

Comparing Effects of Caesarean Section using Spinal and General Anesthesia on Neonatal Short-Term Outcome

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Abstract: *Background:* Caesarean section can be performed under general or regional anesthesia like spinal anesthesia technique, and both have advantages and disadvantages.

Objective: To compare the effect of general anesthesia versus spinal anesthesia on 1 and 5 minute Apgar score of neonates born by elective caesarean section

Methods: The study was carried out in Zheen International Hospital, Kurdistan, Iraq from May 2014 to May 2015. This study was performed on 100 women presenting for elective Caesarean section. Fifty pregnant females were given general anesthesia and other 50 received spinal anesthesia. The Apgar score was recorded at 1 minute and 5 minute interval after each delivery.

Result: The results showed that baseline characteristics inducing age, obstetrics history, and gestational age in females in both study groups were comparable ($p>0.05$). The demographic characteristics of newborns between study group showed comparable body weight and male to female sex ratio ($p>0.05$). The Apgar score values at one minute ($p=0.0375$) and at 5 minutes ($p=0.0002$) showed significantly higher number of score in spinal anesthesia group as compared to general anesthesia group.

Conclusion: There is a significant difference between the effects of general anesthesia and spinal anesthesia on Apgar score of neonate 1 minute and 5 minutes after delivery of full term neonate by elective Caesarean section, but there may not be clinically significant difference between the effect of general anesthesia and spinal anesthesia on Apgar score of healthy mothers.

Keywords: Elective caesarean section, general anesthesia, spinal anesthesia, Apgar score.

INTRODUCTION

Obstetric anesthesia is one of the most challenging experiences to the anaesthesiologist and requires high set of skills, the anesthetist must appreciate the physiological and anatomical changes that involves all maternal organs in order to provide safe anesthesia to the mother and enable safe delivery of the fetus [1].

Although majority of women undergoing CS are young and healthy and would be considered to be at minimal operative risk, pregnancy, certain maternal-fetal factors and pre-existing medical conditions significantly increase surgical and obstetric risks [2]. There are major alterations in nearly every maternal organ system, these changes are initiated by hormones and mechanical effects of enlarged uterus and compression of surrounding structure. This altered physiologic state that involve hematologic, cardiovascular, ventilatory, metabolic, and gastrointestinal functions has relevant implications for the anesthesiologist [3].

With the advent of fetal heart rate and tocodynamometric monitoring, a reduction in breech and forceps-assisted deliveries, and the changing social

and medicolegal environment, caesarean deliveries now account for 25% to 30% (range 1.8%-40.5%) of deliveries nationally and internationally [4]. In Iraq, according to the Iraq Multiple Indicator Cluster Survey 2006 (Iraq MICS 2006) about 20% of births were delivered by caesarean section and 17.6% in Kurdistan-Iraq Region [5]. While the international healthcare community has considered the ideal rate for caesarean sections to be between 10% and 15% [6]. The increasing trend in the setting of advanced maternal age, obesity and other concomitant diseases continue to pose challenge to the obstetric anesthetists in providing safe regional and general anesthesia [7,8].

Two authors, August Bier and Theodor Tuffier, described authentic spinal anesthesia. In a comparative review of the original articles by Bier, Tuffier, and Corning, it was concluded that Corning's injection was extradural, and Bier merited the credit for introducing spinal anesthesia [9,10].

None of the anesthetic techniques is ideal for caesarean section, Each of the techniques has advantages and risks to both mother and fetus [11,12,26]. However the aim of anesthetist is to choose the method which is comparatively safest and most comfortable for the mother, least depressant to the newborn and which provides optimal working

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conditions for the obstetrician [13,26]. Choice of anesthesia for caesarean section is determined by multiple factors, including the indication for the operative delivery, its urgency, patients and obstetrician preferences, and the skills of the anesthetist. Advantages of spinal anesthesia include less neonatal exposure to depressant drugs, a decreased risk of maternal pulmonary aspiration, and awake mother at the birth of her child [14]. The most common complications of spinal anesthesia include hypotension, nausea and vomiting, and risk of post-dural puncture headache. Certain conditions or time constraints may contraindicate its use such as localized infection or generalized sepsis, coagulation disorders, severe hypovolemia, and cardiac pathologies where hypotension may be especially detrimental. Severe antepartum haemorrhage, uterine rupture, acute and severe fetal distress may contraindicate the procedure because of the time necessary to establish a surgical anesthesia. Hypotension presents the greatest risk to maternal and fetal health [15]. While general anesthesia offers a very rapid and reliable onset, control over the airway and ventilation, greater comfort for parturient who have morbid fear of needles or surgery, and potentially less hypotension than spinal anesthesia. Its principal disadvantages are risk of pulmonary aspiration, the potential inability to intubate or ventilate the patient, and drug induced fetal depression [16].

Although anesthesia-related maternal mortality has been declining during the past few decades, it still accounts for 3% to 12% of maternal deaths, with the majority associated with general anesthesia secondary to failures in intubation, ventilation, and oxygenation [15].

Apgar Score

In 1952, Dr. Virginia Apgar devised a scoring system that was a rapid method of assessing the clinical status of the newborn infant at 1 minute of age and the need for prompt intervention to establish breathing [17]. This scoring system provided a standardized assessment for infants after delivery. The Apgar score comprises 5 components: color, heart rate, reflexes, muscle tone, and respiration. Each of these components is given a score of 0, 1, or 2. Thus, the Apgar score quantitates clinical signs of neonatal depression, such as cyanosis or pallor, bradycardia, depressed reflex response to stimulation, hypotonia, and apnea or gasping respirations. The score is reported at 1 minute and 5 minutes after birth for all

infants, and at 5-minute intervals thereafter until 20 minutes for infants with a score less than 7 [18,19]. The Apgar score provides an accepted and convenient method for reporting the status of the newborn infant immediately after birth and the response to resuscitation if it is needed. A 5-minute Apgar score of 7 to 10 is considered normal. Scores of 4, 5, and 6 are intermediate and are not markers of increased risk of neurologic dysfunction. An Apgar score of 0 to 3 at 5 minutes may correlate with neonatal mortality but alone does not predict later neurologic dysfunction. The Apgar score is affected by gestational age, maternal medications, resuscitation, and cardiorespiratory and neurologic conditions. Low 1- and 5-minute Apgar scores alone are not conclusive markers of an acute intrapartum hypoxic event, other factors such as umbilical arterial blood gases need to be considered when defining an intrapartum hypoxic-ischemic event as a cause of cerebral palsy [20].

Regarding the growing number of newborns that are born via Cesarean surgery, one of the most concerning issues for management is the changes in Apgar score of Cesarean babies. Therefore this prospective study was planned to compare the effect of general versus spinal anesthesia on Apgar score at one and five minutes.

MATERIALS AND METHODS

The proposed study was carried out at Department of Obstetrics and Gynecology, Zheen International Hospital, Kurdistan, Iraq. The study started after obtaining permission from the Institutional Ethics Committee of Zheen International Hospital, Kurdistan, Iraq. Before recruiting patients and doing any procedure, written consent was taken from all the patients. The observed data was recorded in patient information sheets.

The study population consisted of 100 pregnant patients who were admitted between May 2014 and May 2015 for undergoing elective lower section Caesarean section (LSCS). Pregnant patients with other concomitant medical conditions were excluded. The samples selected non-randomly (conveniently) per minimal statistical requirement.

The surgical and anesthetic procedures followed were as per the standard treatment protocol of Department. Fifty patients were given general anesthesia and other 50 patients received spinal anesthesia, assignment of patients to each group

based on the wishes of the patients after carefully discussing the procedures, advantages, and disadvantages of each type of anesthesia.

General Anesthesia

In the general anaesthesia group, after pre-oxygenation, anaesthesia was induced with either thiopentone 4-6mg/kg or propofol 2-3mg/kg. Atracurium or rocuronium used for muscle relaxation, trachea intubated with rapid sequence technique and applying cricoid pressure within one minute. Patients were adequately ventilated and anaesthesia maintained with isoflurane and air in oxygen. ECG, Blood pressure, SpO₂ and end tidal CO₂ monitored throughout the surgical procedure. The newborns were delivered maximum within 5 minutes of incision, were received and evaluated by a paediatrician using 1 and 5 minutes Apgar scoring. Oxytocine and fentanyl were given to the mother, at the end of the procedure, muscle relaxant was reversed using neostigmine and atropine.

Spinal Anesthesia

The patient was placed in sitting position, and L3/L4 intervertebral space was the first choice for injection. In case of difficulty one space below was used, needle size used was ranging between G22 and G24, with the lumbar puncture done in median approach. Whenever it was difficult, para median approach was an alternative. The anesthetic, 2 ml of lidocaine 5% in 7.5% dextrose was injected, then the patient was placed in recumbent position shortly after the spinal injection with slight trendelenburg. Any hypotention was corrected with ephedrine in 3 mg increments and with not more than one liter of crystalloid fluid. ECG, blood pressure, and SpO₂ were monitored throughout procedure.

After surgery, all the patients were discharged to the isolation room when fully conscious, with adequate respiration and hemodynamic stability.

The Apgar score of all the babies were recorded by a pediatrician at 1 minute and 5 minutes after each delivery. Birth weight of the babies were also recorded.

Statistical Analysis

The continuous variable data was expressed as Mean \pm standard deviation (SD) and categorical variables are presented as absolute numbers with range. T-test was used to compare Mean \pm standard deviation (SD) of continues variables such as age,

gestational age, and body weight, while Chi-Square and Mann Whitney tests were used to compare categorical data. The p value <0.05 was considered significant. All statistical analysis done using GraphPad:InStat Version 3.06.

RESULTS

All patients with pregnancy who were advised to undergo Cesarean section were admitted in the Department of Gynecology and Obstetrics and were evaluated. The characteristics about patient demographics, including age, obstetrics history, and gestational age were compared between two study groups and results are summarized in Table 1. Values of age of patients in years and gestation age in weeks are expressed as Mean \pm SD and values of gravida, para and abortion are expressed as median numbers with range. The results showed that baseline characteristics in both study groups were comparable (p>0.05).

Table 1: Baseline Characteristics in Pregnant Females of both Study Groups

Characteristics	General Anesthesia Group	Spinal Anesthesia Group	P value ^c
Age ^a (years)	28.74 \pm 5.22	30.75 \pm 6.06	0.0729
Gravida ^b	2 (1-10)	3 (1-10)	0.0585
Para ^b	1(0-5)	1 (0-8)	0.0676
Abortion ^b	0 (0-5)	0 (0-6)	0.1022
Gestational age ^a (weeks)	37.33 \pm 5.07	37.64 \pm 1.60	0.6682
Total	50	50	-

^aUnpaired T test, ^bMann Whitney Test, ^cP Value <0.05 versus spinal anesthesia group

The effect of both anesthetic technique was evaluated using Apgar score at 1 and 5 minutes and number of neonatal intensive care admissions required. Additionally other factors including body weight and male to female sex ratio were compared between babies born to females of either group. The results are summarized in Table 2. Values of Apgar score are expressed as absolute scores with range; body weight was expressed in kilograms whereas male to female sex ratio was expressed as actual numbers.

The number of newborns in general anesthesia and spinal anesthesia groups was 50 and 51 respectively due to presence of twin delivery in spinal anesthesia group. The demographic characteristics of newborns

between study group showed comparable body weight and male to female sex ratio ($p>0.05$). The Apgar score values at one minute ($p=0.0375$) and at 5 minutes ($p=0.0002$) showed significantly higher number of score in spinal anesthesia group as compared to general anesthesia group.

Table 2: Comparison of Characteristics of Newborn Babies between Two Study Groups

Characteristics	General Anesthesia group	Spinal anesthesia group	P value ^d
Apgar 1 min ^b	7.5 (1-9)	8 (4-10)	0.0375
Apgar 5 min ^b	8 (7-10)	9 (8-10)	0.0002
Body weight ^a	3.12±0.43	3.27±0.57	0.1830
Male: Female ^c	13:37	11:40	0.7723
Total	50	51	

^aUnpaired T test, ^bMann Whitney Test, ^cChi-square test, ^dP Value <0.05 versus spinal anesthesia group

Number of neonates with Apgar scores less than 7 was 13 in general anesthesia group whereas it was 11 in spinal anesthesia group. Two patients each from both study groups were admitted in neonatal intensive care units, i.e. there was no difference in number of admissions in NICU for both groups.

DISCUSSION

Caesarean section, which was introduced into clinical practice as a lifesaving procedure for both the mother and the baby, is one of the most common surgeries performed in modern obstetrics. Formerly it was performed in interest of the mother; currently it is frequently done for fetal indication [21].

Delivery of baby by caesarean section has become increasingly common. However the choice of anesthetic technique remains controversial. As it said earlier that no technique is ideal for cesarean sections, and both general and spinal anesthesia have certain advantages and disadvantages.

Our study results have showed that, the median score of Apgar at 1 minute and at 5 minute were significantly lower in general anesthesia group as compared to spinal anesthesia group. But the median scores in both the study groups were above 7 which mean most of the newborns from both study groups did not require special medical care. But the study inclusion criteria have restricted the evaluation to those

patients who were at term and also had undergone elective Cesarean section.

A study done by Krishnan L *et al.* on two groups of patients, one received general anesthesia and other spinal anesthesia, showed that no significant difference was seen in the mean 1 minute Apgar scores in the two groups, however more neonates of the general anaesthesia group appeared depressed soon after birth, needing free flow of oxygen and bag and mask ventilation [22].

Another study done by Roberts SW *et al.* observed that no anesthetic method was necessarily hazardous or safer than another and that each method had its own liabilities. Inhalational agents necessary for general anesthesia was seen to depress the newborn, as our 1 minute Apgar scores reflected the same effect [23].

Whereas studies done by Lucas *et al.* on 202 babies born through Cesarean surgeries with General anesthesia method, the Apgar score of minute 1 was significantly lower than Spinal anesthesia [24].

Various studies conducted using anesthetic techniques on Apgar score has provided conflicting results. But that could be due to difference in the composition of population or since most of the volunteers studied were healthy females with cesarean section done in an elective manner. A recently published Cochrane review has concluded that with all the study data available, practically, one form of anesthesia has not been shown to be superior to the other. It further states that there were not enough participants to assess the very rare outcome of mortality for the mother or newborn, which may be an important aspect [25].

Therefore both general as well as spinal can be used according to condition of patients and it all depends on clinical judgment of surgeon if general anesthesia will lead to fetal distress due to any maternal condition.

CONCLUSION

There is a significant difference between the effects of general anesthesia and spinal anesthesia on Apgar score of neonates at 1 minute and 5 minutes interval, born after full term elective cesarean section of healthy patients. But clinical significance was not seen in cases of healthy patients especially in terms of number of NICU admissions due to respiratory distress. Both techniques have advantages and disadvantages but

spinal anesthesia can be better option in case of suspected neonatal distress due to other factors like preterm birth or other respiratory tract problems. Additional studies are required with maternal and fetal co-morbid conditions to find a definite evidence of efficacy.

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