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Research Article

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Comparison between Effect of Spinal and General Anesthesia for Caesarian Section C/S on Apgar Score

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ABSTRACT

Introduction: The choice between spinal and general anesthesia during cesarean section can influence neonatal outcomes, particularly Apgar scores. Evidence suggests that spinal anesthesia may lead to better immediate neonatal health indicators.

Aim of the Research: This study aimed to compare the effects of spinal versus general anesthesia on neonatal Apgar scores following cesarean delivery and to examine associated maternal and neonatal outcomes.

Methods: A quasi-experimental comparative study was conducted involving 50 women undergoing cesarean section, evenly assigned to either spinal or general anesthesia groups. Data were collected on maternal demographics, anesthesia procedures, and neonatal outcomes. Apgar scores were assessed at one and five minutes post-birth, and maternal and neonatal complications were evaluated.

Results: Neonates delivered under spinal anesthesia showed significantly higher Apgar scores at both one minute (8.2 ± 1.0 vs. 7.5 ± 1.3, $p < 0.01$) and five minutes (9.3 ± 0.7 vs. 8.8 ± 1.1, $p < 0.01$) compared to those delivered under general anesthesia. Nausea and vomiting were more frequently observed in the general anesthesia group (32% vs. 12%), while hypotension was more common in the spinal anesthesia group (20% vs. 8%). Neonatal complications such as the need for resuscitation (20% vs. 8%) and NICU admission (16% vs. 4%) were also higher with general anesthesia. Multivariate analysis indicated spinal anesthesia as a significant predictor of higher Apgar scores (AOR = 1.65, 95% CI: 1.25–2.16, $p < 0.01$), along with gestational age (AOR = 1.05, $p = 0.03$). Maternal age and parity had no significant effect.

Conclusion: The findings highlight the clinical advantage of spinal anesthesia in cesarean sections, as it is associated with better neonatal Apgar scores and fewer complications. Spinal anesthesia should be considered the preferred technique when appropriate to enhance both maternal and neonatal outcomes.

Key Words: Spinal Anesthesia, General Anesthesia, Cesarean Section, Apgar Score, Neonatal Outcome

INTRODUCTION

As the rates of cesarean deliveries continue to rise globally, understanding the implications of different anesthetic techniques on newborn health becomes increasingly critical. The Apgar score, which evaluates a newborn's physical condition at one and five minutes post-delivery based on factors such as heart rate, respiratory effort, muscle tone, reflex response, and skin coloration, serves as a vital indicator of immediate health and can dictate the need for further medical intervention.[1]

Historically, general anesthesia was more commonly used for C/S; however, there has been a shift towards regional anesthesia, particularly spinal anesthesia, due to perceived benefits such as lower maternal anxiety, better postoperative pain management, and enhanced neonatal outcomes. Previous studies have suggested that spinal anesthesia may be associated with fewer adverse effects on newborns, although findings remain inconsistent and sometimes contradictory. Moreover, spinal anesthesia enables mothers to remain conscious during the procedure, fostering early bonding with the newborns. [2]

Despite these advantages, the choice between general and spinal anesthesia remains complex and context-dependent. Studies comparing their effects on neonatal outcomes, particularly as measured by the Apgar score, have yielded mixed results. [3,4] Some research suggests that spinal anesthesia is associated with higher Apgar scores and fewer neonatal complications, while other studies indicate negligible differences or raise

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concerns about maternal hypotension during spinal anesthesia potentially impacting neonatal well-being. [5,6]

Furthermore, the implications of anesthesia choice extend beyond Apgar scores to encompass broader maternal and neonatal health parameters. General anesthesia may pose risks such as neonatal respiratory depression due to transplacental transfer of anesthetic agents.[6,7,8] Conversely, spinal anesthesia, while generally considered safer for neonates, may lead to maternal hypotension and uteroplacental insufficiency, potentially affecting neonatal oxygenation. [9]

Cesarean sections are common surgical procedures, and various anesthesia techniques are employed to ensure maternal and neonatal safety. However, there remains a lack of consensus on the impact of spinal versus general anesthesia on neonatal outcomes, particularly when assessed using the Apgar score. [10] The existing literature presents inconsistent findings, creating challenges for obstetricians and anesthetists in making informed clinical decisions. Therefore, a thorough investigation of these effects is essential to establish evidence-based guidelines for choosing the optimal anesthesia technique during cesarean deliveries. [11]

A cesarean section (C/S) is a surgical intervention used to deliver a baby through incisions in the mother's abdominal wall and uterus. This procedure is typically recommended when a vaginal delivery poses potential risks to the mother, the fetus, or both. Indications for cesarean delivery are commonly grouped into maternal, fetal, or combined maternal-fetal categories. [12] Maternal indications include conditions such as obstructed labor, uterine rupture, and hypertensive disorders. Fetal indications may involve abnormal fetal positioning, congenital anomalies, or signs of fetal distress. [13] Combined maternal-fetal factors like placenta previa and abruptio placentae often require urgent surgical delivery to safeguard the health of both the mother and the baby. Trends in Cesarean Delivery Rates Globally, the rate of cesarean deliveries has been steadily increasing, with notable differences observed across countries and healthcare systems. In South Africa, studies have documented a substantial rise in cesarean procedures, attributed to factors such as previous cesarean deliveries, prolonged labor, and fetal compromise. [14] In Iraq, the cesarean section rate grew from 18.0% in 2008 to 24.4% in 2012, reflecting evolving medical practices and changes in patient preferences. Contributing factors include expanded access to healthcare services, increased availability of obstetric care, and a shift toward surgical delivery in certain clinical and social contexts.[15] Research also indicates disparities in cesarean rates within Iraq. Urban centers tend to report higher rates than rural areas, largely due to better healthcare infrastructure and access. [16] Additionally, private hospitals often show increased use of cesarean delivery compared to public facilities. This trend is frequently driven by elective procedures, patient requests, and the perception that surgical births are safer. However, the rising cesarean rates raise concerns about the potential for overuse, emphasizing the importance of ensuring that such interventions are based on medical necessity. Mechanism of Anesthetic Action General anesthesia exerts its effects by altering neural transmission within the central nervous system. Its action is primarily mediated through modulation of ion channels and neurotransmitter activity. Specifically, general anesthetics enhance inhibitory signaling through gamma-aminobutyric acid type A (GABA) receptors, leading to neuronal hyperpolarization and decreased synaptic activity. At the same time, they inhibit excitatory transmission by blocking receptors such as N-methyl-D-aspartate (NMDA), resulting in a widespread suppression of brain activity necessary for inducing unconsciousness and preventing pain perception during surgery.[12,16] Spinal anesthesia, in contrast, involves injecting a local anesthetic directly into the cerebrospinal fluid within the subarachnoid space. This technique produces a targeted nerve block by interrupting sensory, motor, and autonomic nerve conduction at the spinal level. The extent of anesthesia achieved depends on factors such as the dose and concentration of the anesthetic and the patient's posture during and after administration. Spinal anesthesia is commonly used in cesarean deliveries due to its rapid onset, effective pain control, and lower maternal and neonatal complication rates compared to general anesthesia.[17] Study Aim This research seeks to compare the impact of spinal versus general anesthesia on neonatal Apgar scores following cesarean section, along with evaluating maternal and neonatal outcomes associated with each anesthetic technique.

METHODOLOGY

This research employs a quasi-experimental, comparative design to investigate the differences in neonatal outcomes, specifically Apgar scores, associated with two primary anesthetic techniques spinal anesthesia and general anesthesia during cesarean sections.

Participants of Research

The current research include 50 participants for detecting differences in Apgar scores between the two anesthesia groups. Participants were evenly divided into two groups of 25 each (spinal vs. general anesthesia). This research was conducted in Najaf Governorate at Al-Zahraa Teaching Hospital from October 2023 to January 2024 where the hospital routinely performed caesarean sections with the participation of anesthesiologists.

Inclusion and Exclusion Criteria

Inclusion Criteria

Participants in the research include:

1. Pregnant women scheduled for elective or emergency cesarean section.
2. Women aged 18 years and older.
3. Women providing informed consent to participate in the research.

The data collection was structured in three phases:

Pre-operative Data Collection

Information was collected regarding maternal demographics (age, BMI, parity), obstetric history (gestational age, previous cesarean deliveries), and any relevant medical conditions. This was help identify factors potentially influencing neonatal outcomes.

Intra-operative Anesthesia Administration

The type of anesthesia used was documented, including details such as the specific drugs administered, dosages, maternal positioning, and any complications arising during the procedure.

Post-operative Neonatal Assessment

Apgar scores were documented at one and five minutes post-delivery by paediatric staff trained in Apgar scoring. Additional neonatal outcomes, including birth weight and any immediate resuscitation measures, were also be recorded.

Complications Documentation

Maternal and neonatal complications requiring intervention post-delivery were categorized and recorded based on established definitions. Any adverse events were noted to allow for further analysis of the impacts of different anesthesia types.

Ethical Considerations

Approval for conducting the research was obtained from AL-Hilla University\Department of Anesthesia Techniques. Informed consent was sought from all participants, ensuring that they understand the research 's purpose, procedures, risks, and benefits. Confidentiality was maintained throughout the research, with all data anonymized and securely stored. This research was conducted in Najaf Governorate at Al-Zahraa Teaching Hospital from October 2023 to January 2024.

Ethical Approval: All procedures prepared in studies including human patient's participants were following the ethical standards of AL-Hilla University\Department of Anesthesia Techniques. Apgar : Anmar 00260-07-2023). Informed Consent: Informed consent was obtained from all the individual participants included in the study.

Statistical Analysis

Data was analyzed using statistical software SPSS version 26. Descriptive statistics summarized demographics and clinical characteristics of participants. Inferential statistics was employed to compare Apgar scores between the groups using independent t-tests for continuous variables and chi-square tests for categorical variables. To control for potential confounding variables that could influence outcomes, multivariate logistic regression analyses were performed. This was allowed for adjustment for identified covariates such as maternal age, gestational age, and number of previous births.

RESULTS AND DISCUSSION

Table 1 presents the demographic characteristics of participants in the research. The mean age of mothers was 30.6 years (±5.9), with no significant difference between the spinal anesthesia (30.2 ± 5.6) and general anesthesia (31.0 ± 6.1) groups. Similarly, the mean BMI was comparable between groups, with slightly higher values observed in the general anesthesia group (25.1 ± 2.9) compared to the spinal anesthesia group (24.5 ± 3.2) regarding parity, 36% of participants were nulliparous, 38% had one previous delivery, and 26% had two or more previous deliveries. The distribution was relatively similar between the two anesthesia groups. The mean gestational age was also comparable, averaging 38.6 weeks (±1.2), with minimal differences between groups.

Table 1: Demographic Characteristics of Participants

Variable	Spinal Anesthesia (n=25)	General Anesthesia (n=25)	Total (n=50)
Age (mean ± SD)	30.2 ± 5.6	31.0 ± 6.1	30.6 ± 5.9
BMI (mean ± SD)	24.5 ± 3.2	25.1 ± 2.9	24.8 ± 3.1
Parity			
0	10 (40%)	8 (32%)	18 (36%)
1	8 (32%)	11 (44%)	19 (38%)
≥2	7 (28%)	6 (24%)	13 (26%)
Gestational Age (weeks, mean ± SD)	38.5 ± 1.2	38.7 ± 1.3	38.6 ± 1.2

The demographic characteristics in this research indicate that the two anesthesia groups were well-matched in terms of maternal age, BMI, parity, and gestational age. Prior research has shown that maternal age and BMI can influence perinatal outcomes, but their impact is often less significant compared to clinical factors such as anesthesia type. [18] The similar distribution of these factors between groups suggests that differences in neonatal outcomes were primarily influenced by anesthesia rather than maternal characteristics.

Comparisons of Apgar Scores at 1 and 5 Minutes

Table 2 shows the Apgar scores at 1 and 5 minutes for neonates delivered under spinal and general anesthesia. The mean Apgar score at 1 minute was significantly higher in the spinal anesthesia group (8.2 ± 1.0) compared to the general anesthesia group (7.5 ± 1.3) ($p < 0.01$). Similarly, the Apgar score at 5 minutes was higher in the spinal anesthesia group (9.3 ± 0.7) compared to the general anesthesia group (8.8 ± 1.1) ($p < 0.01$).

Table 2: Comparisons of Apgar Scores at 1 and 5 Minutes

Anesthesia Type	Apgar Score at 1 Minute (mean ± SD)	Apgar Score at 5 Minutes (mean ± SD)
Spinal Anesthesia	8.2 ± 1.0	9.3 ± 0.7
General Anesthesia	7.5 ± 1.3	8.8 ± 1.1
p-value	< 0.01	< 0.01

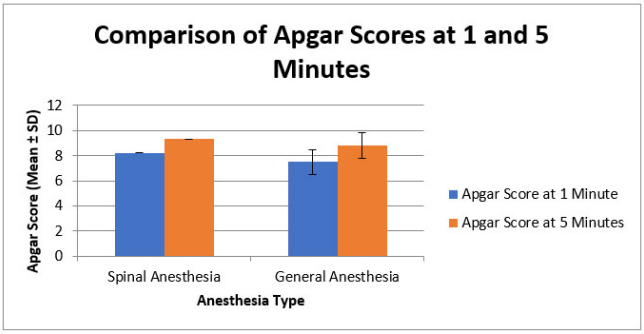

Figure 1: Comparisons of Apgar Scores at 1 and 5 Minutes

The significantly higher Apgar scores in the spinal anesthesia group are consistent with previous findings. Spinal anesthesia is associated with a lower risk of neonatal respiratory depression due to reduced placental transfer of anesthetic agents compared to general anesthesia. General anesthesia has been linked to lower Apgar scores due to fetal exposure to anesthetic drugs, which can suppress neonatal respiratory and central nervous system function. [18] Several studies have reported similar findings, with neonates delivered under general anesthesia having lower initial Apgar scores but improving at the 5-minute mark. This is likely due to the transient effects of anesthetic drugs, which can cause initial respiratory depression but resolve as the neonate adapts. [19]

Maternal and Neonatal Complications

Table 3 summarizes maternal and neonatal complications. Maternal complications varied between the two groups, with nausea and vomiting occurring more frequently in the general anesthesia group (32%) compared to the spinal anesthesia group (12%). Hypotension, on the other hand, was more common in the spinal anesthesia group (20%) compared to the general anesthesia group (8%). Neonatal complications also differed between groups. More neonates required resuscitation in the general anesthesia group (20%) compared to the spinal anesthesia group (8%). Additionally, NICU admissions were higher in the general anesthesia group (16%) compared to the spinal anesthesia group (4%).

Table 3: Maternal and Neonatal Complications

Complication Type	Spinal Anesthesia (n=25)	General Anesthesia (n=25)	Total (n=50)
Maternal Complications			
Nausea/Vomiting	3 (12%)	8 (32%)	11 (22%)
Hypotension	5 (20%)	2 (8%)	7 (14%)
Neonatal Complications			
Resuscitation Required	2 (8%)	5 (20%)	7 (14%)
NICU Admission	1 (4%)	4 (16%)	5 (10%)

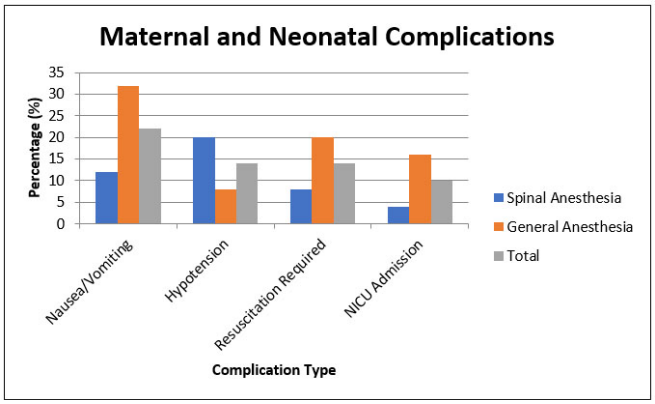

Figure 2: Maternal and Neonatal Complications

The higher incidence of nausea and vomiting in the general anesthesia group aligns with previous research showing that inhalational anesthetics and opioid use can induce postoperative nausea and vomiting. Conversely, the higher incidence of hypotension in the spinal anesthesia group is a well-documented effect due to sympathetic blockade. [20] This transient hypotension is typically managed with fluid administration and vasopressors. Neonatal complications were more frequent in the general anesthesia group, with higher rates of resuscitation and NICU admission.[21] These findings support prior research indicating that general anesthesia increases the risk of neonatal respiratory depression, necessitating more frequent resuscitation efforts. The increased NICU admissions may also be attributed to transient respiratory distress caused by anesthetic agents crossing the placenta.

Multivariate Analysis of Factors Influencing Apgar Scores

Table 4 presents the results of a multivariate analysis evaluating factors influencing Apgar scores. Spinal anesthesia was associated with significantly higher Apgar scores compared to general anesthesia (Adjusted Odds Ratio (AOR) = 1.65, 95% CI: 1.25–2.16, $p < 0.01$). Gestational age was also a significant predictor of higher Apgar scores (AOR = 1.05, 95% CI: 1.02–1.08, $p = 0.03$). However, maternal age and parity did not show statistically significant associations with Apgar scores.

Table 4: Multivariate Analysis of Factors Influencing Apgar Scores

Factor	Adjusted Odds Ratio (AOR)	95% Confidence Interval (CI)	p-value
Anesthesia Type (Spinal vs. General)	1.65	1.25 - 2.16	< 0.01
Maternal Age (per year)	0.98	0.95 - 1.01	0.23
Gestational Age (per week)	1.05	1.02 - 1.08	0.03
Parity (0 vs. ≥1)	1.12	0.78 - 1.61	0.54

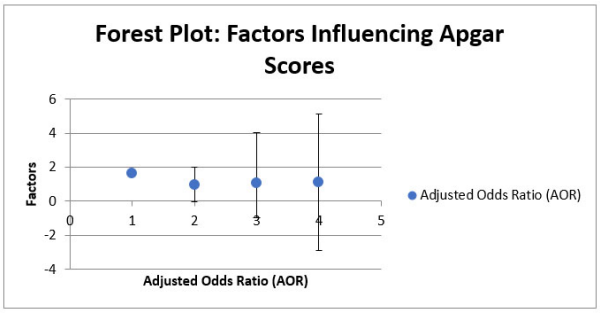

Figure 3: Multivariate Analysis of Factors Influencing Apgar Scores.

The multivariate analysis reinforces the significant impact of anesthesia type on neonatal outcomes. Spinal anesthesia was associated with significantly higher Apgar scores, confirming its protective role in neonatal health. Gestational age also emerged as a significant factor, which is expected given its influence on fetal lung maturity and neonatal adaptation. [22] Interestingly, maternal age and parity did not significantly influence Apgar scores in this research. While some studies have suggested that multiparity or advanced maternal age can impact neonatal outcomes, the findings here suggest that anesthesia choice is the primary determinant in this setting. [23]

CONCLUSION

Spinal anesthesia is associated with better neonatal outcomes and fewer complications compared to general anesthesia, particularly in elective cesarean sections. It significantly improves Apgar scores and reduces NICU admissions, making it the preferred choice despite manageable maternal side effects.

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