of 18–40
- Patients undergoing emergency cesarean section for obstetric indications
- Patients categorized as having a physical status I or II according to the ASA
- Cases with complete and well-documented medical records, including anesthetic details and neonatal outcomes

### Exclusion Criteria

- Patients undergoing elective cesarean section
- Patients with severe systemic illness (ASA III and IV)
- Cases of multiple gestations (twins, or greater order pregnancies)
- Patients with incomplete, missing, or inconsistent clinical data
- Cases where conversion between anesthesia techniques occurred intraoperatively

### Sample Size

The study included 100 patients who fulfilled the inclusion criteria. These topics were further subdivided into two categories in terms of anesthetic type applied with 50 patients in the spinal anesthetic and 50 patients in general anesthetic group (Group S and Group G respectively). The sample size was calculated by looking at the availability of complete and reliable clinical records in the course of the study and equal distribution was insisted to maintain a balanced and objective comparison of the two groups.

### Study Procedure

Retrospective data were then elicited using a structured proforma, which was founded on hospital records, anesthesia charts and operation theater registers. Rapid sequence induction including endotracheal intubation and inhalational maintenance, and spinal anesthesia at L3-L4 0.5% hyperbaric bupivacaine under aseptic conditions were used to perform the general anesthesia and spinal anesthesia, respectively. The parameters of data were: maternal (BP, HR, complications), intraoperative, neonatal (APGAR scores, NICU admission), and postoperative recovery. The ethical approval was granted by the Institutional Ethics Committee of Gouri Devi Institute of Medical Sciences and Hospital and the patient confidentiality was taken care of.

### Statistical Analysis

SPSS version 25.0 (IBM, USA) was used to analyze data obtained. The mean ± standard deviation (SD) of age and blood pressure were used as continuous variables, and the frequencies and percentages (percentage) of the categorical variables (complications and APGAR score categories) were used. Continuous variables were compared through the aid of the independent t-test; categorical variables through the aid of the chi-square test or Fisher exact test to compare the spinal and general anesthesia groups. The statistically significant p-value was considered 0.05 ($p < 0.05$) and this implied that there is a significant difference between the two groups.

### Results

The sample of the study was 100 patients undergoing emergency cesarean section (50 patients in the spinal anesthesia (Group S)) and 50 patients in the general anesthesia (Group G) group. The findings were compared and evaluated based on the demographic features, maternal hemodynamic changes, newborn outcomes, intraoperative and postoperative complication.

| Table 1: Demographic Characteristics of Study Participants (n = 100) | | |
|---|---|---|
| **Parameter** | **Spinal (n=50)** | **General (n=50)** |
| Mean Age (years) | 26.8 ± 4.2 | 27.1 ± 3.9 |
| BMI (kg/m²) | 24.2 ± 2.1 | 24.5 ± 2.3 |
| Primigravida (%) | 52% | 48% |

Table 1 show that spinal anesthesia group and general anesthesia group were similar regarding the variables used as baseline, which made the outcomes fairly and unbiased to compare them. The mean of the patients in spinal group was 26.8 +4.2 years and in general anesthesia group was 27.1 +3.9 years with a very low standard deviation value which means that distribution of age group was almost similar in both spinal and general anesthesia group. Similarly, the mean body mass index (BMI) of the spinal group and general anesthesia group were 24.2 + 2.1 kg/m2 and 24.5 + 2.3 kg/m2 respectively with most of them being in the same nutritional and physical state. As to obstetric features, the percentage of primigravidas was a bit more in the spinal anesthesia group (52) compared to the general anesthesia group (48) but was not significant. On the whole, these results indicate that there was no significant difference between these groups regarding the demography and the baseline clinical features, thus, demonstrating that the differences in maternal or neonatal outcomes could have been ascribed to the type of anesthesia, and not to the demographic factors.

| Table 2: Maternal Hemodynamic Changes | | |
|---|---|---|
| **Parameter** | **Spinal (%)** | **General (%)** |
| Hypotension | 30% | 10% |
| Tachycardia | 18% | 22% |
| Nausea/Vomiting | 20% | 8% |

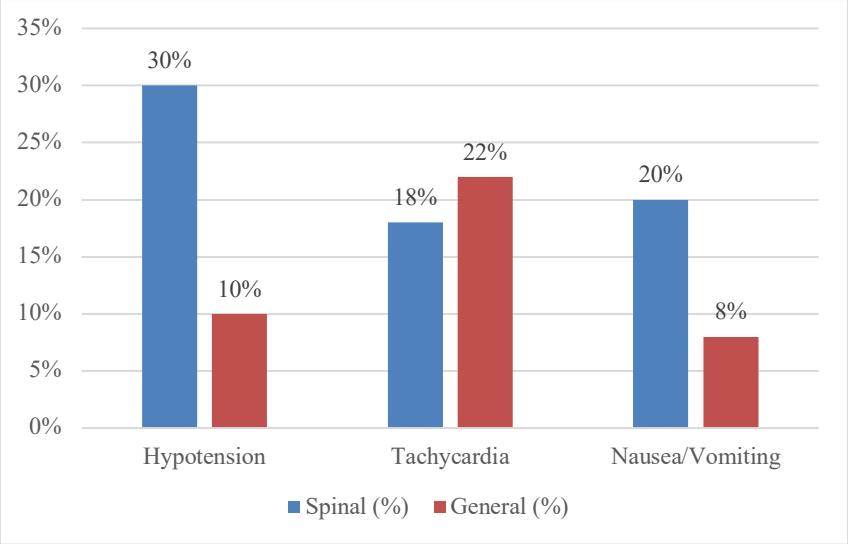


**Figure 1: Graphical presentation of Maternal Hemodynamic Changes**

Table 2 report significant variations between the spinal and general anesthesia groups. The incidence of hypotension was much higher in the patients undergoing spinal anesthesia (30 %) when compared to those undergoing general anesthesia (10 %), and this is due to the sympathetic blockage that comes with use of the spinal anesthesia resulting to vasodilation and reduced systemic vascular resistance.
However, tachycardia was a little bit more prevalent in the group of general anesthesia

(22 vs. 18) perhaps due to physiological reaction to intubation, influence of anesthetic drugs and surgical stress. In addition, the frequency of nausea and vomiting in the spinal anesthesia group (20) was greater than that of the general anesthesia group (8) which usually accompanies hypotension and vagal stimulation during regional anesthesia. On the whole, these results indicate that although spinal anesthesia is linked to a greater extent of hemodynamic variability, specifically, hypotension and other related symptoms, these events can be largely anticipated and countered with proper intraoperative monitoring and supplementary interventions.

**Table 3: Neonatal Outcomes**

| Outcome | Spinal | General |
|---|---|---|
| APGAR <7 at 1 min | 10% | 28% |
| APGAR <7 at 5 min | 4% | 16% |
| NICU Admission | 8% | 20% |

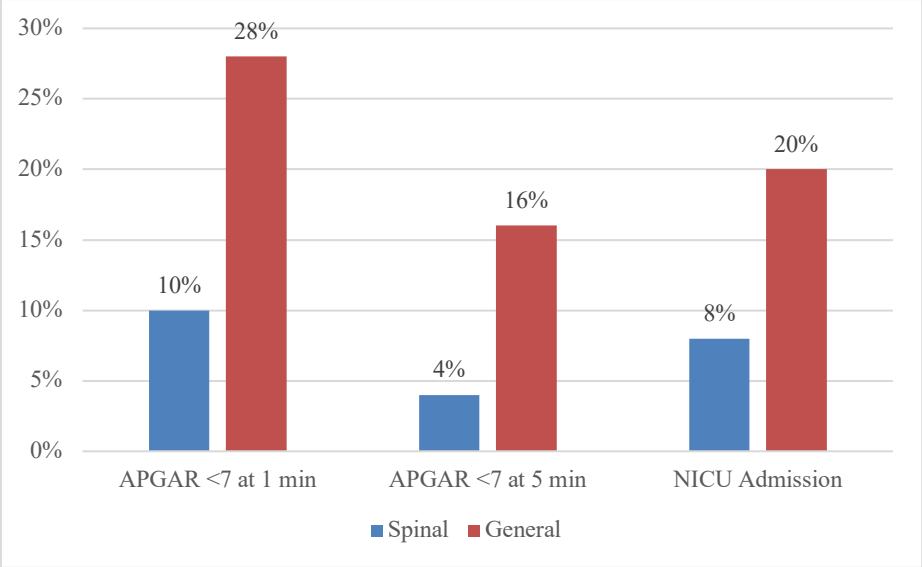


**Figure 2: Graphical presentation of Neonatal Outcomes**

Table 3 show a definite benefit of spinal anesthesia versus general anesthesia. The proportion of APGAR score less than 7 at 1 minute was very low in the spinal anesthesia group (10%), in contrast to the general anesthesia group (28) and showed a better immediate neonatal condition in the group with a spinal anesthesia. In line with this, the proportion of neonates with an APGAR score of less than 7 in 5 minutes was only 4 per cent in the spinal group, compared to 16 per cent in the general anesthesia group, showing that there is more enduring neonatal depression that occurs with the use of general anesthesia. Furthermore, the rate of NICU admission in spinal (8% versus general 20%), also declined significantly, which can be explained by the improved overall neonatal outcomes and a reduction in the intensive care needs. These findings are indicative of the fact that spinal anesthesia is associated with better neonatal physiological status, most likely due to less exposure to the action of the anesthetic drugs in question and due to the non-occurrence of respiratory depression that is seen with general anesthesia.

| Table 4: Intraoperative Complications | | |
|---|---|---|
| **Complication** | **Spinal (%)** | **General (%)** |
| Airway issues | 0% | 12% |
| Aspiration risk | 0% | 6% |
| Failed technique | 4% | 2% |

Table 4 differ in the two methods of anesthesia. It is interesting to note that airway-related complications were not observed in the spinal anesthesia population (0%), whereas they were observed in 12% of patients in the general anesthesia population, demonstrating the fact that airway management is a rather risky process, and challenging cases of intubation and difficulty in ventilating patients can be observed. In the same manner, only in the general anesthesia group, there was a risk of aspiration (6%), which can be explained by the loss of protective airway reflexes during induction and intubation. Conversely, spinal anesthesia does not involve manipulation of the airways, hence, removing these risks. Nevertheless, the incidence of failed anesthesia technique was a little more in the spinal group (4%), than in the general group (2%), perhaps because of technical difficulties in performing the block, or insufficiently spreading anesthetic. All these findings indicate that the risk of spinal anesthesia technical failure is low, but the prevalence of severe intraoperative events, especially those linked to airway control, is lower with this method, so it is safer in most instances.

| Table 5: Postoperative Recovery | | |
|---|---|---|
| **Parameter** | **Spinal** | **General** |
| Early mobilization | 70% | 40% |
| Post-op pain (moderate–severe) | 20% | 35% |

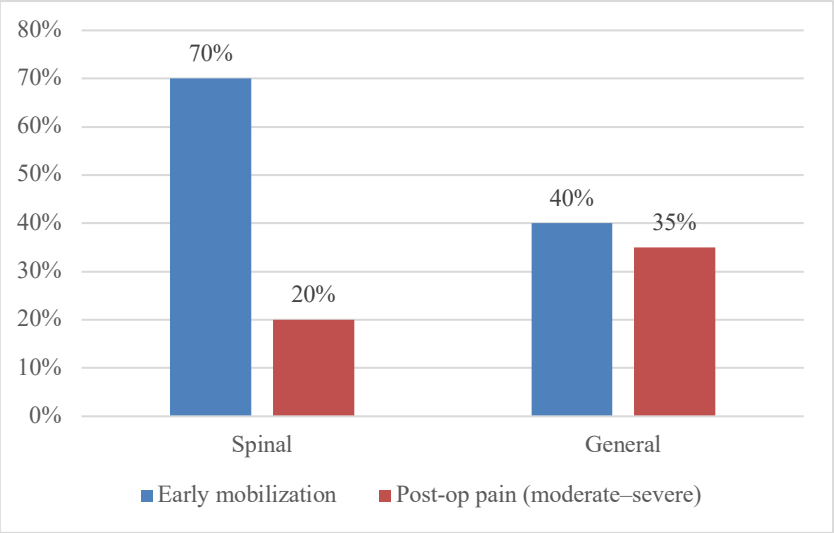


**Figure 3: Graphical presentation of Postoperative Recovery**

Table 5 shows an indicator of an obvious benefit of spinal over general anesthesia. In 70 % of the patients compared to 40 % in the general anesthesia group, spinal anesthesia was more likely to lead to early mobilization, thus demonstrating that spinal anesthesia would lead to quicker functional recovery and reduced postoperative morbidity. This may be attributed to the prevention of systemic anesthetic effect and promotion of physiological stability. Also, the moderate or severe postoperative pain was also less in the spinal group (20 %) than in the

general group (35 %) which could be attributed to the remaining analgesic effect of intrathecal anesthetic drugs. On the contrary, patients who undergo general anesthesia might have greater postoperative pain, which necessitates the increased analgesic care. All in all, these results show that spinal anesthesia has a role to play in the achievement of better postoperative recovery, reduced patient discomfort, and possibly reduced hospitalization as compared to general anesthesia.

**Discussion**

The present article provides a comparative study of spinal and general anesthesia in emergency cesarean section, their maternal and neonatal outcomes, intra- and postoperative complications, and hemodynamic changes. This study reveals that spinal anesthesia possesses several advantages over general anesthesia particularly to the health of the baby and postpartum healing of the mother but has a few complications which can be easily addressed.

Some of the key findings of this study included the fact that the neonatal outcomes of the spinal anesthesia group had increased. Babies born with assistance of spinal anesthesia scored higher in APGAR at 1 minute and 5 minutes compared to those that were born with assistance of general anesthesia. This is primarily due to the minimal diffusion of anesthetic agents across the placenta with spinal anesthesia. On the other hand, general anesthesia involves intravenous and inhalational drugs, which can cross the placental barrier, and lead to respiratory depression in babies. Probably this is a drug effect, and this may be the reason why the proportion of lower APGAR scores and higher NICU admissions were higher in general anesthesia group. These findings are consistent with the available literature, which indicates the benefits of regional anesthesia in preserving neonatal physiological states.

Despite its advantages, the current research has discovered that spinal anesthesia was associated with increased maternal hypotension rate. About 30 % of spinal group patients experienced hypotension but 10 % of general anesthesia group patients. Sympathetic blockade is known to lead to vasodilation and reduced systemic vascular resistance. Hypotension, once unattended, can have a negative impact on uteroplacental perfusion and potentially fetal oxygenation. However, left uterine displacement is also a complication that can be appropriately addressed with the assistance of appropriate preventive measures, such as preloading or co loading with intravenous fluids and the use of vasopressors such as ephedrine or phenylephrine. Consequently, hypotension can still be a reason to be worried, yet it can be anticipated and managed in the clinical practice.

Even though this approach is advantageous when it comes to emergency induction and urgent surgery, in this study, there is a list of maternal and neonatal risks associated with general anesthesia. Airway-related complications include difficult intubation and aspiration risk, which were only seen in the general anesthesia group. In pregnancy, physiological changes affect airway edema, reduced functional residual capacity, a greater oxygen uptake rate and all this contributes to a greater risk of airway complications during a general anesthesia. All these dangers highlight the significance of being careful on airway check and preparation when using general anesthesia to work in obstetric emergencies.

In addition, the researchers discovered that the postoperative recovery was far more positive in those who were undergoing the spinal anesthesia. There was a higher percentage of early mobilization in the patients of the spinal group and low percentage of moderate to severe postoperative pain. This may be due to remaining analgesic effect of the spinal anesthesia that provides proper analgesia in

the immediate postoperative period. On the other hand, patients who have general anesthesia may experience slow recovery due to the systemic action and activity of anesthetic drugs and even require higher amounts of postoperative analgesics.

The overall findings of this research do agree with the literature put out previously, which would always be inclined towards the use of the regional anesthesia methods, particularly spinal anesthesia, in the cesarean section where feasible. It has been associated with reduced morbidity in the mother, improved newborn outcome and optimal postoperative recovery. However, it is necessary to mention that the choice concerning anesthesia in case of an emergency cesarean section must be individualized, relying on the urgency of the situation, condition of the mother, contraindications to regional anesthesia, and competence of the anesthesiologist.

Even in very emergency situations, when it is the cesarean section category I where the baby or mother is at risk of facing the compromised and therefore requires delivery immediately, general anesthesia can be the most appropriate and life-saving option due to its rapid response. Therefore, spinal anesthesia should be used; however, there are some clinical conditions when general anesthesia is a critical requirement.

Overall, this paper has advocated the importance of adopting the most appropriate anesthetic technique based on a balanced approach to the safety of the mother, the health of the fetus, and the clinical urgency. The findings indicate that spinal anesthesia is the technique that best fits most emergency cesarean section cases with general anesthesia mainly being applied in special situations where an immediate response is required or the case has contraindications to regional anesthesia.

## Conclusion

The present study demonstrates that spinal anesthesia is more efficient and safer application of emergency cesarean delivery with improved neonatal outcomes, reflected by high APGAR scores and low NICU admission, and maternal outcomes, such as an early mobilization and lower postoperative pain. The chief contributing factors to these benefits include low exposure of fetus to anesthetic agents, and no manipulation of the airways. Although the spinal anesthesia is associated with a higher incidence of maternal hypotension, the latter can be predicted and managed with success in case of appropriate intraoperative monitoring, fluid replacement, and vasopressor therapy. However, despite its connection with an increased risk of neonatal respiratory depression, airway problems, and aspiration, general anesthesia remains an inescapable option in cases, when urgent action is required, or when regional anesthesia is contraindicated. Therefore, the selection of anesthesia should be made on the basis of the urgency of the condition, maternal and fetal conditions, and clinical judgment. Overall, spinal anesthesia should be applied when an option and the general anesthesia should be applied when there is a choice with careful patient selection and monitoring of their perioperative conditions being crucial to achieve the best maternal and neonatal outcomes.

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