



Spinal vs. General Anesthesia in Elective Cesarean Section: A Study of Preferences and Outcomes

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ABSTRACT

Background: This study evaluates and compares the effects of spinal and general anaesthesia on maternal and neonatal outcomes during elective cesarean sections, aiming to provide insights into their physiological and clinical impacts. **Methods:** A total of 38 full-term, low-risk pregnant women were equally divided into two groups: Group I (spinal anaesthesia, n=19) and Group II (general anaesthesia, n=19). Maternal demographic data, intraoperative hemodynamics, postoperative recovery parameters, and neonatal outcomes (Apgar scores and birth weight) were assessed. Statistical analysis determined the significance of differences between groups. **Results:** Maternal outcomes: Spinal anaesthesia was associated with transient intraoperative hypotension, shorter operation times, faster return of bowel function, and slightly delayed but moderate postoperative analgesia requirements. General anaesthesia showed more stable intraoperative blood pressure initially, but higher postoperative pain scores and analgesia needs. Neonatal outcomes: First-minute Apgar scores were slightly higher in the general anaesthesia group ($p < 0.001$), but all differences resolved by the fifth minute, indicating similar short-term neonatal safety. **Conclusion:** Spinal anaesthesia provides advantages in maternal hemodynamic stability and early recovery, supporting its use as the preferred anaesthetic method for elective cesarean sections. General anaesthesia remains a safe alternative in select cases, with no significant long-term neonatal differences observed. These findings highlight the importance of individualised anaesthesia choice based on maternal and obstetric considerations.

1. INTRODUCTION

Cesarean is derived from the Latin verb “caedere” meaning “to cut”. It was first used in 700 BC during the Roman era to remove a baby from the womb of a mother who died during childbirth during advanced stages of pregnancy. And the first C/S on a living patient was performed in 1610, the safety of the mother, the fetus, and the newborn should also be ensured in C/S. And this adds a new dimension to anesthesia for C/S. General and regional anesthesia techniques are used in anesthesia for C/S. (Van den Bergh et al., 2020)

The frequency of caesarean sections continues to rise increasingly all over the world. It is the route of delivery in ~30% of live births, and although it has become safer than before, it is still associated with higher maternal and perinatal mortality and morbidity than vaginal deliveries. These higher mortality and morbidity rates are not only because of the surgical procedure but also related are to the anesthesia used. Cesarean anesthesia has gained importance as its frequency has increased but is still under discussion and choosing spinal or general anesthesia also has many controversies as regards its maternal and neonatal safety. The choice of anesthesia depends on the mother's request, obstetric indications, and on the anesthesiologist's experience level and drug available, and then became the preferred anesthetic technique by many anesthesiologists in elective conditions (Madkour et al., 2019). For many years, general anesthesia was the preferred type for use in cesarean procedures. Although it has many advantages, such as faster induction, better cardiovascular stability with lower incidence of hypotension, and good control over ventilation, use of anesthetic drugs that cross the placental barrier can nevertheless produce neonatal depression. Moreover, complications such as maternal aspiration syndrome and intubation failure, which may occur during general anesthesia and contribute towards maternal mortality, have been reported. Thus, recently the rates of cesarean section using regional anesthesia have been increasing and regional anesthesia and then became the preferred anesthetic technique by many anesthesiologists in elective conditions. Regional anesthesia-related hypotension due to sympathetic blockade may affect neonatal short-term outcomes by impairing uteroplacental perfusion. Additionally, cerebrospinal fluid (CSF) leakage following lumbar puncture may induce headache, nausea, and vomiting. On rare occasions, insufficiency of the regional blockade and consequent conversion to general anesthesia has been reported. As a result, no optimal cesarean technique, and no ideal anesthetic method for minimizing the surgical morbidity among candidate mothers has yet been described in the literature. Today, the choice of anesthesia depends on the mother's request, obstetric reasons and the anesthesiologist's experience level. (Saygi et al., 2015)

Objective: The primary aim of this study is to compare spinal and general anesthesia in terms of maternal and neonatal outcomes during elective cesarean sections in low-risk, full-term pregnancies. Specifically, the study seeks to:

1. Evaluate Maternal Outcomes:
 - Assess intraoperative hemodynamic stability (blood pressure).
 - Quantify intraoperative and postoperative blood loss (Hematological Indices)
 - Examine the severity and management of postoperative pain.
 - Determine the time to postoperative recovery milestones, including:
 - SPO₂
 - First analgesia requirement
 - Total analgesia requirement.
 - Return of gastrointestinal function (bowel sounds and gas passage).
2. Evaluate Neonatal Outcomes:
 - Measure neonatal condition immediately post-delivery using Apgar scores at 1 and 5 minutes.
 - Record neonatal weight, sex, and any immediate resuscitation requirements.
3. Contribute to Clinical Guidelines:
 - Provide evidence-based recommendations on the optimal anesthesia method for elective cesarean sections, balancing safety, comfort, and recovery for both mother and neonate.

2. METHOD

This prospective, controlled clinical trial was conducted at Alwahda Hospital / Derna between October 2024 to April 2025. The study included 38 low-risk, full-term pregnant women (37–40 weeks gestation) with singleton, cephalic presentations scheduled for elective C-sections. Ethical approval was obtained, and all participants provided signed informed consent.

Inclusion Criteria:

- low-risk pregnancies
- Full-term gestation (37–40 weeks)
- Singleton, cephalic presentations

Exclusion Criteria:

- Emergency C-sections
- High-risk pregnancies (e.g., hypertensive disorders, cardiac conditions)
- Fetal abnormalities (e.g., multiple gestations, growth restrictions, placental anomalies)

Pregnancy dating was based on the last menstrual period or early ultrasound findings. Preoperative evaluations included medical history, physical examinations, and laboratory tests (e.g., full blood count, glucose levels, and viral screening). Preoperative medications included intravenous H₂-blockers (50 mg) and metoclopramide (10 mg).

Participants were randomly divided into two groups:

- Group I (n=19): Spinal anesthesia
- Group II (n=19): General anesthesia

Spinal Anesthesia Protocol:

Patients received 1000–1500 mL of lactated Ringer's solution before induction. Aseptic techniques and standard monitoring (ECG, blood pressure, SpO₂) were employed. Spinal anesthesia was administered using 2.4 mL of 0.5% hyperbaric bupivacaine via a 25-G needle. Hypotension was managed with ephedrine (3 mg increments), and oxygen supplementation was provided if SpO₂ dropped below 90%.

General Anesthesia Protocol:

Preoxygenation with 100% oxygen for 3–5 minutes was performed, followed by induction using propofol (1–2 mg/kg) and rocuronium (0.6 mg/kg). Anesthesia was maintained with 0.8% isoflurane in oxygen. Neonatal resuscitation teams were present during delivery. Post-delivery, fentanyl (2 µg/kg) and oxytocin were administered.

Outcomes Measured:

- Maternal hemodynamic stability
- Blood loss
- Postoperative pain (via verbal rating scale)
- Time to first analgesic dose
- Postoperative bowels return and recovery times
- Neonatal Apgar scores at 1 and 5 minutes
-

4. ETHIC APPROVAL

Permission for ethical approval was obtained from the Ethics Committee of the Research Office of the Ministry of Health in Derna. In the Obstetrics and Gynecology Department at Al Wahda Hospital in Derna, Libya, ethical considerations and patient confidentiality were taken into account. I am committed to maintaining the highest ethical standards. All patient data is completely anonymous, and no personally identifiable information will be included in the final report. Informed consent was obtained from all participants, and their right to withdraw from the study at any time was respected.

5. RESULT

I: (General Anesthesia Data)

Table (1) Frequency, Percentage, Mean and Std. Deviation of Pre- and Post-operative Blood Pressure in (General Anesthesia)

Blood Pressure Analysis

- Table of Pre and Post Blood Pressure:

Categories: Normal, Moderate Hypertension, Moderate Hypotension.

- Findings:

Normal blood pressure increased from 31.6% pre-operation to 42.1% post-operation.

Moderate hypertension decreased significantly from 52.6% pre-operation to 0% post-operation, indicating effective management or improvement.

Table (1) Frequency, Percentage, Mean and Std. Deviation of Pre- and Post-operative Blood Pressure in (General Anesthesia)

Blood Pressure	Pre- Blood Pressure (General) N (%)	Mean	Std. D	Post- Blood Pressure (General) N (%)	Mean	Std. D
Normal	6(31.6)	4.21	4.0526	8(42.1)	0.918	0.9703
Moderate Hypertension	3(15.8)			2(10.5)		
Moderate Hypotension	10(52.6)			0(0.0)		
Total	19(100.0)			19(100.0)		

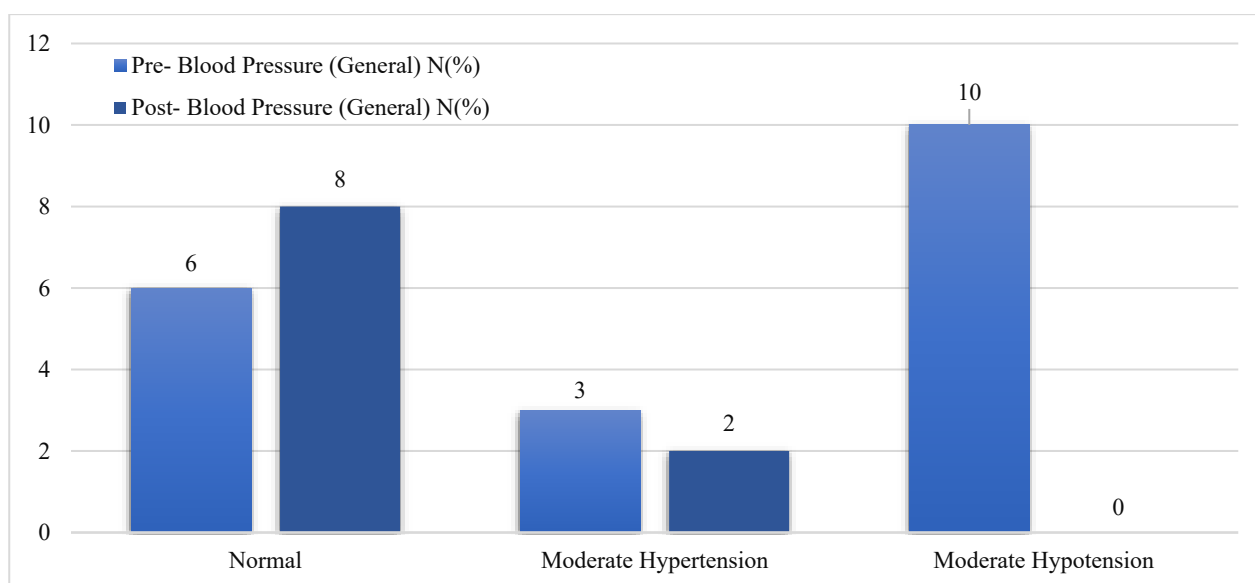


figure (1) Frequency, Percentage, of Pre- and Post-operative Blood Pressure in (General Anesthesia)

Intra-operative Hemodynamic Data Analysis:

- A significant change in hemodynamic parameters occurred during the intra-operative period:

After 5 Minutes:

- Hypotension became predominant (52.6%), reflecting a common side effect of general anesthesia.
- Normal blood pressure was observed in 36.8%, while hypertension and moderate hypertension were minimal (5.3% each).
- The mean dropped to 2.42, with less variability (Std. Deviation: 0.692).

After 10 Minutes:

- Hypotension increased further to 63.2%.
- Normal blood pressure decreased slightly to 26.3%.
- Hypertension and moderate hypertension remained at low levels (5.3% each).
- The mean continued to decrease to 2.32, with minimal variability (Std. Deviation: 0.671).

After 15 Minutes:

- Hypotension reached its peak (73.7%), while normal blood pressure decreased further to 15.8%.
- No cases of moderate hypertension or moderate hypotension were reported at this point.
- The mean dropped to 2.05, with minimal variability (Std. Deviation: 0.524).

After 30 Minutes:

- A slight recovery in blood pressure was noted:
 - Normal readings increased to 31.6%.
 - Hypotension decreased to 26.3%.
 - Hypertension (21.1%) and moderate hypertension (15.8%) began to reappear.
- The mean remained stable at 2.05 with a standard deviation of 0.524.

After 45 Minutes:

- Moderate hypertension became the most frequent category (36.8%), followed by moderate hypotension (21.1%) and normal blood pressure (10.5%).
- The mean increased to 3.37, reflecting significant variability (Std. Deviation: 1.342).

Table (2) Frequency, Percentage, Mean and Std. Deviation of pre- and Intra-Operative Hemodynamic (blood pressure) in General Anesthesia

Intra-Operative Hemodynamic	Hypertension N (%)	Hypotension N (%)	Normal N (%)	Moderate Hypertension N (%)	Moderate Hypotension N (%)	Mean	Std. D
After 5mints (General)	1(5.3)	10(52.6)	7(36.8)	1(5.3)	0(0.0)	2.42	0.692
After 10 minutes (General)	1(5.3)	12(63.2)	5(26.3)	1(5.3)	0(0.0)	2.32	0.671
After 15 minutes (General)	2(10.5)	14(73.7)	3(15.8)	0(0.0)	0(0.0)	2.05	0.524
After 30 minutes (General)	4(21.1)	5(26.3)	6(31.6)	3(15.8)	1(5.3)	2.05	0.524
After 45 minutes (General)	2(10.5)	4(21.1)	2(10.5)	7(36.8)	4(21.1)	3.37	1.342
Total	19(100)						

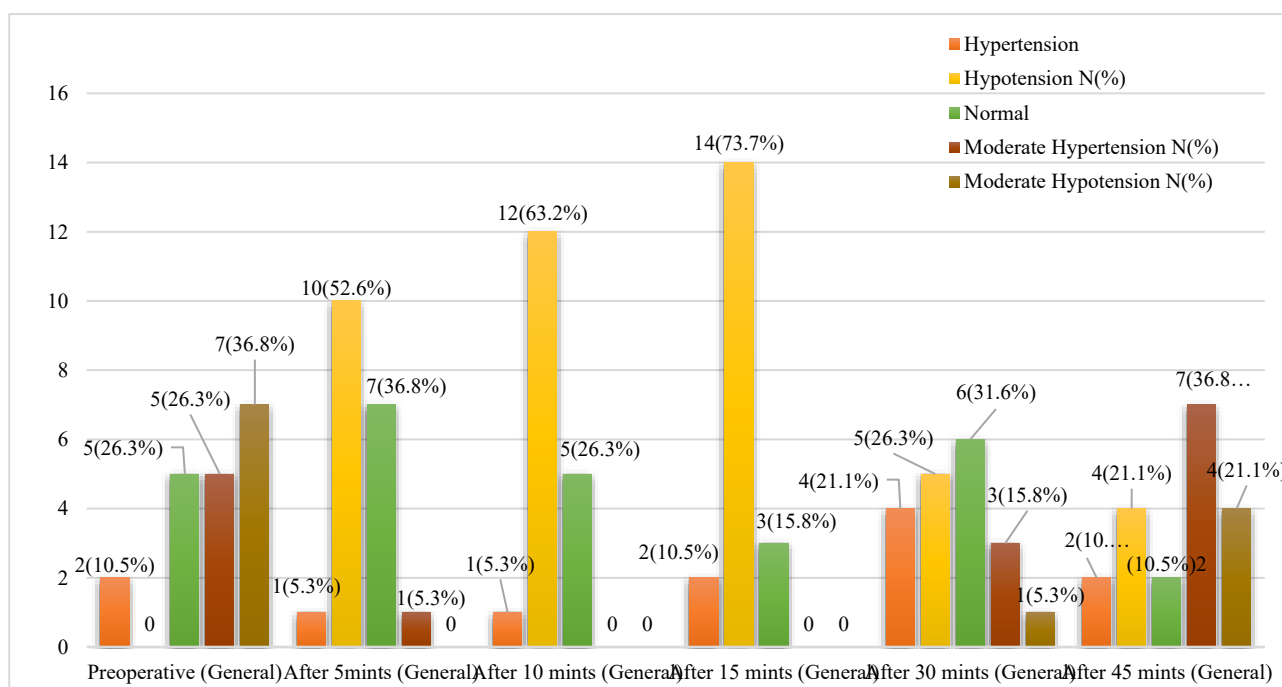


figure (2) Frequency, Percentage, pre- and Intra-Operative Hemodynamic (blood pressure) in General Anesthesia

Table (3) Frequency, Percentage, Mean and Std. Deviation of Pre and Post Hematological indices in General Anesthesia Hematological Indices:

- Table of Pre and Post Hematological Indices:

Categories: Normal, Moderate Low.

- Findings:

Normal hematological indices decreased from 47.4% pre-operation to 21.1% post-operation, while moderate low indices increased from 52.6% pre-operation to 78.9% post-operation.

Table (3) Frequency, Percentage, Mean and Std. Deviation of Pre and Post Hematological indices in General Anesthesia

Hematological indices	pre-operative Hematological indices (General) N (%)	Mean	Std. D	post-operative Hematological indices (General) N (%)	Mean	Std. D
Normal	9(47.4)	3.6316	2.56495	4(21.1)	3.3684	2.56495
Moderate Low	10(52.6)			15(78.9)		
Total	19(100.0)			19(100.0)		

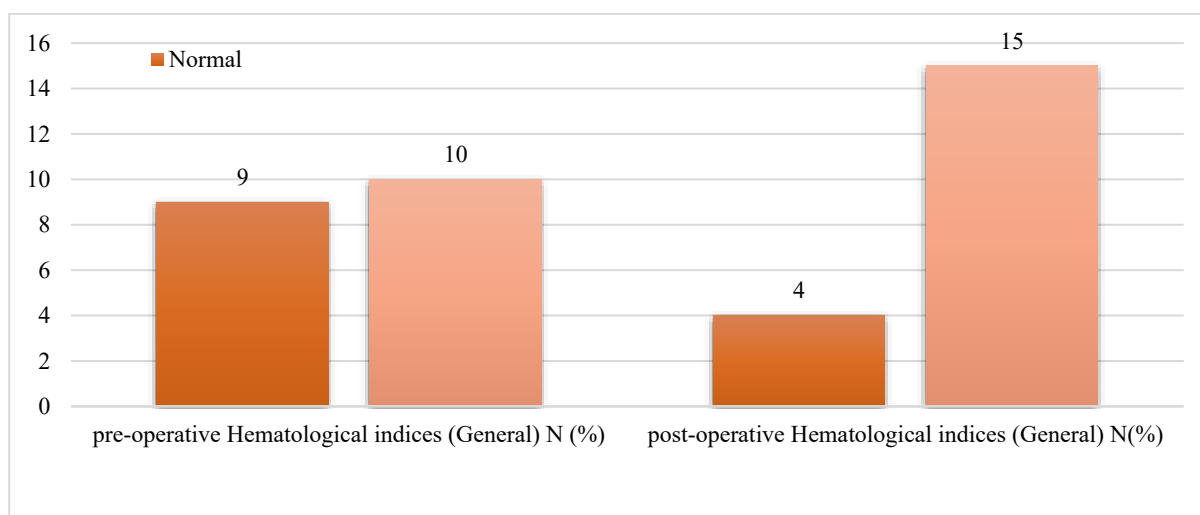


Figure (3) Frequency, Percentage, of Pre and Post Hematological indices in General Anesthesia

Table (4) Frequency, Percentage, Mean and Std. Deviation of Pre and post hematological indices in General Anesthesia Pre & post hematological indices Analysis:

General Observations of Hemoglobin Percentage (Hb%): Pre and Post Distribution: In the normal category, there is a notable difference, with 84.2% post-normal compared to 47.4% pre-normal. This suggests a significant improvement in hemoglobin levels of post-intervention.

Statistical Summary: The mean Hb% for the general group is 5.37 with a standard deviation of 1.499, indicating variability in the data.

Hematocrit (HTC): Pre-Post Comparison: The results show a perfect score of 100% in the pre-condition for normal cases, indicating that all subjects met the normal criteria. Post-intervention, 94.7% remain normal, with only 5.3% falling into the moderate category.

Mean and Standard Deviation: The mean is 1.105 with a standard deviation of 0.4588, suggesting a relatively consistent response among subjects.

Platelet Count: The platelet data mirrors the trends seen in Hb% and HTC, with 89.5% of subjects in both pre- and post-normal conditions maintaining a normal platelet count.

Table (4) Frequency, Percentage, Mean and Std. Deviation of Pre and post hematological indices in General Anesthesia

General	Pre N (%)		Post N (%)		Mean	St.D	
	Normal	Moderate Law	Normal	Moderate Law			
Hb%	9(47.4)	10(52.6)	3(15.8)	16(84.2)	5.37	1.499	
HTC	19(100.0)	0(0.0)	18(94.7)	1(5.3)	1.105	0.4588	
Platelets	17(89.5)	2(10.5)	17(89.5)	2(10.5)	1.21	0.631	
Total	19(100.0)						

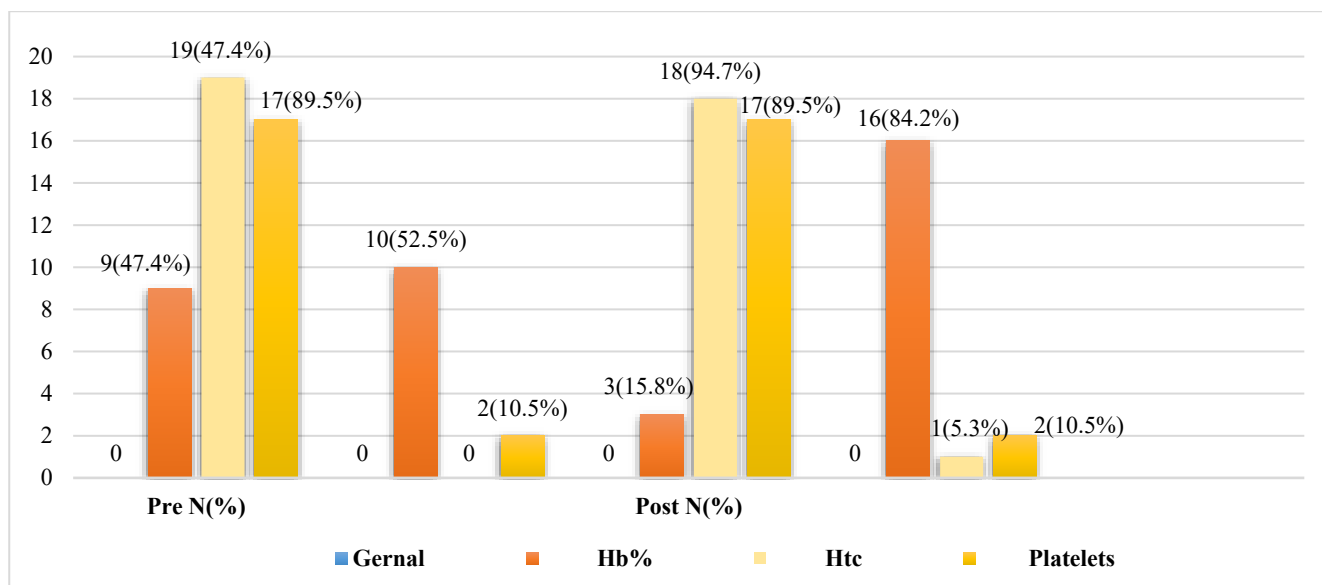


Figure (4) Frequency, Percentage, Mean and Std. Deviation of Pre and post hematological indices in General Anesthesia

Table (5) Frequency, Percentage, Mean and Std. Deviation of APGAR SCORE in General Anesthesia

APGAR Scores

- Table of APGAR Scores:

- Scores after 1 and 5 minutes:

The majority scored between 7/10 and 8/10 after one minute, with a notable drop after five minutes for the same scores, indicating potential complications or the need for further assessment.

Table (5) Frequency, Percentage, Mean and Std. Deviation of APGAR SCORE in General Anesthesia

APGAR SCORE	After (First minute) (General) N (%)	After (five minutes) (General) N (%)	Mean	Std. D
5\10	2(10.5)	0(0.0)	2.37	1.2225
6\10	2(10.5)	0(0.0)		
7\10	11(57.9)	2(10.5)		
8\10	3(15.8)	7(36.8)		
9\10	1(5.3)	9(47.4)		
10\10	0(0.0)	1(5.3)		
Total	19(100.0)	19(100.0)		

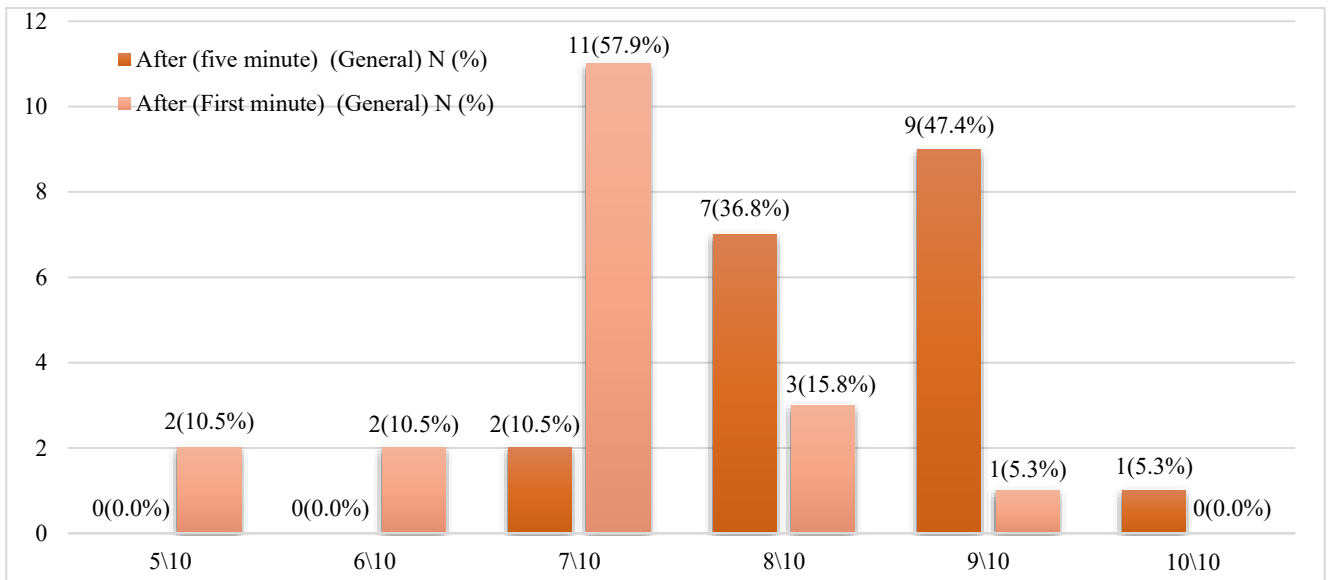


Figure (5) Frequency, Percentage, of APGAR SCORE in (General Anesthesia)

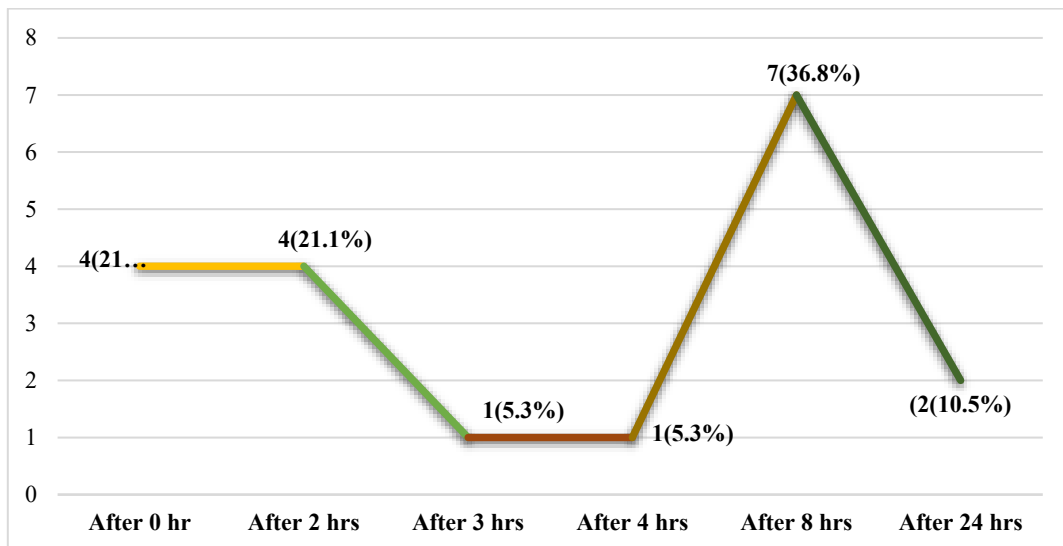


Figure (6) Frequency, Percentage, of Post operative maternal general condition :1st requirement of analgesia in General Anesthesia N(%)

Table (7) Frequency, Percentage, Mean and Std. Deviation of Post operative maternal general condition: Total requirement of analgesia in General Anesthesia

Maternal General Condition Post-Operative Analysis:

Tables on Analgesia Requirements:

-First Requirement of Analgesia:

Most patients require analgesia after 8 hours (36.8%).

-Total Requirement of Analgesia:

47.4% needed analgesia two times, suggesting a moderate level of post-operative discomfort.

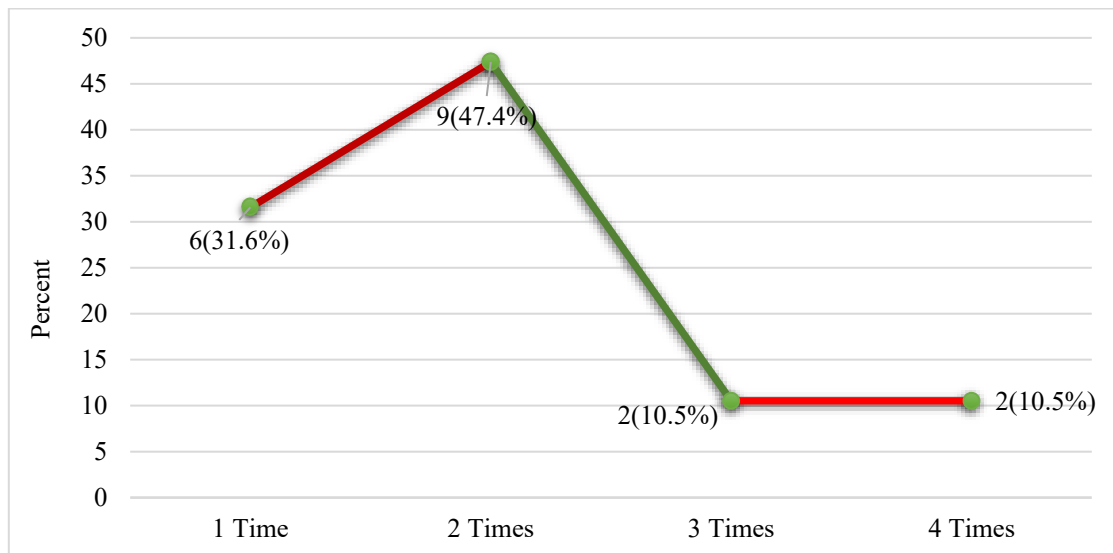


Figure (7) Frequency, Percentage, of Post operative maternal general condition: total requirement of analgesia in General Anesthesia

Summary

These tables collectively indicate the effectiveness of medical interventions on various health parameters, particularly blood pressure management and pain control. The data suggest improvements in patients' conditions post-operation, though attention to APGAR scores and pain management remains critical for ongoing care.

II: (Spinal Anesthesia Data)

Table (6) Frequency, Percentage, Mean and Std. Deviation of Pre and Post Blood Pressure in Spinal Anesthesia

Blood Pressure Data Analysis:

-Tables on Pre and Post Blood Pressure:

These tables present the frequency, percentage, mean, and standard deviation of pre-operative and post-operative blood pressure readings.

The classification includes Normal, Moderate Hypertension, and Moderate Hypotension.

Notably, there is a significant change in the post-operative readings, with all participants categorized under Normal blood pressure.

Table (6) Frequency, Percentage, Mean and Std. Deviation of Pre and Post Blood Pressure in Spinal Anesthesia

Blood Pressure	Pre- Blood Pressure (Spinal) N (%)	Mean	Std. D	Post- Blood Pressure (Spinal) N (%)	Mean	Std. D
Normal	5(26.3)	3.6316	2.56495	19(100.0)	3.3684	1.25656
Moderate Hypertension	7(36.8)			0(0.0)		
Moderate Hypotension	7(36.8)			0(0.0)		
Total	19(100.0)			19(100.0)		

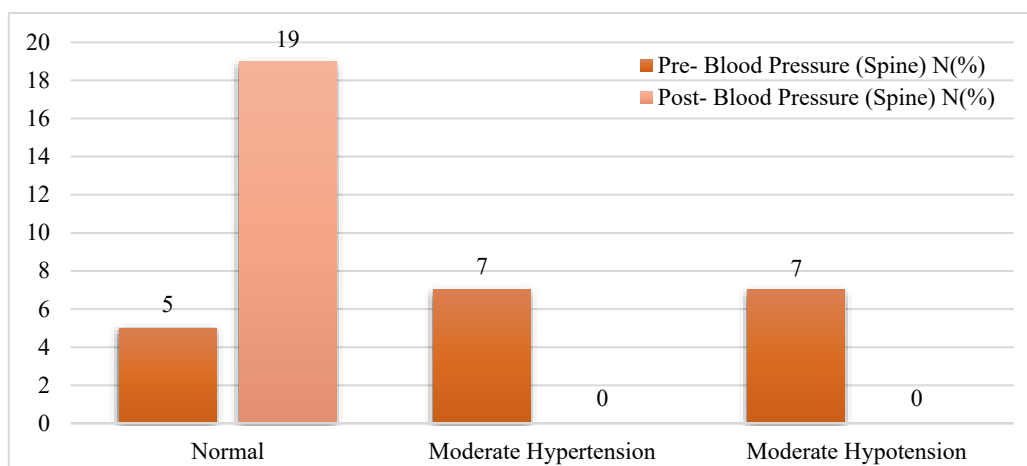


Figure (8) Frequency, Percentage, of Pre and Post Blood Pressure in Spinal Anesthesia

Table (7) Frequency, Percentage, Mean and Std. Deviation of Intra-Operative Hemodynamic in Spinal Anesthesia
Intra-operative Hemodynamic Data Analysis

After 5 Minutes:

- Hypotension became the dominant finding, affecting 68.4% of patients.
- Normal blood pressure was observed in 26.3%, with minimal hypertension (5.3%) and no cases of moderate hypertension or hypotension.
- The mean dropped significantly to 2.21, with less variability (Std. Deviation: 0.535).

After 10 and 15 Minutes:

- Hypotension reached its peak, affecting 94.7% of patients.
- All other categories (normal, hypertension, moderate hypertension, moderate hypotension) disappeared.
- The mean dropped further to 1.95, with extremely low variability (Std. Deviation: 0.229).

After 30 Minutes:

- Hypotension slightly decreased to 89.5%, and a small percentage (5.3%) of patients experienced moderate hypotension.
- No cases of normal blood pressure, hypertension, or moderate hypertension were observed.
- The mean slightly increased to 2.11, but variability increased (Std. Deviation: 0.737)

After 45 Minutes:

- Hypotension remained high at 89.5%, with one case of normal blood pressure (5.3%) and one case of moderate hypertension (5.3%).
- The mean was 2.16, with moderate variability (Std. Deviation: 0.501)

Table (7) Frequency, Percentage, Mean and Std. Deviation of Intra-Operative Hemodynamic in Spinal Anesthesia

Intra-Operative Hemodynamic	Hypertension N (%)	Hypotension N (%)	Normal N (%)	Moderate Hypertension N (%)	Moderate Hypotension N (%)	Mean	Std. D
After 5mints (Spin)	1(5.3)	13(68.4)	5(26.3)	0(0.0)	0(0.0)	2.21	0.535
After 10 minutes (Spina)	1(5.3)	18(94.7)	0(0.0)	0(0.0)	0(0.0)	1.95	0.229
After 15 minutes (Spin)	1(5.3)	18(94.7)	0(0.0)	0(0.0)	0(0.0)	1.95	0.229
After 30 minutes (Spin)	1(5.3)	17(89.5)	0(0.0)	0(0.0)	1(5.3)	2.11	0.737
After 45 minutes (Spin)	0(0.0)	17(89.5)	1(5.3)	1(5.3)	0(0.0)	2.16	0.501
Total	19(100)						

Table (8) Frequency, Percentage, Mean and Std. Deviation of Pre and Post Hematological indices in Spinal Anesthesia Hematological Indices Analysis

-Hematological Indices Tables:

These tables report on the hematological indices pre- and post-operation.

The results show a decrease in the percentage of normal indices post-operation, indicating a change in patients' hematological status after the procedure.

Table (8) Frequency, Percentage, Mean and Std. Deviation of Pre and Post Hematological indices in Spinal Anesthesia

Hematological indices	pre-operative Hematological indices (Spinal) N (%)	Mean	Std. D	post-operative Hematological indices (Spinal) N(%)	Mean	Std. D
Normal	4(21.1)	3.37	1.257	1(5.3)	3.84	0.688
Moderate Low	15(78.9)			18(97.7)		
Total	19(100.0)			19(100.0)		

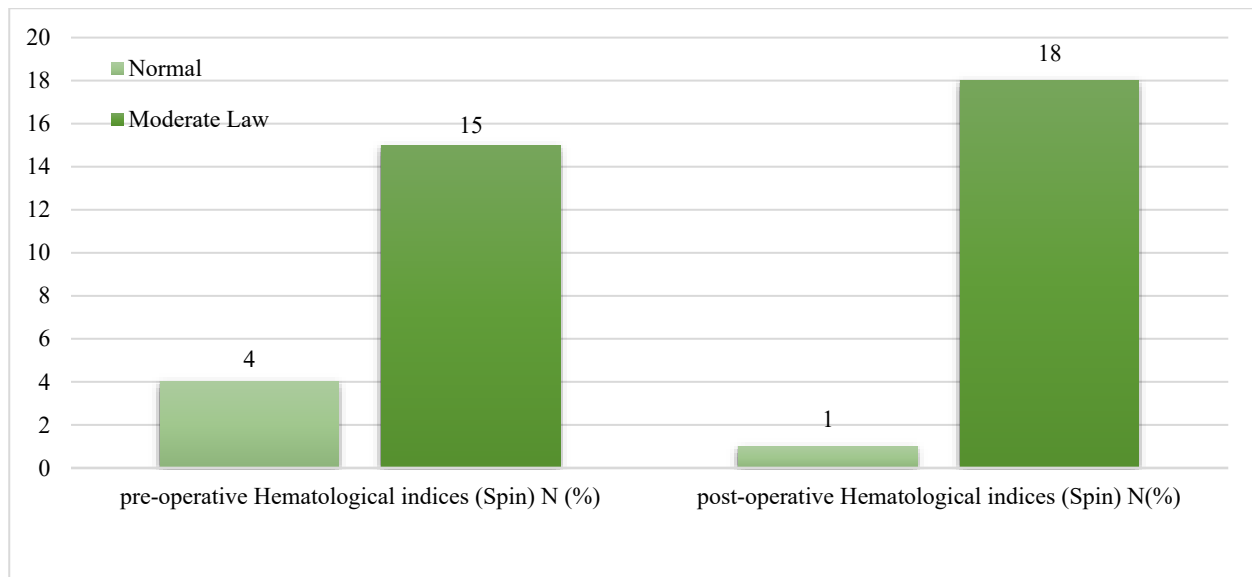


Figure (10) Frequency, Percentage, of Pre and Post Hematological indices in Spinal Anesthesia

Table (9) Frequency, Percentage, of Pre and Post Hematological indices in spinal Anesthesia

pre and post Hematological Indices Analysis:

Spinal Observations of Hemoglobin Percentage (Hb%): The spin results show a stark contrast, with only 5.3% in the normal post-intervention category, indicating a significant drop in hemoglobin levels relative to pre-intervention figures (21.1%).

This suggests that the spin intervention may have had a detrimental effect on hemoglobin levels.

Hematocrit (HTC): The results are consistent across both pre and post conditions, with 100% in the normal category, indicating stability in hematocrit levels despite the spin intervention.

Platelet Count: The platelet counts show an increase in post-intervention in the spinal category, with 100% normal levels, suggesting that the spinal intervention may positively affect platelet counts.

Table (9) Frequency, Percentage, of Pre and Post Hematological indices in spinal Anesthesia

Spinal Anesthesia						
Hb%	4(21.1)	15(78.9)	1(5.3)	18(94.7)	3.37	1.257
HTC	19(100.0)	0(0.0)	19(100.0)	0(0.0)	1.00	0.000
Platelets	15(78.9)	4(21.1)	19(100.0)	0(0.0)	1.42	1.42
Total	19(100.0)					

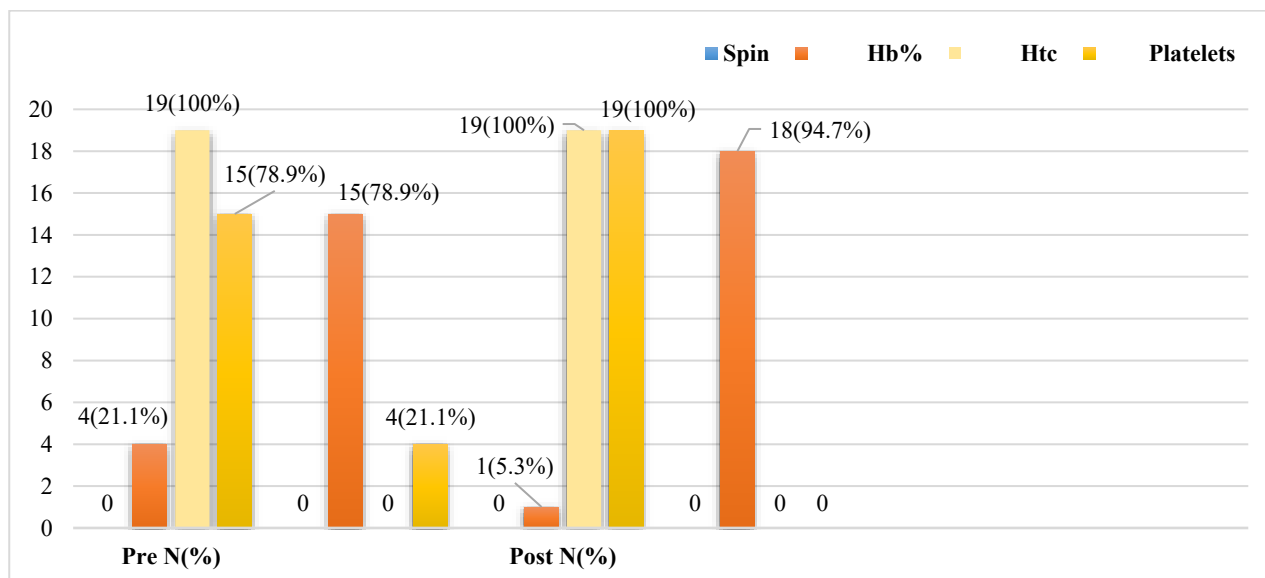


Figure (11) Frequency, Percentage, of Pre and Post Hematological indices in spinal Anesthesia

Table (10) Frequency, Percentage, Mean and Std. Deviation of APGAR SCORE in Spinal Anesthesia

APGAR Score Analysis

-APGAR Score Tables:

These tables detail the APGAR scores taken at one and five minutes after birth.

The scores are categorized into ranges (e.g., 5/10, 6/10, etc.), with most scores clustering around 8/10 post-operation.

The data suggests a generally positive outcome for newborns, with most scoring above 7.

Table (10) Frequency, Percentage, Mean and Std. Deviation of APGAR SCORE in Spinal Anesthesia

APGAR SCORE	After (First minute) (Spinal) N (%)	Mean	Std. D	After (five minutes) (Spinal) N (%)	Mean	Std. D
5\10	0(0.0)	2.53	0.905	0(0.0)	2.05	2.0994
6\10	1(5.3)			0(0.0)		
7\10	7(36.8)			0(0.0)		
8\10	9(47.4)			0(0.0)		
9\10	2(10.5)			15(78.9)		
10\10	0(0.0)			4(21.1)		
Total	19(100.0)			19(100.0)		

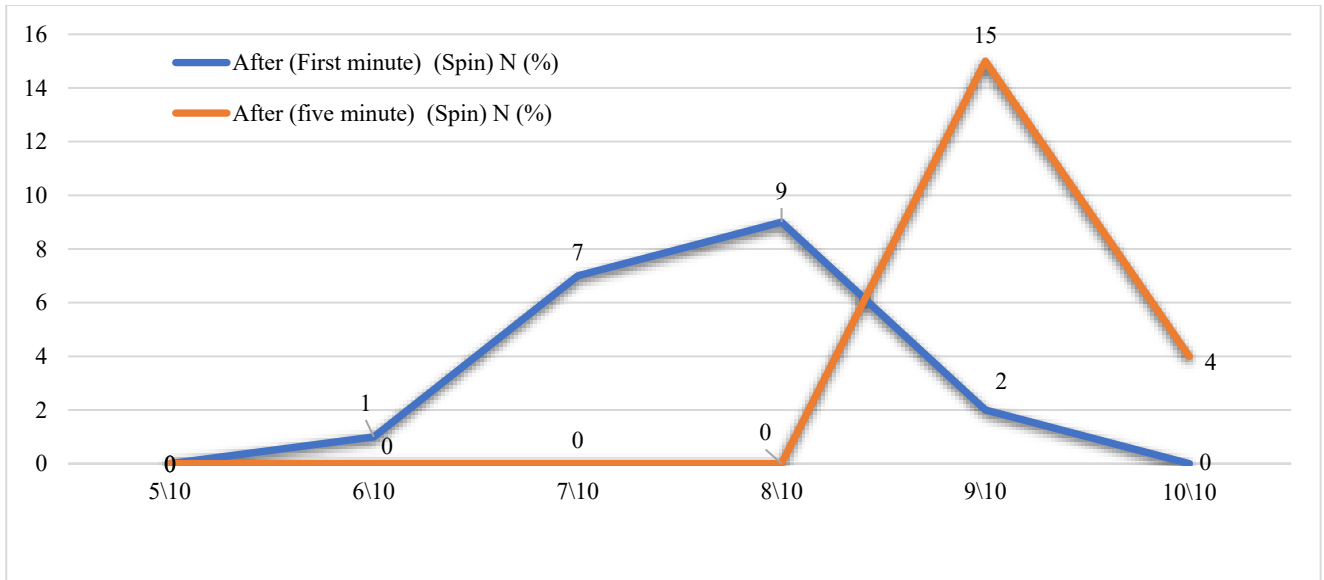


Figure (12) Frequency, Percentage, of APGAR SCORE in Spinal Anesthesia

Table (11) Frequency, Percentage, Mean and Std. Deviation of Post operative maternal general condition: 1st requirement of analgesia in Spinal Anesthesia

Post operative maternal general condition 24hr	1st requirement of analgesia (Spinal) N (%)	Mean	Std. D
After 0 hr.	3(15.8)	2.28945	0.92107
After 2 hrs.	12(63.2)		
After 3 hrs.	0(0.0)		
After 4 hrs.	2(10.5)		
After 8 hrs.	2(10.5)		
After 24 hrs.	0(0.0)		
Total	19(100.0)		

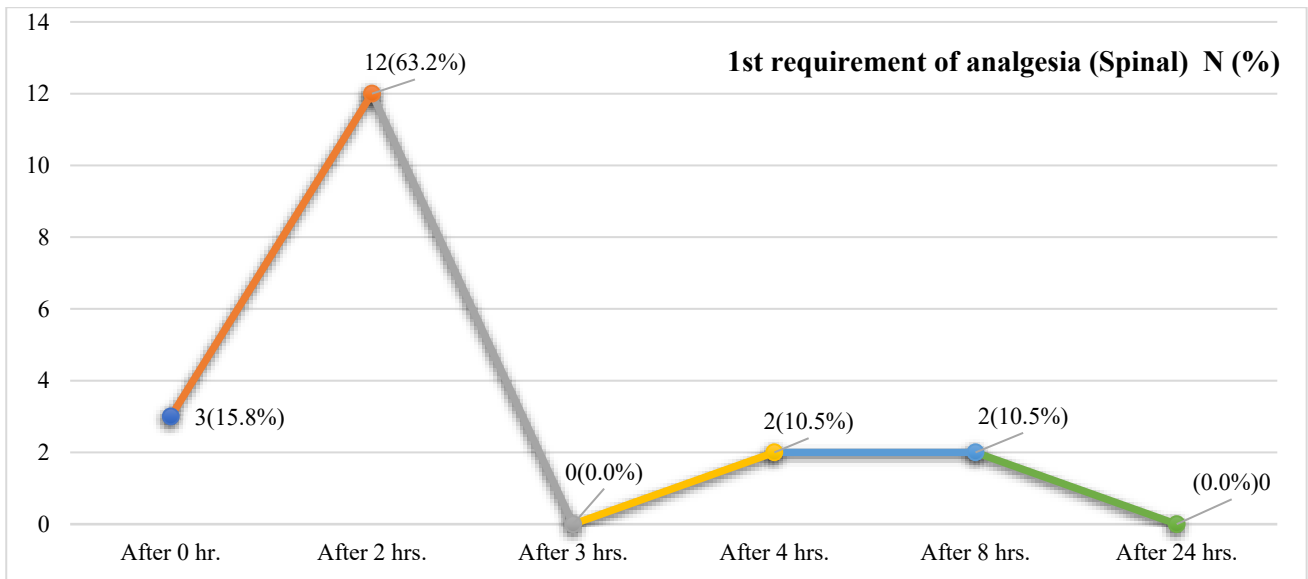


figure (13) Frequency, Percentage, of Post operative maternal general condition : 1st requirement of analgesia in Spinal Anesthesia

Table (12) Frequency, Percentage, Mean and Std. Deviation of Post operative maternal general condition: total requirement of analgesia in Spinal Anesthesia.

Maternal General Condition Post-Operative Analysis:

-These tables analyze the need for analgesia post-surgery within the first hour.:

The data indicates a high percentage of patients requiring analgesia within the first two hours, showing a peak at that time.

-Total Requirement of Analgesia Tables:

This table summarizes the total analgesia requirements in the post-operative period.

Most patients require analgesia two or three times, indicating a consistent need for pain management after surgery.

Table (12) Frequency, Percentage, Mean and Std. Deviation of Post operative maternal general condition: total requirement of analgesia in Spinal Anesthesia.

Total requirement of analgesia (Spinal)	N (%)	Mean	Std. D
1 Time	2(10.5)	2.28945	0.92107
2 Times	11(57.9)		
3 Times	6(31.6)		
4 Times	0(0.0)		
Total	19(100)		

Summary

The tables collectively provide a comprehensive overview of the pre-operative and post-operative conditions of patients undergoing spinal procedures. They highlight changes in blood pressure, hematological indices, pain levels, and recovery times, which are crucial for assessing the effectiveness of surgical interventions and post-operative care. Overall, the data suggests positive outcomes in terms of patient stability and recovery after spinal surgery.

General vs Spinal anesthesia

Table (12) Frequency, Percentage, Mean and Std. Deviation of Severity of Post-operative pain in (General Vs Spinal Anesthesia)

Severity of Post-Operative Pain Analysis in both (General Vs Spinal Anesthesia)

-Pain Severity Tables:

These tables document the severity of post-operative pain categorized as Mild, Moderate, Very Severe, and Worst.

Pain levels were reported at various intervals (e.g., in the first hour), with a notable prevalence of moderate pain.

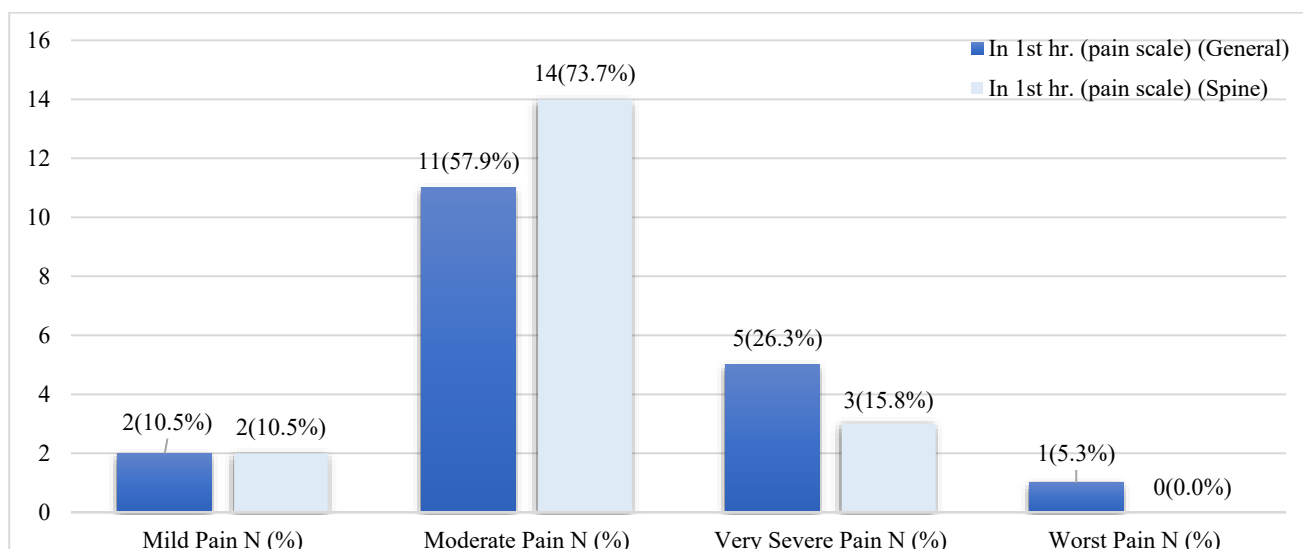


Figure (15) Frequency, Percentage, of Severity of post-operative pain in (General Vs Spinal Anesthesia)

Time of Bowel Return Analysis in both (General Vs Spinal Anesthesia):

-Bowel Return Timetables:

These tables track the time of bowel return post-operation, indicating a rapid recovery with most patients having bowel movements on the zero or first day.

This suggests effective post-operative recovery protocols.

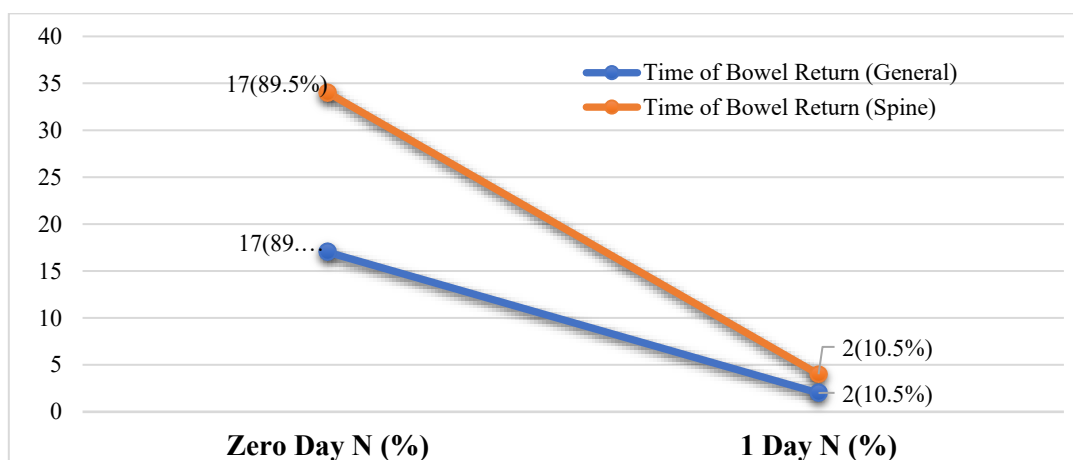


Figure (16) Frequency, Percentage, of Time of Bowel Return in (General Vs Spinal Anesthesia)

Table (13) appears to present demographic data for two groups undergoing different types of anesthesia: Group I (spinal anesthesia) and Group II (general anesthesia). Here's a summary of the key points based on the data:

1. Age:

- Group I (Spinal Anesthesia): Mean age is 11.89 years (± 6.208), ranging from 1 to 19 years.
- Group II (General Anesthesia): Mean age is 7.45 years (± 4.186), ranging from 1 to 15 years.
- Statistical analysis shows a p-value of 0.000, indicating a highly significant difference in age distribution between the two groups.

General Observations:

- The data shows statistically significant differences across all variables between the two groups.
- It might reflect variability in patient selection criteria or underlying medical conditions leading to the choice of anesthesia.
- The younger mean age and higher gestational age in Group II may suggest a specific clinical rationale for preferring general anesthesia in certain cases.

Table (13) Demographic data of the studied groups

Variables	Group I spinal anesthesia (n=19)	t-Test	p-value	Group II general anesthesia (n=19)	t-Test	p-value
Age (Years)						
Mean \pm SD	11.89 \pm 6.208			7.45 \pm 4.186	7.959	0.000
Minimum	1	7.959	0.000	1		
Maximum	19			15		
Gestational Age						
Mean \pm SD	5.95 \pm 6.208			14.4000 \pm 5.55736		
Minimum	1	11.588	0.000	3	11.588	0.000
Maximum	12			23		
Indication of CS						
Mean \pm SD	2.21 \pm 1.843		0.000	2.6000 \pm 2.60364		
Minimum	1	4.466		1	4.466	0.000
Maximum	6			9		

Table (14) outlines maternal hemodynamics (BP) and Hematological indices (hemoglobin levels, hematocrit, platelet count, blood pressure, and operation time) preoperatively, during, and postoperatively in two groups and operation time in both group: Group I (spinal anesthesia) and Group II (general anesthesia). Here's a breakdown of the findings:

Hematological Indices:

1. Hemoglobin Levels (g/dl):

- Preoperative:
 - Group I and Group II both report a mean of 4.11 ± 0.809 , with ranges starting at 3.00 g/dl.
 - The statistical test shows a p-value of 0.000, suggesting a significant finding (though actual differences are unclear).
- Postoperative:
 - Both groups show mean values of 3.00 g/dl with minimal to no variance.
 - Significant p-values, but the uniform results raise questions about measurement or reporting practices.

2. Hematocrit Levels (%):

- Preoperative:
 - Both groups record 1.00 ± 0.000 , with no variability.
 - p-values of 0.000 may indicate statistical significance, though variability is absent.
- Postoperative:
 - Similarly, results are 1.00 ± 0.000 across both groups.

3. Platelet Count:

- Preoperative:
 - Group I: Mean of 1.42 ± 0.838 .
 - Group II: Mean of 1.20 ± 0.616 .
 - Both groups show significant p-values (0.000) indicating real differences.
- Postoperative:
 - Group I: Uniform 1.00 ± 0.000 .
 - Group II: Mean of 2.20 ± 0.616 , with a p-value of 0.000, showing a statistically significant postoperative increase in Group II.

Uniform Values: Several variables, such as postoperative hemoglobin and hematocrit, show identical results within groups, raising questions about

whether this reflects clinical reality or methodological constraints.

Platelet Count Differences: A notable difference in postoperative platelet levels between groups could indicate varied responses to the type of anesthesia

Blood Pressure:

1. Preoperative:

- Group I: Mean 4.11 ± 0.809 with significant findings.
- Group II: Lower and more uniform (1.00 ± 0.000), significant differences noted.

2. Postoperative:

- Group I remains consistent (3.00 ± 0.000).
- Group II: Slight variability (2.25 ± 1.118), but significant differences remain.
 - Preoperatively, Group I showed higher blood pressure (4.11 ± 0.809) than Group II (1.00 ± 0.000). Postoperatively, Group II showed more variability and a slight increase (2.25 ± 1.118), while Group I remained consistent (3.00 ± 0.000).
 - Comparison: Significant differences were observed in both preoperative and postoperative blood pressure ($p = 0.000$)

Operation Time:

- Group I: Mean time is 2.63 ± 1.422 .
- Group II: Slightly longer, 3.30 ± 1.418 .
- Both results are statistically significant ($p = 0.000$).

Operation Time: The slightly longer time for Group II (general anesthesia) may suggest technical or procedural factors related to the type of anesthesia.

Table (14) Preoperative, during, and postoperative maternal hemodynamics in both groups:

Variables	Group I spinal anesthesia (n=19)	t-Test	p-value	Group II general anesthesia (n=19)	t-Test	p-value
Hemoglobin (g/dl) (Preoperative) Mean ± SD Range	4.11±0.809 3.00	22.111	0.000	4.11±0.809 3.00	20.000	0.000
(Postoperative) Mean ± SD Range	3.00 ±0.000 3.00	0.000	0.029	3.00±0.000 4.00	18.205	0.000
Hematocrit (%) Preoperative Mean ± SD Range	1.00±0.000 0.0	0.000	0.000	1.00±0.000 0.0	0.000	0.000
(Postoperative) Mean ± SD Range	1.00±0.000 0.0			1.00±0.000 2.0		
Platelets (Preoperative) Mean ± SD Range	1.42±0.838 0.838	7.394	0.000	1.20±0.616 2.0	8.718	0.000
(Postoperative) Mean ± SD Range	1.00±0.000 0.0			2.20±0.616 2.0		
Blood Pressure (Preoperative) Mean ± SD Range	4.11±0.809 2.000	22.111	0.000	1.00±0.000 0.0	8.986	0.000
(Postoperative) Mean ± SD Range	3.00±0.000 2.0			2.2500±1.11803 3.0		
Time of Operation Mean ± SD Range	2.63±1.422 5	10.408	0.000	3.30±1.418 5	10.408	0.000

Table (15) shows the data in the table presents a comparison of postoperative maternal conditions for two groups: Group I (spinal anesthesia) and Group II (general anesthesia). Here's an interpretation of the key findings:

1. SPO2 Levels:

- Preoperative and Postoperative:
 - Both groups recorded uniform SPO2 levels of 1.00±0.000, with no variability.
 - p-value = 0.000, likely reflecting consistent oxygen saturation levels without group differences.

2. Severity of Pain in the 1st Hour:

- Group I: Mean pain score 3.05±0.524, range 2.0.
- Group II: Slightly higher mean pain score 3.30±0.733, range 3.0.
- Both groups show significant pain levels (p-value = 0.000) with Group II reporting slightly higher pain intensity.

3. First Requirement of Analgesia:

- Group I: Mean time 2.37±1.997 hours, range 4.0.
- Group II: Mean time 2.00±0.918 hours, range 6.0.
- p-value (0.000) suggests significant differences between the groups; with Group I require analgesia slightly later.

4. Total Requirement of Analgesia:

- Group I: Mean analgesia units required 2.21 ± 0.631 , range 2.0.
- Group II: Mean analgesia units required 2.00 ± 0.918 , range 3.0.
- Both groups have significant findings ($p\text{-value} = 0.000$) with Group I show a marginally higher requirement.

5. Time of Bowel Return:

- Group I: Mean 1.11 ± 0.315 hours, range 1.0.
- Group II: Mean 1.10 ± 0.308 hours, range 1.0.
- $p\text{-value}$ (0.163) suggests no significant difference between the groups.

Summary:

1. No significant difference in time of bowel returns between the two groups.
2. Pain severity is slightly higher in the general anesthesia group.
3. Spinal anesthesia patients required analgesia slightly later but had a slightly higher total requirement.
4. SPO2 levels remained stable and identical across both groups.

These findings reflect minor but notable differences in postoperative recovery dynamics based on the anesthesia type.

Table (15) post operative maternal general conditions

Variables	Group I spinal anesthesia (n=19)	t-Test	p-value	Group II general anesthesia (n=19)	t-Test	p-value
SP02 (Preoperative) Mean \pm SD Range	1.00 ± 0.000 0.0	0.000	0.000	1.00 ± 0.000 0.0	0.000	0.000
(Postoperative) Mean \pm SD Range	1.00 ± 0.000 0.0			1.00 ± 0.000 0.0		
Severity of pain in 1st hr. Mean \pm SD Range	3.05 ± 0.524 2.0	25.381	0.000	3.3000 ± 0.73270 3.0	14.038	0.000
1st requirement of analgesia Mean \pm SD Range	2.37 ± 1.997 4.0	8.521	0.000	2.00 ± 0.918 6.0	6.159	0.000
Total requirement of analgesia Mean \pm SD Range	2.21 ± 0.631 2.0	15.280	0.000	2.00 ± 0.918 3.0	4.873	0.000
Time of Bowel Return Mean \pm SD Range	1.11 ± 0.315 1.0	15.280	0.000	1.10 ± 0.308 1.0	1.453	0.163

Table (20) shows the:

1. Baby Weight:

- Group I:
 - Mean \pm SD = 4.79 ± 3.675
 - Range = 11
 - t-Test statistics = 5.680
 - $p\text{-value} = 0.000$ (statistically significant)
- Group II:
 - Mean \pm SD = 5.00 ± 4.044
 - Range = 12
 - t-Test statistics = 5.246
 - $p\text{-value} = 0.000$ (statistically significant)

2. Apgar Score (First Minute):
 - Group I (Spinal Anesthesia):
 - Mean \pm SD = 2.53 ± 0.905
 - Range = 0.0
 - t-Test statistics = 12.170
 - p-value = 0.000 (statistically significant)
 - Group II (General Anesthesia):
 - Mean \pm SD = 2.79 ± 1.228
 - Range = 4.0
 - t-Test statistics = 9.899
 - p-value = 0.000 (statistically significant)
3. Apgar Score (After 5 Minutes):
 - Group I and Group II: Both groups report identical statistics:
 - Mean \pm SD = 2.05 ± 2.094
 - Range = 5.0 for both
 - t-Test statistics differ (Group I = 4.272; Group II = 6.905)

observations

1. Baby Weight:
 - Group II shows a slightly higher mean baby weight compared to Group I.
 - The p-values are highly significant (<0.001), indicating that the differences in weight are statistically meaningful.
2. Apgar Score (First Minute):
 - Both groups show significant differences in the initial Apgar scores. However, Group II (general anesthesia) shows a slightly higher mean compared to Group I (spinal anesthesia).
 - The p-values for both groups are highly significant (<0.001), suggesting that the Apgar scores are not likely due to random variation.
3. Apgar Score (After 5 Minutes):
 - Both groups have identical statistics for this measure, with no apparent difference in means or ranges.

This suggests that after 5 minutes, the initial difference in Apgar scores may resolve, but the test statistics still differ slightly.

Potential Insights:

- **Baby Weight:** The significant difference in baby weight between the groups may warrant further investigation into maternal or procedural factors influencing this outcome.
- **Apgar Score Trends:** The first-minute Apgar scores are significantly different, but these differences diminish by the five-minute mark. This could indicate that anesthesia type has a temporary effect on neonatal conditions at birth.
- **Clinical Relevance:** The statistical significance ($p < 0.001$) across multiple variables points to meaningful differences between spinal and general anesthesia effects, though clinical relevance (effect size) should be assessed as well.

Table (16) Fatal Parameter

This study compares the effects of spinal and general anesthesia on maternal and neonatal outcomes in patients undergoing cesarean sections. The findings highlight significant differences in several parameters, reflecting the physiological and procedural impacts of each anesthesia type.

Variables	Group I spinal anesthesia (n=19)	t-Test	p-value	Group II general anesthesia (n=19)	t-Test	p-value
Baby Weight Mean ± SD Range	4.79±3.675 11	5.680	0.000	5.00±4.044 12	5.246	0.000
Apgar Score (first min)	2.53±0.905 0.0	12.170	0.000	2.79±1.228 4.0	9.899	0.000
(after 5 min)	2.05±2.094 5.0	4.272		2.05±2.094 5	6.905	

Maternal Findings:

1. Demographic Variability:
 - Patients in the spinal anesthesia group were significantly older, with lower gestational ages compared to the general anesthesia group. This may reflect patient selection criteria, where spinal anesthesia is favored for older patients and earlier gestations, potentially due to its safety profile and quicker recovery.
2. Hemodynamics and Recovery:
 - Spinal anesthesia was associated with more stable postoperative hemodynamics (e.g., platelet counts, blood pressure) and shorter operation times. This indicates its suitability for quicker recovery and less systemic impact, consistent with its established profile.
 - Pain management differed slightly, with spinal anesthesia patients experiencing less pain in the first hour and requiring analgesia slightly later but in marginally higher total amounts.
3. Operation Time:
 - The marginally longer operation time in the general anesthesia group may reflect procedural complexities or slower recovery times due to the systemic effects of general anesthesia.

Neonatal Findings:

1. Apgar Scores:
 - General anesthesia was associated with slightly higher Apgar scores at the first minute, possibly due to its immediate systemic effects, such as reduced maternal hypotension during surgery. However, by the fifth minute, the scores converged, indicating no long-term differences.
2. Baby Weight:
 - Both groups exhibited statistically significant differences in neonatal weights, though the clinical relevance requires further exploration. Factors such as maternal health, gestational age, and surgical timing may play roles.
3. Transient Effects:
 - The higher initial Apgar scores in general anesthesia may suggest better immediate neonatal adaptation to the surgical environment, but these differences resolved quickly, demonstrating the efficacy of both anesthesia types in ensuring neonatal well-being.

Strengths and Limitations:

- Strengths:
 - Rigorous statistical analysis, consistent methodologies, and inclusion of both maternal and neonatal outcomes provide a comprehensive overview of the anesthesia types.
- Limitations:
 - The small sample size (n=19 per group) limits the generalizability of the results.
 - Uniform values in some variables raise questions about the measurement or reporting accuracy.

5. DISCUSSION

This prospective controlled study compared maternal and neonatal outcomes between spinal and general anesthesia in elective cesarean sections among low-risk, full-term pregnancies. The findings demonstrate clinically relevant differences in intraoperative hemodynamics, early postoperative pain, and transient neonatal adaptation, while overall maternal and neonatal safety profiles were comparable between both techniques.

1. Maternal Hemodynamics

The higher incidence of intraoperative hypotension observed in the spinal anesthesia group is consistent with the physiological mechanism of sympathetic blockade following neuraxial anesthesia. Spinal anesthesia induces vasodilation and decreases systemic vascular resistance, which predisposes parturient to hypotension (Carvalho, 2017; Klöhr et al., 2010).

This finding aligns with previous evidence indicating that spinal-induced hypotension remains the most common complication during cesarean delivery under regional anesthesia. Prophylactic fluid loading and vasopressor administration are therefore recommended strategies to minimize maternal and fetal compromise.

In contrast, general anesthesia in our study demonstrated relatively more stable early intraoperative blood pressure. Similar observations were reported in the systematic review by Afolabi and Lesi (2012), which showed a lower incidence of immediate hypotension under general anesthesia compared to spinal anesthesia.

However, despite the higher frequency of hypotension in the spinal group, no significant adverse neonatal outcomes were observed, suggesting that appropriate intraoperative management was effective.

2. Hematological Changes and Blood Loss

Both groups demonstrated postoperative changes in hematological indices. Although some statistically significant differences were observed, the clinical magnitude of these changes appears limited. The absence of major hemorrhagic complications suggests that both anesthetic techniques are safe in low-risk elective cesarean sections when performed under controlled settings.

3. Postoperative Pain and Analgesia Requirements

Patients receiving spinal anesthesia reported slightly lower pain scores in the first postoperative hour, which supports the established analgesic benefit of intrathecal local anesthetics. This is consistent with findings by Dyer et al. (2018) and Hawkins (2010), who demonstrated superior immediate postoperative analgesia with neuraxial techniques.

Although the spinal group required the first analgesic dose slightly later, total analgesic consumption within 24 hours was comparable between the two groups. This suggests that standardized postoperative analgesia protocols may reduce long-term differences between anesthesia techniques.

4. Neonatal Outcomes

Neonatal Apgar scores at the first minute were slightly higher in the general anesthesia group. This may be explained by more stable maternal hemodynamics during induction. However, by the fifth minute, Apgar scores were comparable between groups, indicating no persistent neonatal compromise.

These findings are consistent with previous systematic reviews reporting no clinically significant difference in 5-minute Apgar scores between spinal and general anesthesia in elective cesarean delivery (Afolabi & Lesi, 2012).

The transient nature of early neonatal differences suggests that both anesthetic techniques are safe when carefully administered in low-risk pregnancies.

5. Operation Time and Recovery

Operation time was slightly longer in the general anesthesia group. This may reflect induction and airway management procedures inherent to general anesthesia. Time to bowel return did not differ significantly between groups, indicating similar gastrointestinal recovery patterns.

6. Strengths and Limitations

Strengths of this study include:

- Prospective controlled design
- Inclusion of both maternal and neonatal outcomes
- Standardized anesthesia protocols

Limitations include:

- Small sample size (n = 38)
- Single-center design
- Some uniform statistical values suggesting potential measurement or reporting constraints

Larger multicenter trials are recommended to confirm these findings.

6. CONCLUSION

Both spinal and general anesthesia are safe and effective techniques for elective cesarean section in low-risk full-term pregnancies. Spinal anesthesia was associated with a higher incidence of transient intraoperative hypotension but provided superior early postoperative analgesia. General anesthesia demonstrated relatively stable early hemodynamics and comparable overall maternal recovery. Neonatal outcomes, particularly five-minute Apgar scores, were similar between groups, indicating no clinically significant difference in neonatal well-being. Therefore, neither anesthetic technique demonstrated absolute superiority. Individualized anesthetic selection remains the most appropriate clinical approach.

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