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RESEARCH ARTICLE
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A COMPARATIVE STUDY ON THE EFFECTS OF SPINAL VERSUS GENERAL ANAESTHESIA ON APGAR SCORE OF THE NEONATES AMONG PATIENTS ENDURING ELECTIVE CAESAREAN SECTION

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ABSTRACT

Objectives : The purpose of this research is to establish the use of spinal versus general anesthesia for elective caesarean section and how it affects the Apgar score among neonates together with the maternal and neonatal outcomes.

Materials and Methods : A cross-sectional study was planned among 200 women who were planned for elective cesarean sections at multiple centers incuding Department of Anesthesiology, Isra University Hospital Hyderabad, Pakistan and Department of Anaesthesiology and Surgical ICU Liaquat University of Medical and Health Sciences Hospital Jamshoro Hyderabad, Pakistan. Participants were divided into two groups based on the type of anesthesia administered: Local anesthesia that involves the use of spinal anesthesia and general anesthesia. Maternal characteristics, initial apgar scores, and neonates that required resuscitation were recorded and compared.

Results : These studies revealed neonates who were delivered under spinal anaesthesia had better mean Apgar scores at 1 minute as compared to those delivered under general anaesthesia. Nevertheless, spinal anaesthesia was found to increase the rate of maternal hypotension and vasopressor use. Neonatal resuscitation rate was however higher in general anaesthesia but maternal haemodynamics were more stable during the procedure.

Conclusion : Regarding the neonatal Apgar scores, spinal anesthesia has little advantage compared with epidural anesthesia but has more impact on maternal cardiovascular stability. Each of these two sorts of anesthesia has relative merits and demerits; they cannot be delivered in an impersonal manner.

Keywords: Spinal anaesthesia, general anaesthesia, Apgar score, elective caesarean section, maternal health, neonatal outcomes, Pakistan.

INTRODUCTION

This paper focuses on the effect of the mode of anesthesia used during elective cesarean sections in terms of its impact on maternal and neonatal mortality. Of all the forms of anesthesia, the most widely

used methods are spinal anesthesia and general anesthesia both of which affiliation differs concerning their effect on the mother and the neonate. Newborns' health condition is usually evaluated with Apgar score during the initial minutes after birthing, and this has often been used to measure the impact of these anesthetic techniques on neonates. This paper seeks to analyze how spinal anesthesia and general anesthesia affect the Apgar scores among children born through an elective CS and the impact of such anesthesia methods on newborn welfare and security.

Spinal anesthesia has subsequently emerged to be popular because of its benefits in giving adequate analgesia during a cesarean section while making the mother wake and strategic throughout the procedure. Unfortunately, general anesthesia is occasionally required, especially where the regional anesthesia is contraindicated in the mother (1); however, it is accompanied by certain risks, such as complications involving airway management and slow post-operative mobilization (1). Prior research has pointed out that maternal satisfaction with spinal anesthesia is better, and postoperative pain and systemic complication rates are reduced and thus should be a preferred option for elective CS (2). However, the influences on the neonate Apgar score that evaluates the heart rate, respiratory effort, muscle tone, reflex activity, and skin hue remains unclear to relate with general anesthesia and, therefore, needs further study to set standard comparisons.

The impact of anesthesia on cesarean section developments that occurred postnatally and before or during the neonatal period has been stressed in several works. Khan et al. (2022) analyzed the effects of anesthesia modalities in setting up neonatal Apgar ratings and concluded that spinal anesthesia drew better Apgar scores than general anesthesia during patients receiving elective CS. Indeed, the status of the neonate during the immediate postoperative period, as represented by the Apgar score, is an important marker of neonatal health. In this regard, the higher Apgar score indicates that the newborn is in a better position to adapt to the extrauterine environment and recognize and manage complications the newborn potentially may develop (3).

However, as will be shown in the paper, the impact of spinal anesthesia on the neonate depends on factors such as the dose of the anesthetic agents used, the level of blockage, and the duration of the procedure. Regional anesthesia, particularly spinal anesthesia, avoids the use of these general anesthetic drugs that are likely to depress neonatal respiration and circulation (4). General anesthesia may be characterized by an intravenous or inhaled agent and necessarily be followed by a temporary decrease in uterine tone and, therefore, reduced placental blood flow with a likely corresponding percentage of Apgar scores in neonates (5).

As already stated, other maternal factors can affect neonatal outcomes, including age, comorbidities, and adjuvants admins ephedrine; hypotension resulting from spinal anesthesia is combated, and the study shows improved maternal and neonatal continuity, which enhances the Apgar score (6). Furthermore, warm saline rinse or application of external warming device during CS operations can help prevent neonatal hypothermia readjusting the Apgar score after birth as well (7). Consequently, these variables must be kept constant in any comparison study between the different techniques of anesthesia.

Another factor that has to be taken into consideration is the new tendency to use regional anesthesia with other agents, fentanyl, for example, which provides for the improvement of the analgesic effect and, at the same time, diminishes the concentration of LA used (8). These changes in anesthetic practice may affect both the maternal perception of the procedure and the neonatal outcome, reason why we need to consider these possible confounders when comparing spinal and general anesthesia.
This study thus seeks to extend current knowledge by undertaking a comprehensive analysis of the impact and relative differences of spinal anesthesia and general anesthesia on Apgar scores of newborns who undergo elective LSCS. In light of the varying neonatal outcomes, as assessed by

Apgar scores, this study will provide useful information concerning the appropriate method of anesthesia for elective CS cases. The findings of this study will help to build knowledge on safety for both maternal and neonatal populations and will guide clinical management practices that enhance both maternal comfort as well as neonatal well-being.

Lastly, the selection of the type of anesthesia for elective cesarean section can have a serious impact on the neonatal, especially as measured by Apgar scores. Newborns could benefit from spinal anesthesia, which is reported to have fewer maternal complications and faster post-operative recovery processes. However, it is possible that these effects combine in some way and that the nature of these effects, particularly regarding the subsequent Apgar score, can be clarified in comparative studies rather like the present investigation. The effects of different anesthetic techniques on neonatal well-being and the mechanisms used to make these decisions can be beneficial for modifying existing clinical procedures to provide better birthing conditions for the mother and the baby (9).

Objective: The purpose of this study is to establish the difference between the spinal anesthetic technique and general anesthetic technique on the Apgar score of neonates who were born through elective cesarean section. The proposed study will compare which of these two anesthetic methods gives better neonatal outcomes and aligns safer anesthetic use in CS procedures.

MATERIALS AND METHODS

Study Design: This is a comparative, prospective, observational study aimed at comparing the impact of spinal anesthesia and general anesthesia on the Apgar score of neonates born via elective LSCS.

Study setting: The proposed study was conducted at multiple centers incuding Department of Anesthesiology, Isra University Hospital Hyderabad, Pakistan and Department of Anaesthesiology and Surgical ICU Liaquat University of Medical and Health Sciences Hospital Jamshoro Hyderabad, Pakistan.

Duration of the study: The study was carried out for one year, from August, 2023 to July, 2024 to ensure enough patients are admitted, data collected and analyzed.

Inclusion Criteria

The eligibility criteria for recruitment into this study were drawn in a way that would afford a comparative analysis of elective patients under spinal and general anesthesia. To ensure strict comparability, only women of 18 to 40 years who were electively delivered through cesarean sections were selected for this study. The participants had to be carrying a single-term fetus, with gestational ages between 37 and 40 two weeks.

Exclusion Criteria

These were as follows to reduce factors that would influence the outcome; Patients with a history of other types of substance abuse or dependence were excluded. Participants with conditions that predispose them to complications associated with spinal or general anesthesia were also excluded, including those with allergies or reactions to anesthetic agents. Furthermore, the study did not involve women who were pregnant or breastfeeding their children and those who had had complications when pregnant, such as preeclemptic seizures or when the child was in distress. The study excluded emergency cesarean sections to keep the situation more stable and elective. Conversely, some characteristics rejected from the study because they probably affected the anesthetic outcome were serious medical diseases, including heart diseases or diabetes type 2 complications. Finally, the women with multiple pregnancies were rejected because their cases would introduce extra factors that could interfere with the type of anesthesia or the well-being of the neonates.

Methods

The study will include 100 patients scheduled for elective cesarean section, randomly divided into two groups: the first patient will receive spinal anesthesia, while the other will receive general anesthesia. Group 1 will receive spinal anesthesia, where 0.5% hyperbaric bupivacaine will be used, and Group 2 will receive general anesthesia using Propofol induction and isoflurane maintenance. The first endpoint, 1- and 5-minute Apgar scores, will be assessed and documented by the attending pediatrician. Some maternal parameters, like blood pressure, pulse rate, and oxygen saturation levels, will be measured on a real-time basis. Data on perinatal outcomes, such as Apgar scores, the necessity of neonatal resuscitation, and the frequency of neonatal disorders (for example, respiratory distress), will be recorded.

Additional anthropometric measurements, namely age, BMI, and gestational age will also be obtained. Quantitative data will be analyzed using the independent sample's t-tests and chi-squared tests, and mean Apgar scores will be compared at $p < 0.05$.

RESULTS

The patient sample comprised 100 subjects, fifty in each of the two anaesthesia groups. Patients' demographic profile and basic information are presented in Table 1.

Table 1: Demographic Characteristics of Study Participants

Variable	Spinal Anaesthesia Group (n=50)	General Anaesthesia Group (n=50)	p-value
Age (years)	29.6 ± 4.2	30.1 ± 3.9	0.54
BMI (kg/m²)	25.2 ± 3.1	25.6 ± 3.5	0.72
Gestational Age (weeks)	38.5 ± 1.1	38.3 ± 1.2	0.43
Parity	25/25	26/24	0.83

As far as possible the maternal blood pressure and heart rate were recorded before, during and after the procedure was carried out. The frequency of hypotension, a typical side effect of spinal anesthesia was 40% higher in the spinal anesthesia group in comparison with 12% in the general anesthesia group. The findings of maternal vital signs and complications during surgery are reviewed in table 2.

Table 2: Maternal Vital Signs and Complications

Variable	Spinal Anaesthesia Group (n=50)	General Anaesthesia Group (n=50)	p-value
Maternal Hypotension (%)	40	12	0.001
Maternal Heart Rate (bpm)	82 ± 10	85 ± 9	0.16
Maternal Oxygen Saturation (%)	98 ± 1.5	97 ± 2	0.15
Need for Vasopressors (%)	25	6	0.004

The neonatal Apgar scores at 1 minute and 5 minutes are as follows: The findings are presented in table 3. Mean Apgar scores in the spinal anesthesia group recorded slightly higher scores at both

intervals of time and this difference was statistically significant at the 1-minute Apgar score (p= 0.03). Although, comparing the outputs no significant difference was found at 5 minutes time (p = 0.12).

Table 3: Neonatal Apgar Scores at 1 and 5 Minutes

Apgar Score Time	Spinal Anaesthesia Group (n=50)	General Anaesthesia Group (n=50)	p-value
1 Minute Apgar Score	8.2 ± 0.6	7.7 ± 0.8	0.03
5 Minute Apgar Score	9.5 ± 0.5	9.4 ± 0.6	0.12

Another variable that was captured was the need for neonatal resuscitation. Neonatal resuscitation was required in 6 patients (12%) in the GA group and only in 3 patients (6%) in the SA group. Although the results differed significantly, the comparison was not statistically significant (p=0.22). In the last case, although spinal anesthesia was associated with slightly better neonatal Apgar scores at 1 minute, fewer maternal complications like hypotension were recorded under general anesthesia. More investigation is necessary to assess the results and to determine whether these disparities in Apgar scores persist in affecting neonatal health.

Discussion: Thus, the findings of this study compared the spinal and general anesthesia on the neonatal outcomes of elective Caesarean sections. Based on the implications, it was observed that although spinal anesthesia yields slightly better neonatal Apgar scores, the given maternal risk, particularly hypotensive, is considerably higher. This observation is in parallel with earlier findings that spinal anesthesia is at least as much as 50 percent more likely to cause a complication such as maternal hypotension compared to general anesthesia (Hasan et al., 2023; Khan et al., 2022). In this study, we found that the rate of vasopressor use to manage hypotension was much higher in the spinal anesthesia group, which again shows that spinal anesthesia might cause hemodynamic stress to the mother.

Hypotension is a known consequence of spinal anesthesia, particularly during cesarean sections. The reason for this is the. Sympathetic nerve blockage is caused by spinal anesthesia, which leads to vasodilation and, thus, less venous return. Therefore, normal blood pressure is reduced (Ahmad et al., 2024). This is mostly treated with vasopressor agents such as ephedrine or phenylephrine which are used to ensure an individual has enough blood pressure. The spinal anesthesia group in this study had a higher proportion of hypotension cases, also concordant with other previous studies. Nevertheless, the frequency of vasopressors was less in the general anesthesia group, evidenced by the direct control of blood pressure during general anesthesia by drugs like propofol and overall stability during the plane of isoflurane.

As for newborns, in the spinal anesthesia group, there were higher Apgar scores at 1 minute with regard to newborns, which is an auspicious sign in regard to the first adverse effects noted in the mother's status. A higher score obtained at 1 minute shows that the neonatal condition at the delivery time reflects that the baby did not have problems with ventilation soon after birth, and there was no initial distress. This result is in parallel with the study conducted by Khan et al. (2022), who also reported slightly better neonatal Apgar scores in the spinal anesthesia group as compared to general anesthesia. The variation in the scores at 1 minute after birth may be a result of the impact of spinal anesthesia on maternal hemodynamics, which indirectly has a positive influence on maintaining fetal oxygenation during the whole process of delivery. At 5 minutes, however, the previous differences between the two groups were no longer statistically significant, indicating that while spinal anesthesia may have small beneficial effects on neonatal health, this may not be sustained.

Although numerically insignificant and not statistically interpretable, a reasonably high incidence of resuscitation requirements in the general anesthesia group triggers questions related to the adequacy of fetal oxygenation as well as intraoperative adversity. In the case of neonates requiring resuscitation, several factors may come into play that affect oxygenation during delivery, including, but not limited to, the management of anesthesia and surgical factors in the mother, her general health and condition, and that of the fetus. General anesthesia that results in a transient periodic reduction in the uterine blood flow and demand of oxygen for the fetus may have caused the increased rate of newborn resuscitations in this group (Rajabi et al., 2020). It is especially true during cesarean section sections where anesthesia has a role to play in maintaining the best state for the mother and the fetus.

The results also convey that even though spinal anesthesia has some postulated benefits in the neonatal period, it comes at the cost of maternal hemodynamic stability. Previous authors, as noted by Uluc et al. (2024), reported a higher rate of hypotension, and thus, vasopressors raise concern about the clinical events in the spinal anesthesia group. While general anesthesia might have a stable effect on maternal hemodynamics, it might present new risks for neonates, including resuscitation needs and possible changes in fetal oxygen levels.

Therefore, it emphasizes the need to choose the correct anesthetic technique depending on the pathology or specific characteristics of the patient. Although spinal anesthesia is still the most frequently used anesthetic technique for cesarean sections because of pain and maternal comfort, the technique has its downside in certain specific categories of patients, such as in cases of potential hypotensive patients or patients with cardiovascular diseases. On the other hand, general anesthesia seems safer for some of the patients, especially where there are contraindications to spinal anesthesia for the mother,r, but it has other risks to the neonate that should be considered.

Here are several limitations that should be mentioned in the present study. While the patient numbers may be large enough to make the first level of analysis feasible, the actual sample size selected might be insufficient to pick up many finer distinctions between the two anesthetic methods. Additionally, the findings of the study excluded patients with emergency caesarian sections or those with some pregnancy complications that may alter the results. The results of the study may thus only apply to the hospital setting of the single-center study design. Moreover, this study revealed the differences in Apgar scores and the rate of resuscitation, but there might thus be competent other neonatal outcomes and satisfaction with anesthesia that can be observed to understand the true effects of anesthetic choice.

Finally, this paper emphasizes both spinal and general anesthesia in newborns during elective cases of cesarean sections. There are some advantages of spinal anesthesia from the neonate view based on Apgar scores but more disadvantageous complications include hypotension among the maternal. Thus, general anesthesia, which affords better maternal circulation stability, is associated with more frequent neonatal resuscitation compared to regional anesthesia. Future studies employing greater sample sizes and broader patient samples are required to extend such results further and examine other maternal and neonatal implications. The decision on the type of anesthesia most preferred should, therefore, depend on the patient's previous or current health status, risk factors, and the setting of the cesarean section.

CONCLUSION

Therefore, this study highlights the issues surrounding the options in spinal and general anesthesia for an elective LSCS plan focusing on the newborn and mothers' outcomes. In terms of 1-minute neonatal Apgar scores, this study indicates trends in slight advantage in favor of spinal anesthesia, which may be attributable to superior, stable maternal cardiovascular condition during this form of anesthesia. Nevertheless, spinal anesthesia is accompanied by higher risks associated with maternal hypotension

necessitating increased vasopressor administration. However, general anesthesia has clearer and more stable maternal hemodynamics; it has a higher requirement for newborn resuscitation, seemingly indicating poor fetal perfusion. Both techniques of anesthesia have some pros and cons; however, based on the maternal condition, risk factors, and circumstances of the patient, the anesthesia should be chosen. Subsequent studies, including a wider population sample size of postoperative mothers who were given these anesthesia techniques and their neonates, will be needed to determine the implications of these findings on maternal and neonatal outcomes..

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