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A COHORT STUDY COMPARING THE SHORT-TERM OUTCOME OF NEWBORN INFANTS: SPINAL VERSUS GENERAL ANAESTHESIA IN ELECTIVE CESAREAN SECTION.

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ABSTRACT

Background:
During C-sections, general anesthesia is required to guarantee the safety of the fetus and the mother. In this retrospective cohort investigation, average variations in hematocrit and predicted loss of blood, newborn Apgar evaluation at one and five minutes, and postoperative hemodynamic parameters (prior- and following surgery systolic blood pressure, heart rate) were used to compare maternal and fetal results among general and spinal sedation for C-sections. The study aims to compare maternal and fetal outcomes between spinal anesthesia and general anesthesia in elective cesarean sections.

Methods:
A retrospective study was performed on information collected from electronic health records of 227 pregnancies with one child between X to Y; 200 instances were given to the spinal category (n = 100) or general category (n = 100), and 27 cases were excluded.

Results:
The overall organization's afterward hemodynamic results (SBP: 136 ± 16.5 vs. 120 ± 12.5 mmHg, heart rate: 93.0 ± 17 vs. 71.0 ± 12.5 beats per min, $P < 0.001$) were significantly greater than those of the spinal category. Furthermore, a statistically significant distinction was observed ($P < 0.001$) between the prior and afterward hematocrit in the overall category compared to the spinal category (4.8 ± 3.5% vs. 2.3 ± 4.0%, each). In the overall category, compared to the spinal category, there was a greater percentage of newborns with 5-min Apgar scores < 7 (6/141 [4.3%] vs. 0/146 [0%], accordingly, $P = 0.012$).

Conclusion:
Compared to the spinal category during cesarean sections, the general category is linked to greater maternal loss of blood and a higher percentage of infants with 5-minute Apgar evaluation < 7.

Recommendations:
Based on the study's findings, it is recommended to prefer spinal anesthesia over general anesthesia for elective cesarean sections to minimize maternal blood loss and improve neonatal Apgar scores.

Keywords: *Spinal anaesthesia, General anaesthesia, Elective caesarean section*
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INTRODUCTION

There are two anesthetic types used for C-sections: regional and general. The benefits of general anesthesia include helping obstetric emergencies proceed quickly and ensuring that parturient women experience less discomfort due to unconsciousness. Aspiration pneumonia, awareness during the procedure due to insufficient anesthesia, unsuccessful intubation, and respiratory issues in both the mother and the baby are among the drawbacks of general anesthesia. Numerous intravenous anesthetics that are injected into the mother can pass the placental barrier, enter the fetal circulation, and sedate or depress the infant's breathing. Spinal and epidural sedation are the two forms of regional and general anesthesia used during C-sections. Because the mother is conscious throughout the process, localized anesthesia has the benefit of promoting early bonding and reducing the risks associated with general anesthesia [1]. Due to its quick onset, efficiency, and decreased need for

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local anesthetics, spinal anesthesia has recently been chosen over epidural anesthesia for C-sections; nevertheless, it is linked to a higher risk of arterial hypotension [2]. It is less likely that total spinal anesthesia or maternal systemic toxicity will result from spinal anesthesia utilizing small doses of local anesthetics. Comparing the impact of spinal and general anesthesia during cesarean deliveries on the results for the mother and the fetus is therefore important.

Prior research has contrasted the levels of postoperative maternal hematocrit following cesarean sections under general and spinal anesthesia [3, 4]. Three research articles on mother's blood loss and cesarean sections are available in the Cochrane database [5]. Two of the studies evaluate spinal and general anesthesia, while the other one compares epidural and general anesthesia. Neonatal well-being is indicated by the Apgar score. While two research [6,7] found that the 1-minute Apgar test results were less than those of regional and general anesthesia overall, several studies have found no statistically major difference in Apgar tests between regional and regional and general anesthesia [5]. The relationship between neonatal well-being scores and general and regional and general anesthesia is still up for debate. The medical information of women who had cesarean deliveries under general or spinal anesthesia was reviewed in this retrospective investigation, and the outcomes for the fetus and mother were contrasted among the two anesthesia categories based on perioperative hemodynamic parameters, hematocrit, predicted loss of blood, and neonatal scores for Apgar at 1 and 5 minutes.

The study aims to compare maternal and fetal outcomes between spinal anesthesia and general anesthesia in elective cesarean sections.

MATERIAL AND METHODS

Study design

A retrospective cohort study

Study setting

The study took place between October 2023 to April 2024 at the Department of OBG, Shaheed Hasan Khan Mewati Government Medical College, Nuh, Mewat, Haryana, India.

Participants

Of the 227 subjects, 27 were eliminated overall. The mother decided on the anesthesia induction technique, and the two anesthesiologists' differing preferences were noted. Finally, a total of 200 subjects were included in the study.

Inclusion Criteria

- Singleton deliveries.
- Pregnancies that received either spinal or general anesthesia for elective cesarean sections.

Exclusion Criteria

- Necessity of converting spinal to general anesthesia.
- Emergency or epidural anesthesia cases.
- Deliveries with expected bleeding, such as those involving coagulopathy or placenta previa.

Bias

There was a chance that bias would arise when the study first started, but it was avoided by giving all participants identical information and hiding the group allocation from the nurses who collected the data.

Procedure: Before surgery, all parturient women fasted for a minimum of eight hours and were not given any pharmaceutical prior medication. We regularly used typical observing in the operating room, which included non-invasive pulse oximetry blood pressure monitoring (SpO2), and the ECG.

Study method

The analysis focused on the outcomes for both the fetus and mother following general or spinal anesthesia for an elective C-section. During the obstetric operations, anesthesia was managed by two anesthesiologists. The same medications were used by both anesthesiologists inducing anesthesia, as well as our institutional procedure was followed for patient monitoring, extubation standards, and spinal method.

Preoxygenation and the bispectral index (BIS) were employed, which involved giving every person in the general anesthesia category 100% oxygen over three to five minutes. Thiopental 5 mg/kg was then used to trigger anesthesia. The Sellick maneuver was used to avoid aspiration during intubation of the endotracheal tube, which was made easier by an intravenous injection of 0.5 mg/kg rocuronium. We implemented ventilation control in each case, using a rate of breathing of 12–14 breaths per minute and 8 ml/kg tidal volume. A solution of 1.5–2.0 vol% sevoflurane and 50% nitrous oxide in oxygen was used to maintain anesthesia. Intravenous rocuronium (0.15 mg/kg) was added if a maintenance dose was needed. Following the procedure, Glycopyrrolate (4µg/kg) was used to reverse the remaining neuromuscular blockage, and Neostigmine (0.2 mg/kg). After being completely awake, patients were extubated to avoid aspiration.

Once the free and unobstructed flow of CSF was confirmed, a slow injection of 9–10 mg of 0.5% bupivacaine combined with 10µg of fentanyl was performed. After that, the patients

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were positioned completely supine with a 15° leftward and down tilt to avoid supine hypotensive disorder. The cold test was used to figure out the level of sensory block. The process began when the degree of sensory blockage reached (T4-T5). A constant infusion of phenylephrine (1 mg/h) was used to avoid arterial hypotension. If hypotension persisted, an IV bolus of 0.1 mg phenylephrine was administered, or the constant injection rate was raised to 2 mg/h. The constant rate of injection was lowered to 0.5 mg/h or stopped if hypertension developed. Less than 70% or less than 90 mmHg at the systolic level of the initial pressure was referred to as hypotension. If the mother requested it, she could have been sedated with intravenous midazolam after the baby arrived.

Health records were used to gather information on the following topics: fetal age, height, body weight, heart rates (beats/min), HCT (%), pre and postoperative systolic blood pressure (mmHg), time spent under anesthetics (day), time among skin incision and labor (hour), estimated loss of blood (EBL), and transfusions. Both a gravimetric method and visual estimation —which weighs soiled sponges and measures the fluid in suction canisters—were used to measure EBL. A pediatrician examined the sex, weight, and 1- and 5-minute Apgar evaluation of newborns. The C-section was assigned to pediatricians at random.

Statistical analyses

R (variant 3.5.3) had been the program employed for all statistical analyses. The Shapiro-Wilk test was used to determine whether the continuous variable distribution was normal. For continuous, typically distributed variables, we employed independent t-tests; for continuous, irregularly distributed variables, we employed the Wilcoxon rank-sum test. In descriptive statistics, the data are displayed as a percentage, median [1Q, 3Q], or mean ± SD.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULTS

Table 1 displays that there were no statistically significant variations in demographic data among the categories receiving spinal and general anesthesia, except for surgical time (57 ± 13.0 vs. 53 ± 11.0 min, P = 0.011).

Table 1: demographic and clinical information.

Parameters	General (n=100)	Spinal (n=100)	P value
Age (years)	35 ± 4.5	33 ± 4.0	0.21
Height (cm)	160 ± 5.0	160 ± 5.5	0.26
Weight (kgs)	72 ± 14.9	71 ± 11.0	0.46
Gestation (weeks)	37 ± 2.1	37 ± 2.0	0.30
Gravidity	3 (2,4)	2 (1,3)	0.30
Operation	57 ± 13.0	53 ± 11.0	0.01
Anesthesia	75 ± 14.5	77.5 ± 12.1	0.11
Skin incision	6.0 ± 2.2	6.2 ± 2.2	0.31

The following information was found in the mother's and baby data: the prior to surgery SBP in the categories under spinal and general anesthesia (132 ± 17.5 vs. 135.1 ± 17 mmHg, respectively) did not differ significantly. But after surgery, the general anesthesia category's systolic rate of heart was noticeably higher than the spinal anesthesia category's (136 ± 16.5 vs. 120 ± 12.5, respectively, P < 0.001) (Table 2). The general anesthesia category had a substantially lower mean postoperative HCT level (31 ± 4.0% vs. 34 ± 5.0%, respectively, P < 0.001) than the spinal anesthesia category.

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Table 2: Maternal and fetal variables.

Measures		General	Spinal	P value
Maternal	Preoperative SBP (mm of Hg)	135.1 ± 17	132 ± 17.5	0.051
	Postoperative SBP (mm of Hg)	136 ± 16.5	120 ± 12.5	< 0.001†
	Preoperative HR (beats/min)	81.5 ± 12.5	85.5 ± 13.5	0.011*
	Postoperative HR (beats/min)	93.0 ± 17	71 ± 12.5	< 0.001†
	Preoperative hct (%)	36 ± 3.3	37 ± 3.0	0.404
	Postoperative hct (%)	31 ± 4.0	34 ± 5.0	< 0.001†
	dhct	4.8 ± 3.5	2.3 ± 4.0	< 0.001†
	EBL (ml)	856.7 ± 117.9	819.9 ± 81.9	0.002*
	Transfusion rate (%)	3 (2.1)	2 (1.4)	0.969
	Hospital stays duration (day)	5.0 ± 0.6	5.0 ± 0.7	0.924
Fetal	Fetal weight (g)	2,974.8 ± 594.8	2,977.4 ± 620.3	0.970
	Apgar score (1 min) < 7 (%)	31 (22.0)	23 (15.8)	0.178
	Apgar score (5 min) < 7 (%)	6 (4.2)	0 (0)	0.012*

DISCUSSION

Based on the average difference in pre-and postoperative hct levels and the after-surgery mean EBL volume, the findings indicate that general anesthesia is prone to result in more bleeding than spinal anesthesia.

The study compared the outcomes of newborn infants and their mothers who underwent elective cesarean sections under either spinal or general anesthesia. The findings indicated that mothers who received general anesthesia experienced significantly greater blood loss and a larger decrease in postoperative hematocrit levels compared to those who received spinal anesthesia, suggesting a higher risk of perioperative bleeding associated with general anesthesia. Additionally, postoperative systolic blood pressure and heart rate were significantly higher in the general anesthesia group, indicating increased stress or compensatory mechanisms due to greater blood loss. The duration of surgery was slightly longer for the general anesthesia group, likely due to the additional time required to manage increased bleeding.

For neonatal outcomes, a higher percentage of newborns in the general anesthesia group had lower 5-minute Apgar scores (<7) compared to the spinal anesthesia group, indicating better immediate neonatal outcomes with spinal anesthesia. Overall, the findings suggest that spinal anesthesia is preferable over general anesthesia for elective cesarean sections as it is associated with lower maternal blood loss, better maintenance of postoperative hematocrit levels, and improved neonatal Apgar scores. These results support the use of spinal anesthesia to enhance both maternal and fetal safety during elective cesarean deliveries.

Even though cesarean sections are meant to improve both the health of the fetus and mother, there is a significant risk of maternal morbidity after the procedure. About 35.7% of mothers experience maternal morbidity after a cesarean birth [8]. The primary reason for death following a cesarean section is perioperative bleeding; approximately 1,000 ml of EBL is transfused [9]. With general anesthesia as opposed to local anesthesia, mother's bleeding following cesarean section is more prevalent [3, 4]. Inhalation anesthetics may relax the uterus, which could explain why postoperative bleeding is more common in mothers under general anesthesia than under local anesthesia [10].

In prospective assigned research, Saygi et al. [11] compared the outcomes for mothers and fetuses going through C-sections under general and spinal anesthesia. In this research, those who were under general anesthesia experienced lower postoperative hematocrit levels and higher EBL than the category under spinal anesthesia. Furthermore, in the category of receiving general anesthesia, the postoperative heart rate appeared to rise to make up for hypovolemia or anemia. It's interesting to note that the

general anesthesia category's operation took much longer than the spinal anesthesia category's, presumably because the general anesthesia category required more operative manipulations to stop bleeding.
Local anesthesia affected surgical bleeding, according to Guay [12], but this did not typically result in fewer patients needing transfusions. In a similar vein, there was no discernible difference among the two categories' transfusion rates in this investigation.
Afterward, HCT levels were found to be considerably lower in the category receiving general anesthesia than in the category receiving spinal anesthesia in this study; however, the differences were more pronounced in POD 3 compared to POD 1. After surgical blood loss, erythropoiesis was enhanced by day 7, and by day 28, the postoperative hct deficit was resolved [13].

The Apgar score was employed in this study as a fetal well-being indicator. Table 2 shows that while the percentage of newborns with 1-min Apgar scores < 7 was not notably different among the two categories, the number of babies with 5-min Apgar scores < 7 was considerably greater in the general anesthesia category than in the spinal anesthesia category (6/141 [4.3%] vs. 0/146 [0%], each, P = 0.012).

Recently [3,14], there has been no discernible distinction between the 1- or 5-minute Apgar assessments of neonates receiving spinal anesthesia for C-section and those under general anesthesia. Still, Tonni et al. [15] found that while the mother's saturation of oxygen and partial pressure of oxygen was higher during general anesthesia than during regional and general anesthesia, the umbilical cord's blood pH and partial pressure of oxygen were lower during general anesthesia than they were during the spinal and epidural categories.

While the embryo accepted anesthetic agents well, We reasoned that as they passed through the placenta, they could have an impact on it. Using local anesthesia may decrease the number of analgesics that neonates are subjected to while simultaneously improving placental perfusion and oxygenation in the fetus because it causes sympathetic obstruction. In most cases, when there is distress for the baby or maternal coagulopathy, general anesthesia must be administered. Low
Apgar scores and pH changes in the venous and umbilical arteries linked to general anesthesia frequently accompany neonatal respiratory distress, which is also often temporary. Nonetheless, there are no appreciable negative effects on fetuses or neonates from cautiously and appropriately administering general anesthesia [16].

GENERALIZABILITY

These findings suggest that in a larger population, opting for spinal anesthesia over general anesthesia for elective cesarean sections could lead to reduced maternal blood loss and improved neonatal outcomes, thereby enhancing overall maternal and fetal safety.

CONCLUSION

Although the embryo tolerated anesthetic agents well, it is believed that they might have an impact on it as they pass through the placenta. Because of sympathetic blockade, The amount of anesthetics that neonates endure can be decreased with local anesthesia while also enhancing the perfusion of the placenta and oxygenation of the fetus. For the sake of safety during the c-section, local anesthesia is therefore chosen over general anesthesia.

LIMITATIONS

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

RECOMMENDATION

Based on the study's findings, it is recommended to prefer spinal anesthesia over general anesthesia for elective cesarean sections to minimize maternal blood loss and improve neonatal Apgar scores.

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LIST OF ABBREVIATIONS

C-sections: Cesarean Sections
SBP: Systolic Blood Pressure
HR: Heart Rate
HCT: Hematocrit
EBL: Estimated Blood Loss
SpO2: Oxygen Saturation
ECG: Electrocardiogram
BIS: Bispectral Index
CSF: Cerebrospinal Fluid
IV: Intravenous
POD: Postoperative Day

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CONFLICT OF INTEREST

The authors have no competing interests to declare.

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