Comparison of Maternal and Fetal Complications in Relation to General Anaesthesia vs Spinal Anaesthesia During Caesarean Section

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ABSTRACT

Background: Anesthesia is needed to ensure both maternal and fetal safety during cesarean sections. General anesthesia can be used for the rapid procedure in obstetric emergencies while regional anesthesia can be used for cesarean section due to its effectiveness, and rapid onset.

Objective: The objective of this study was to compare intra-operative and postoperative maternal and fetal complications with general and spinal anesthesia during cesarean section.

Material and Methods: This comparative retrospective study was conducted in the Department of Gynae C Unit, Lady Reading Hospital, Peshawar for a duration of six months (December 2020 to June 2021). A total of 100 patients admitted for cesarean sections were included in this study and categorized into two groups (50 each) based on the anesthesia used either general or spinal anesthesia. All the demographic data, type of anesthesia, and post-anesthesia complications were determined. Data were analyzed using SPSS version 22. Descriptive statistics were stated as the mean, frequency, and percentage.

Results: A total of hundred patients were included and categorized into two (General Anesthesia and Spinal Anesthesia) equal groups of 50 patients each. The mean age of the General anesthesia group was 29.9±3.8 while the spinal anesthesia group's mean age was 29.8±3.0. Parity was 1.6±0.7 and 1.9±0.7 in the general anesthesia and spinal anesthesia group respectively. The preoperative hemoglobin and hematocrit values were insignificant with p=0.257 and p=0.165 respectively. 24 hours after the operation were significantly lower in the general anesthesia group than in the spinal anesthesia group (P <0.001 and P=0.004, respectively). The proportion of newborns with 5th-min Apgar scores < 7 was not significantly different between the two groups, although the general anesthesia group had a significantly larger proportion of newborns with 1-min Apgar scores <7 than the spinal anesthesia group P=<0.001).

Conclusion: General anesthesia and spinal anesthesia are both safe for cesarean sections. In terms of postoperative comfort, spinal anesthesia outperforms general anesthetic during cesarean section. In pregnancies with a high risk of fetal distress, spinal anesthesia should be preferred, with the first minute Apgar score taken into account.

Keywords: General anesthesia, Spinal anesthesia, Caesarean section, Apgar score.

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INTRODUCTION

Cesarean section anesthesia can be either general or regional. The benefits of general anesthesia include the ability to perform a quick procedure in obstetric emergencies and the loss of consciousness, which causes less discomfort to parturient women. The risks of general anesthesia include aspiration pneumonia, maternal awareness during the procedure due to insufficient anesthesia, failed intubation, and respiratory complications in the mother and newborn. Many intravenous anesthetic agents including Propafol can cross the placental barrier and enter the fetal circulation, causing sedation or respiratory depression in the newborn.[1] Spinal and epidural anesthesia are the two types of regional anesthesia used for cesarean sections. Regional anesthesia has the advantage of reducing the complications associated with general anesthesia and promoting initial bonding between the mother and the baby (because the mother is awake during the procedure).[1] Because of its rapid onset, effectiveness, and lower requirement for local anesthetics, spinal anesthesia has recently been preferred over epidural anesthesia for a cesarean section; however, it is associated with a higher incidence of arterial hypotension.[2] Small amounts of local anesthetics used in spinal anesthesia are less likely to cause maternal systemic toxicity or total spinal anesthesia. Spinal anesthesia outperforms general anesthesia in terms of safety, cost-effectiveness, and relatively low morbidity, mortality, and postoperative complications resulting in increased use.[3,4] In spinal anesthesia, the patient is awake and aware of her surroundings, and she witnesses her baby's birth. It is less dangerous, easier to learn, and provides better postoperative pain relief. A cesarean section is associated with a 35.7% maternal morbidity rate.[5]

The Apgar score is a measure of neonatal health. Several studies found no significant difference in Apgar scores between general and regional anesthesia, but two studies found that general anesthesia had lower 1-min Apgar scores than regional anesthesia. As a result, there is still

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debate about the relationship between neonatal well-being scores and general and regional anesthesia.[6,7] Spinal and epidural anesthesia is the favored one over general anesthesia according to Obstetric anesthesia guidelines worldwide.[8] Regional anesthesia is divided into two subgroups: epidural anesthesia and spinal anesthesia. A careful examination of the relevant literature reveals that there is no difference between epidural and spinal anesthesia in terms of maternal side effects.[9] As a result, comparing the effects of general and spinal anesthesia during cesarean sections on maternal and fetal outcomes is important.

MATERIAL AND METHODS

This comparative retrospective study was conducted at the Department of Obstetrics and Gynecology Postgraduate Medical Institute Government Lady Reading Hospital Peshawar. A total of 108 pregnant women, between 20 and 35 years of age, who delivered at term (37-40 weeks) using cesarean section were included. Patients presenting the following were not included in the study: requirement for emergency caesarean section for delivery; classification as multiple gestations; great multiparity (more than four deliveries); macrosomia (=4500 grams); polyhydramnios (defined as amniotic fluid index more than 25 cm); placental abnormalities, such as placental abruption, placenta previa or adherent placenta; possibility of high risk of intraoperative hemorrhage, such as cases of placenta previa or coagulation defects; premature membrane rupture; preterm delivery (defined as before the 37th week of pregnancy); post-term delivery (defined as pregnancies exceeding the 40th gestational week); pregnancies with obstetric problems such as fetal anomaly; intrauterine growth restriction (defined as birth weight two standard deviations below the population mean for gestational age and sex); oligohydramnios (defined as amniotic fluid index less than 5 cm); pre-eclampsia; gestational diabetes mellitus; height less than 150 cm; body mass index (BMI) = 30 kg/m; allergy caused by local anesthesia; systemic illnesses such as goiter, diabetes mellitus or anemia (Hb < 8 g%); and unsuitability for regional anesthesia. Eight patients were excluded owing to failed spinal anesthesia, placenta previa, or coagulopathy. Thus, eventually, 100 patients were stratified into either general anesthesia (n=50) or spinal anesthesia (n=50) groups. The ethical approval was obtained from the hospital Ethical Review Committee (Ref. No. 653/LRH/MTI Dated: 25/12/2020) before conducting the study.

This retrospective study reviewed the medical records of women who underwent cesarean section under general anesthesia or spinal anesthesia and compared the maternal and fetal outcomes based on perioperative hemodynamic parameters (pre- and postoperative mean blood pressure, heart rate), hematocrit, and neonatal Apgar scores at 1 and 5 min between both anesthesia groups. In all patients, the pregnancy was dated based on confirmation of the last menstrual period or was redated from the first or second-trimester ultrasound examination. All the patients' basic demographic information was recorded. In addition, hemoglobin and hematocrit values were determined both before and in the 24th hour following the surgery from the records.
Statistical analyses were performed using the Statistical Package for the Social Sciences version 22 software. Descriptive statistics were stated as the mean, standard deviation, frequency, and percentage. Statistical analyses were performed using Student's t-test for continuous variables and the chi-square test for categorical variables. Parity, body mass index (BMI) at delivery, maternal age at delivery, and Gestational weeks were used for multivariate logistic regression models as potential confounders. Apgar scores at first and fifth minutes and admitted to the neonatal intensive care unit (NICU). Statistical significance was defined as $P < 0.05$.

RESULTS

A total of 100 patients were recruited and categorized into two groups based on the administration of anesthesia. The maternal demographic characteristics of the general and spinal groups including maternal age, parity, BMI, gestation weeks, and gravidity of both groups are shown in Table 1.

Table 1. Demographic data

Variables	General (n = 50)	Spinal (n = 50)	P-value
Maternal Age	29.9 ± 3.8	29.8 ± 3.0	0.884
Parity	1.6 ± 0.7	1.9 ± 0.7	0.044
BMI (kg/m2)	28.9 ± 4.4	27.6 ± 3.8	0.135
Gestation weeks	38.48 ± 0.65	38.54 ± 0.73	0.665
Gravidity	2 ± 1.2	2.4 ± 1.4	0.142

Values are presented as mean ± SD or median *P value < 0.05.

It can be seen that the preoperative hemoglobin and hematocrit values of the two groups were similar (P = 0.257 and P = 0.165, respectively), while the values 24 hours after the operation were significantly lower in the general anesthesia group than in the spinal anesthesia group (P <0.01and P = 0.004, respectively). Regarding the change from before to after the operation, only the difference in hemoglobin values was greater in the general anesthesia group (1.7 ± 0.9 versus 1.1 ± 0.8; P = 0.001) are shown in Table 2.

A requirement for blood transfusion due to postpartum hemorrhage appeared only in the general anesthesia group, in one patient. Significant hypotension following induction of anesthesia was observed in the spinal anesthesia group (2% and 13%, P = 0.004)). In assessing the maternal hemodynamic parameters, the hazard ratio (HR) values at the 30th minute were significantly higher in the spinal anesthesia group (73.4 ± 10.2 versus 79.6 ± 11.5; P = 0.005) are shown in Table 2.

The proportion of newborns with 5th-min Apgar scores < 7 was not significantly different between the two groups, although the general anesthesia group had a significantly larger proportion of newborns with 1-min Apgar scores < 7 than the spinal anesthesia group (4/50 [8%] vs. 0/50 [0%], respectively, P = < 0.001) (Table 2).

There was no significant difference in 30th, postop minute MBP, or mmHg between the general and spinal anesthesia groups (92 ±10.6 vs. 88.5 ± 10.3 mmHg, respectively). However, 60th, postop minute MBP, mmHg was significantly higher in the general anesthesia group than in the spinal anesthesia group (88 ± 9.2 vs. 85.9 ± 10.3, respectively, P = 0.275) (Table 2).

Table 2. Maternal and Fetal Parameters

Parameter	Measures	General Anesthesia	Spinal Anesthesia	P-value
Maternal	Preoperative hematocrit (%)	34.1±2.9	34.9±3.3	0.165
	Postoperative hematocrit (%)	29.9±3.2	32.2±4.1	0.004
	Postoperative SpO2	98.7±1.4	99.2±1.3	0.114
	Hypotension frequency	2(4%)	13(26%)	0.004
	Surgical time (minutes)	40.3±13.3	41±13.6	0.795
	Preoperative hemoglobin (g/100 ml)	11.9±1.2	12.2 ± 1.2	0.257
	Postoperative hemoglobin (g/100 ml)	10.2 ±1.0	11.2 ±1.5	< 0.001
	30th, post-op minute MBP, mmHg	92 ± 10.6	88.5 ± 10.3	0.088
	60th,postop minuteMBP, mmHg	88 ± 9.2	85.9 ± 10.3	0.275
	30th, postop minute maternal HR	73.4 ± 10.2	79.6 ± 11.5	0.005
	60th, postop minute maternal HR	77.2 ± 9.3	80.3 ± 9	0.095
Fetal	Fetal weight(g)	3402.6 ± 413.2	3276.5 ± 398.3	0.123
	Apgar scored in the first minute <7	4/50 (8%)	0/50 (0%)	< 0.001
	Apgar scored in the fifth minutes	10 (8-10)	10 (9-10)	0.156

Apgar scores are expressed as median (range). Postop=postoperative; MBP= mean blood pressure; HR =heart rate; MBP= mean blood pressure.

DISCUSSION

The current study findings shows that almost all measured parameters are statistically significant in the general anesthesia group as compared to spinal anesthesia. Javed et al., 2016 reported that spinal anesthesia is frequently used in c-section cases.[10] Similar to our study findings that spinal anesthesia is a common and appropriate technique for patients in emergency cases. Rana et al., 2016 reported that the mean age of patients was 28.09±4.10.[11] Nearly consistent with our findings the mean age was 29.9 ± 3.8 and 29.8 ± 3.0 in both general and spinal anesthesia groups. On the other side, Razzaq et al., 2019 revealed the mean age of patients was 24.4 years in a sample size of 400 patients,[12] which is lower than our study outcome could be due to different studied populations, sample size, and ethnicity difference. Munir et al., 2019 showed in their report that the mean age of patients was 30.62±4.87 years. The mean age of the spinal group was 30.57±5.25 years whereas the mean age of the general anesthesia group was 30.67±4.51 years (C-5).[13] Which is closely related to our findings.

Munir et al., also reported that the Apgar score in the general anesthesia group was =7 in 87% of patients while the Apgar score in the spinal group was =7 in 96.3% of patients. The Apgar score in both groups was significant with a p-value less than 0.05(C-5).[13] Our findings are inconsistent with our findings. The Apgar score was 8% and 0% with significant reports in both general and spinal anesthesia groups respectively.

Epidural anesthesia is preferred because it has unlimited duration and postoperative pain management; spinal anesthesia, on the other hand, is preferred because of its advantages of being implemented in a shorter period, having a faster onset of action and requiring less medication, and its capacity to form a strong sensory and motor block. In a study conducted in the UK, the regional anesthesia rate was 69.4% in 1992, while it reached 94.9% in 2002.[14] The lower rates may be attributable to sufficient fluid infusion before induction, appropriate patient position, and ephedrine use as a vasopressor agent.

The proportion of newborns with Apgar scores = 7 is significantly low in the first minute in the spinal group, but without any difference in scores between the two groups about the fifth minute.[15] Tonni et al., reported that the proportion with 5-min Apgar scores < 7 was significantly larger in the general anesthesia group than in the spinal anesthesia group.[16] Hypotension was the commonest knock-off effect with regional anesthesia in a study by Biomes et al., 2010.[17] Maternal hypotension can be managed successfully with modest doses of ephedrine and IV fluid infusions. In our study, the frequency of occurrence of intraoperative hypotension in the spinal anesthesia group was found to be 26%, which was lower than the rates given in the current literature.[18]

Maternal hemorrhage has been reported to be less frequent with spinal anesthesia, and some researchers have found that the need for blood transfusion is higher in the general anesthesia group. In our study, both postoperative hemoglobin values (10.2 ± 1.0 versus 11.2 ± 1.5, P < 0.001) and hematocrit values (29.9 ± 3.2 versus 32.2 ± 4.1, P = 0.004) were significantly lower in the general anesthesia group.

Blood transfusion was needed after postpartum atonic bleeding in only one patient. Spinal anesthesia is as effective as general anesthesia.[19,20] The factors that influence the selection of anesthesia method in cesarean delivery are the following: whether the operation is an emergency; any systemic problems; the patient's choice; and the experience level of the anesthesiologist.[21-25]

One of our study's limitations is that we did not analyze localized anesthesia-induced issues such as nausea, vomiting, bradycardia, hypotension, and PDPH. Further prospective studies are required to study the complications of both local and spinal anesthesia including the sub-types of spinal anesthesia. Moreover, greater sample size in different tertiary care hospitals is required to further evaluate the factors related to maternal and fetal health.

CONCLUSION

The outcome of this study showed that spinal anesthesia is more appropriate as compared to general anesthesia in terms of maternal and fetal wellbeing. Furthermore, about pregnancies with fetal problems, we consider that it would be more appropriate to prefer the method of spinal anesthesia by taking first-minute Apgar scores into account. In the future, we may use spinal anesthesia in elective cesarean sections to increase mother happiness and improve fetomaternal outcomes.

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AUTHOR'S CONTRIBUTION
The following authors full fill authorship criteria as per ICMJE guidelines;

Zeb L:	Idea conception, drafting the work, final approval, agreed to be accountable for all the work.
Khattak S:	Design of the work, data acquisition, critical revision, final approval, agreed to be accountable for all the work.
Wahab S:	Data analysis, Data interpretation, drafting of the work, final approval, agreed to be accountable for all the work.