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Comparative analysis of Apgar scores in newborns: the impact of anesthesia methods during cesarean delivery

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Analgesia during caesarean section has a protective property regarding the condition of mother and child. Anesthesia methods should minimize harm to the newborn. The main problem after general anesthesia is respiratory distress syndrome.
The objective: **to evaluate the impact of the use of different types of anesthesia (general anesthesia or spinal anesthesia) during cesarean section on the health of newborns.**
Materials and methods**. 120 full-term pregnant women who underwent planned cesarean section were included in the study. The study participants are divided into groups: I group – 70 pregnant women who underwent a cesarean section under general anesthesia; Group II – 50 patients with spinal anesthesia during cesarean section.**
The duration of labor and the time of induction of anesthesia were carefully recorded. To assess the health of the newborn the Apgar score was used 1, 5 and 10 minutes after delivery.
Results**. The study found that the method of delivery affects the neonatal Apgar score. Shorter time from anesthesia to birth (within 5 min) and delivery through the uterus (more than 120 s) led to a decrease in Apgar scores by 1 min.**
At the same time, it was established that the assessment of newborns at birth according to the Apgar scale at the level of 4–6 points after 5 and 10 minutes was lower during childbirth with general anesthesia compared to the assessment of newborns who were born with the use of spinal anesthesia, and at the assessment of 7–10 points – greater after 5 min and 10 min in newborns who were born in childbirth with spinal anesthesia than in babies who were born in childbirth under usual general anesthesia.
Conclusions**. The results of the study demonstrate that the methods of anesthesia during cesarean section improve the health of the mother and the child. Health care providers can improve prenatal care and outcomes with this knowledge. Spinal anesthesia improves the condition of the newborn, as determined by the Apgar score at three intervals.**
Keywords: *caesarean section, general anesthesia, spinal anesthesia, Apgar scale.*

Порівняльний аналіз балів за шкалою Апгар у новонароджених: вплив методів анестезії під час кесарева розтину

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Знеболювання під час кесарева розтину має захисну властивість щодо стану матері та дитини. Методи анестезії повинні звести до мінімуму шкоду для новонародженого. Основною проблемою після загальної анестезії є респіраторний дистрес-синдром.
Мета дослідження: оцінювання впливу використання різних видів анестезії (загальний наркоз або спінальна анестезія) під час кесарева розтину на здоров'я новонароджених.
Матеріали та методи. До дослідження включено 120 жінок з доношеною вагітністю, яким проведено плановий кесарів розтин. Учасники дослідження розподілені на групи: I група – 70 вагітних, яким кесарів розтин проведено під загальним наркозом; II група – 50 пацієнток, при знеболюванні яких під час кесарева розтину виконано спинномозкову анестезію.
Ретельно записували тривалість пологів та час уведення анестезії. Для оцінювання здоров'я новонародженого використовували оцінку за шкалою Апгар через 1, 5 і 10 хв після пологів.
Результати. Дослідження встановило, що спосіб пологів впливає на неонатальну оцінку за шкалою Апгар. Коротший час від надання анестезії до народження (протягом 5 хв) і пологів через матку (більше 120 с) призвів до зниження балів за шкалою Апгар на 1-у хв.
Водночас встановлено, що оцінка новонароджених при народженні за шкалою Апгар на рівні 4–6 балів через 5 хв та 10 хв була нижчою при пологах із загальною анестезією порівняно з оцінкою новонароджених, які народились із застосуванням спинномозкової анестезії, а при оцінці у 7–10 балів – вищою через 5 хв і 10 хв у новонароджених, які народились в пологах зі спінальною анестезією, ніж у немовлят, які народились в пологах під звичайною загальною анестезією.
Висновки. Результати дослідження демонструють, що методи анестезії під час кесарева розтину покращують стан здоров'я матері та дитини. Постачальники медичних послуг можуть поліпшити пренатальний догляд і результати завдяки цим знанням. Спинномозкова анестезія покращує стан новонародженого, що визначено завдяки оцінці за шкалою Апгар через три інтервали.
Ключові слова: *кесарів розтин, загальна анестезія, спинномозкова анестезія, шкала Апгар.*

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During cesarean surgery, the selection of the best anesthesia technique is a cornerstone for the secession of surgery, the choice of anesthesia is based on different factors like pregnant women's status, degree of emergencies, and patient preference. Generally, anesthesia affects blood perfusion to the uterus which in turn affects the blood supply to the fetus [1].

There is a huge concern about fetal exposure to high doses of anesthesia during general anesthesia in cesarian surgery so other techniques for anesthesia have been used like spinal anesthesia, and spinal anesthesia nowadays become a very popular technique used to induce anesthesia [2]. Some limitations associated with the use of spinal anesthesia, one of them is maternal hypotension which occurs in about 74% of planned cesarean surgeries [3].

Fetal distress syndrome is a major limitation during general anesthesia but in spinal anesthesia, this limitation is almost negligible. the duration of administration of spinal anesthesia and delivery of the fetus is a very important factor for neonatal health[3]. Poor neonatal health after general anesthesia and maternal hypotension during spinal anesthesia make it very important to study and compare both techniques [4]. The Apgar scoring system is a well-established method for promptly assessing the vital signs of newborns in the immediate postnatal period. It encompasses key parameters such as skin color, heart rate, respiratory function, muscular tone, and reflex responsiveness, collectively contributing to an Apgar score [5].

With the increasing prevalence of cesarean section deliveries, anesthesiologists face a distinctive challenge: how to administer anesthesia in a manner that ensures both maternal and neonatal safety[6]. The primary goal is to prevent maternal awareness, uphold fetal oxygen supply, and mitigate potential adverse effects from anesthetic medications crossing the maternal-placental interface [7]. The Apgar score is a crucial tool used to evaluate the health of newborns and determine the effects of obstetric anesthetics [8].

It is used to evaluate criteria within one, five, and 10 minutes after a newborn's birth. Any scores below 4 are classified as dangerously low, whilst scores ranging from 4 to 6 are designated as moderately low. On the other hand, scores within the range of 7 to 10 often indicate a favorable condition in newborns [9]. The primary focus is on determining the amount of time that passes between the beginning of the anesthetic regimen and the delivery of the baby [10].

Among neonates who were born by cesarean section general health of the neonate is very crucial, using the Apgar score to evaluate the general status of a newborn is very important [11]. The ultimate objective is to generate substantial insights that may be used to improve the outcomes for neonates. A comprehensive understanding of the dynamics between anesthetic procedures, the induction-to-delivery interval, and Apgar scores is imperative for advancing clinical practices and enhancing perinatal care [12].

Identifying the factors influencing newborn outcomes in the context of cesarean deliveries empowers healthcare providers to make informed decisions, ultimately enhancing the well-being of both mothers and infants [13].

The objective: of this research is to investigate the influence that various anesthetic methods (spinal anesthesia and general anesthesia) on neonatal health by measuring the Apgar score for different time intervals.

MATERIALS AND METHODS

The study's conduct, which was a prospective observational study, was carried out from November 2022 to March 2023 at Al-Yarmouk Teaching Hospital in Baghdad, Iraq.

Participants

A total of 120 women with singleton pregnancies, between 36 to 40 weeks gestation, and scheduled for elective cesarean section were enrolled in the study. Exclusion criteria included women with pre-existing medical conditions such as diabetes (DM) or hypertension, as well as those who had taken analgesic or sedation drugs before the operation.

Anesthetic techniques

The 120 women were divided into two groups:

1. Group 1 (General Anesthesia) Seventy participants received general anesthesia. Before the initiation of anesthesia, participants underwent a pre-oxygenation process which included the delivery of pure oxygen at a concentration of 100% via a face mask for a length of 3 minutes. Within the context of the intravenous induction technique, a modest dosage of propofol (3–5 mg/kg) was administered in conjunction with a single dose of ketamine (1 mg/kg).

In the subsequent step, a dosage of 0.5 milligrams per kilogram of body weight of the non-depolarizing muscle relaxant rocuronium bromide (Esmeron)® was delivered. The technique of endotracheal intubation was carried out, and the patient was kept under anesthesia by administering a combination of oxygen and 2% isoflurane, in addition to rocuronium bromide at a dosage of 0.1 mg/kg, until the surgical operation was completed [14].

2. Group 2 (Spinal Anesthesia) - Fifty patients received spinal anesthesia following atropine administration. Spinal anesthesia was conducted using Marcaine (0.5%) at a concentration of 5 mg /ml [15].

Data Collection

A systematic questionnaire was used to obtain the following information from each participant: their name, age, body weight, gestational age, and whether they required an induction of cesarean section. This information was gathered before the operation was performed.

Time Intervals

Two specific time intervals were recorded during the procedure:

1. The Induction-Delivery Interval (I-D) refers to the duration between the commencement of anesthetic induction and the moment of the baby's delivery.

2. The Uterine-Delivery Interval (U-D) refers to the duration between the initial uterine incision and the subsequent delivery of the infant.

Outcome Measures

After the delivery of each baby, the Apgar score was recorded at 1, 5, and 10 minutes by trained healthcare providers. Appropriate resuscitation measures were administered, if necessary.

Data Analysis

All the statistical analysis was carried out with the help of the SPSS version 24.0 software. The data were expressed as the frequency (percent). Chi-square tests were used to examine the relationships between Apgar score induction duration and cesarian duration. If the P values were less than 0.05, then the differences were determined to be statistically significant.

Table 1

Comparison between type of cesarians and type of anesthesia used during delivery

	Elective ceserian	Emergency ceserian	P-value
Ceserians achieved by General anesthesia	12 (21.1%)	38 (61.3%)	6.54E-06
Ceserians achieved by Spinal anesthesia	46 (78.9%)	24 (38.7%)	
Total cases	58	62	120

Ethical Considerations

This research was carried out by the ethical criteria that were provided, as well as with the permission of the institutional review board. Before including any of the participants in the research project, we made sure to get their informed consent beforehand.

RESULTS AND DISCUSSION

In Table 1, there are significant relationship when compared between type of cesarian and type of anesthesia that used ($p<0.05$) at the same table, higher percent of deliveries have been found in elective cesarian after spinal anesthesia was 78.9% and lower percent was found in elective cesarian after general anesthesia.

In Table 2, using general anesthesia for induction of cesarian surgery, the Apgar score has been found that, after 1 minute of induction there is a significant relationship between the Apgar score and duration of induction of delivery, the highest score (7–10) has been found in newborn with induction duration between 6 to 9 minutes. In the same table, when measuring the Apgar score for the same newborns after 5 minutes, it has been found that there is a significant relationship between Apgar score and induction before surgery (p less than 0.05) and most newborns had higher Apgar score (7–9) found after induction duration (6–9) minutes. The same finding was seen after 10 minutes of induction.

In Table 3, when the caesarian surgery was achieved by general anesthesia, the Apgar score for the newborn at the first minute showed a significant relationship with the duration of the duration of surgery besides, most of the newborns are at a sore 7–10 when the surgery duration more than 120 second, but when surgery duration is less than 120 seconds most of the newborns are located at 4-6 according to Apgar score.

In the same table, after 5 minutes and 10 minutes of surgery, when the caesarian surgery was achieved by general anesthesia, the Apgar score for the newborn at the first minute showed a significant relationship with the duration of the duration of surgery after 5 minutes of surgery. Besides, most of newborns have an Apgar score (7–10) regardless of the time of surgery.

Table 2

Induction refers to the period after general anesthesia and the newborn's Apgar score

Induction delivery interval (min)	No. of cases	At 1 min in newborns			At 5 min in newborns			At 10 min in newborns		
		0 to 3 Points	4 to 6 Points	7 to 10 Points	0 to 3 Point	4 to 6 Points	7 to 10 Points	0 to 3 Point	4 to 6 Points	7 to 10 Points
Up to 5	16 (22.8%)	1 (20.0%)	11 (32.3%)	4 (12.9%)	0	0	16 (25.4%)	0	0	16 (23.1%)
06–9	49 (70.0%)	2 (40.0%)	21 (61.7 %)	26 (83.8%)	0	5 (61.4%)	44 (70%)	0	1 (100%)	48 (69.6%)
>10	5 (7.2%)	2 (40.0%)	2 (59%)	1 (32.2%)	0	2 (28.6%)	3 (47.6%)	0	0	5 (7.4%)
Total	70	5 (7.1%)	34 (48.6%)	31 (44.3%)	0	7 (10.0%)	63 (90.0%)	0	1 (1.4%)	69 (98.6%)
P-value		2.22E-12			3.18E-13			0.81		

Table 3

Caesarean delivery time following general anesthesia and Apgar scoring in newborns

Cesarean delivery interval (Sec)	No. of cases	At 1 min in newborns			At 5 min in newborns			At 10 min in newborns		
		0 to 3 Points	4 to 6 Points	7 to 10 Points	0 to 3 Points	4 to 6 Points	7 to 10 Points	0 to 3 Points	4 to 6 Points	7 to 10 Points
>120	40 (57.0%)	2 (66.0%)	16 (66.0%)	22 (51.0%)	0	6 (100%)	34 (53.0%)	0	1 (100%)	39 (56.0%)
<120	30 (42.0%)	1 (33.0%)	8 (33.0%)	2 (48.0%)	0	0	30 (46.0%)	0	0	30 (43.0%)
Total	70	3 (4.3%)	24 (34.3%)	43 (61.4%)	0	6 (8.6%)	64 (91.4%)	0	1 (1.4%)	69 (98.6%)
P-value		0.443			0.026			0.383		

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Table 4

Induction – delivery time following spinal anesthesia and Apgar scoring in newborns

Induction delivery interval (min)	No. of cases	At 1 min in newborns			At 5 min in newborns			At 10 min in newborns		
		0 to 3 Points	4 to 6 Points	7 to 10 Points	0 to 3 Point	4 to 6 Points	7 to 10 Points	0 to 3	4 to 6 Points	7 to 10 Points
Up to 5	4 (8.0%)	0	2 (9.5%)	2 (7.0%)	0	0	4 (8.3%)	0	0	4 (8.2%)
6 to10	42 (84.0%)	0	16 (76.0%)	26 (93.0%)	0	1 (50.0%)	41 (85.7%)	0	0	42 (85.7%)
>10	4 (8.0%)	1 (100%)	3 (1.5%)	0	0	1 (50.0%)	3 (7.0%)	0	1 (100%)	3 (6.1%)
Total	50	1 (2.0%)	21 (42.0%)	28 (56.0%)	0	2 (4.0%)	48 (96.0%)	0	1 (2.0%)	49 (98.0%)
P-value		0.0041			0.081			0.0028		

Table 5

Cesarean delivery time following spinal anesthesia and Apgar scoring in newborns

Cesarean delivery interval (Sec)	No. of cases	At 1 min in newborns			At 5 min in newborns			At 10 min in newborns		
		0 to 3 Points	4 to 6 Points	7 to 10 Points	0 to 3 Points	4 to 6 Points	7 to 10 Points	0 to 3 Points	4 to 6 Points	7 to 10 Points
<120	26 (52.0%)	0	6 (46.1%)	20 (74.0%)	0	1 (25.0%)	25 (54.3%)	0	0	26 (53.0%)
>120	24 (48.0%)	0	7 (53.9%)	17 (26.0%)	0	3 (75.0%)	21 (45.7%)	0	1 (100%)	23 (47.0%)
Total	50	0	13 (26.0%)	27 (74.0%)	0	4 (8.0%)	46 (92.0%)	0	1 (2.0%)	49 (98.0%)
P-value		0.0034			0.012			0.00069		

In Table 4, using spinal anesthesia for induction of cesarian surgery, the Apgar score has been found that, after 1 minute of induction there is a significant relationship between the Apgar score and duration of induction of delivery, the highest score (7–10) has been found in a newborn with induction duration between 6 to 9 minutes. In the same table, when measuring the Apgar score for the same newborns after 5 minutes, it has been found that there is no significant relationship between Apgar score and induction before surgery (p more than 0.05) and most newborns had higher APGAR score (7–9) found after induction duration (6–9) minutes. The same finding was seen after 10 minutes of induction except for the relationships between the duration of induction and the Apgar score was significant (p less than 0.05).

In Table (5), when the caesarian surgery was achieved by spinal anesthesia, the measurement of the APGAR score for the newborn at the first minute, 5th minute, and 10th minute showed a significant relationship with duration of duration of surgery, most of the newborns (at 1st, 5th and 10th minutes) are at a sore 7-10 when the surgery duration regardless to duration of surgery.

The results of this research indicate that neonates who were delivered by a cesarean section while under spinal anesthesia had higher 1-minute Apgar scores than those who were delivered under general anesthesia. The association between Apgar scores and the amount of time that passed between the induction of labor and the birth of the baby was investigated via the use of an analysis.

It is important to note that of the patients in Group I, who were given general anesthesia, sixteen of them had induction-delivery intervals that were less than five minutes, and twelve of their newborns had Apgar ratings that ranged from low to moderate. Attributing this discovery to the kind of anesthetic that was administered is a possibility.

On the other hand, none of the patients in Group II who were given spinal anesthetic had induction-delivery intervals that were shorter than five minutes, and none of their infants had poor Apgar scores.

These results are consistent with other studies that have shown that general anesthesia tends to depress Apgar scores at 1 min; at Apgar 5 many infants will have recovered but the initial depression is theoretically linked to early childhood cognitive issues in contrast to spinal anesthesia [16–19].

Additionally, induction-delivery intervals that were longer than ten minutes were similarly linked with moderate Apgar scores. One possible explanation for this is that the extended use of anesthetic led to a greater degree of neonatal acidity than was previously thought.

On the other hand, infants that were delivered under spinal anesthetic consistently demonstrated better Apgar ratings. this finding agreed with a previous study in which Predicting neonatal low Apgar scores after labor induction using this database may be a more effective and promising outcome. This was the case even in situations when the induction-delivery gap became longer [20, 21].

When compared to those in Group II, newborns who were delivered to moms who had uterine delivery intervals that were longer than 120 seconds and who were furthermore undergoing general anesthesia had Apgar ratings that ranged from low to severe severity this finding agreed with a previous study in which they found that, Newborns infants with induction-delivery time (≤5 min and >10 min) and uterine – delivery interval (>120 sec) had low and low to moderate Apgar scores at one minute on other hand all babies born were improved and show satisfactory Apgar score at 5 minute and 10 minutes interval after resuscitation (oxygenation and oral suction) [22].

The lengthening of the time between the uterine delivery and the birth of the baby is known to reduce the effectiveness of the exchange between the mother and the fetus, which may result in fetal activation. The poor 1-minute Apgar scores may be due to laryngeal spasms that were caused by the aspiration of blood or amniotic fluid during intrauterine manipulation.

As a result, the findings of the study indicate that induction-delivery intervals of less than 5 minutes and more than 15 minutes, as well as uterine-delivery intervals of less than 120 seconds, have a lesser impact on the Apgar scores of neonates born to mothers who receive spinal anesthesia as opposed to providing them with general anesthesia, this finding was considered with a previous studies in which they found that the duration of induction impacts an influence on neonatal health and its scoring by Apgar [23–25].

The amount of time that has elapsed between the administration of anesthesia and the clamping of the umbilical cord is a crucial factor that plays a role in determining the outcomes for newborns. This period is the length of time that the fetus is exposed to the medications that the mother is taking while she is carrying the baby. Another crucial factor to consider is the length of time that elapses between the uterine incision and the delivery of the baby. There is a correlation between the length of time that elapses between the incision and the delivery of the baby and an increased risk of fetal acidosis. This condition is often linked to uteroplacental vasoconstriction [26, 27].

CONCLUSIONS

According to present data, Spinal anesthesia appeared to be beneficial when compared to general anesthesia, especially in cases with extended induction-delivery times or prolonged uterine-delivery intervals. However, with appropriate care and resuscitative measures, neonatal Apgar scores can significantly improve, ensuring the well-being of newborns delivered via cesarean section.

These findings provide valuable insights for healthcare practitioners and may contribute to optimizing care and outcomes in cesarean section deliveries. Further research and clinical exploration are warranted to confirm and expand upon these findings.

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