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Original Research Article

Comparative Study of Spinal Anaesthesia versus General Anaesthesia in Severe Preeclampsia Patients Undergoing Cesarean Section

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Abstract:

Introduction: Pre-eclampsia is a multi-system disorder unique to human pregnancy complicating 5-8% of pregnancies. It poses significant risks to both maternal and foetal health. Pre-eclampsia, a pregnancy complication characterized by high blood pressure and organ dysfunction, put unique challenges against anaesthesiologists. While ensuring adequate pain relief and safe delivery, they must navigate the delicate balance of pre-existing maternal health and potential complications. Caesarean section is the procedure where a baby is delivered through an incision on the abdominal wall and uterus of the mother under general or spinal anaesthesia. Both general and spinal Anaesthesia can be used for caesarean section but each has its own advantages and disadvantages to both mother and foetus. We are comparing study of spinal anaesthesia versus general anaesthesia in severe pre-eclampsia patients undergoing caesarean section.

Methods: The present Interventional study was conducted in the Tertiary care hospital amongst 60 patients having severe preeclampsia undergoing caesarean section were divided into two groups 30 each. In group-I had general anaesthesia and in group – II patients had spinal anaesthesia for caesarean section.

Result: The mean age of patients in the Spinal AX group was slightly lower, but this difference was not statistically significant. Majority patients receiving general anaesthesia show high pulse rate showing statistical difference. Maternal haemodynamic parameters, including mean arterial pressure, systolic blood pressure, and diastolic blood pressure were significantly higher in the General AX group. The Visual Analogue Scale (VAS) scores indicated significantly lower pain levels in the Spinal AX group (all Score of 1). A higher incidence of maternal complications, including nausea &vomiting, delayed discharge, was observed in the general AX group. There is significantly higher proportion of newborns in the Spinal AX group with Apgar scores greater than 5 at 1 minute. These findings suggest that newborns of mothers who underwent Spinal AX anaesthesia had better overall neonatal conditions immediately after birth compared to those born to mothers who underwent General AX anaesthesia.

Conclusion: In our study, we concluded that spinal anaesthesia is associated with lower maternal complications and early post operative recovery is good in spinal anaesthesia in terms of early mobility and post operative ICU requirement. Neonatal outcome in terms of APGAR score is better in spinal anaesthesia compared to general anaesthesia.

Keywords: Pre-eclampsia, Spinal Anaesthesia, General Anaesthesia, Caesarean Section, Pregnancy.

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Introduction

Pre-eclampsia is characterized by the new onset of high blood pressure and often a significant amount of protein in the urine which begins after 20 weeks of pregnancy. [1] Pre-eclampsia is a multi-system disorder unique to human pregnancy complicating 5-8% of pregnancies. [2] It poses significant risks to both maternal and foetal health [3].

Pre-eclampsia, a pregnancy complication characterized by high blood pressure and organ dysfunction, put unique challenges against anaesthesiologists. While ensuring adequate pain relief and safe delivery, they must navigate the delicate balance of pre-existing maternal health and potential complications. Caesarean section is the procedure where a baby is delivered through an

incision on the abdominal wall and uterus of the mother under general or spinal anaesthesia.

Challenges in Severe Pre-eclampsia:

i) **Hemodynamic instability:** There is challenged to maintain BP intraoperatively without causing undue fluctuations. Intra-operatively we must minimize hemodynamic changes, decrease maternal and foetal complications.

ii) **Coagulopathy:** Due to deranged coagulation in some patients, we have cautiously select anaesthesia technique as spinal anaesthesia can cause problems spinal hematoma postoperatively.

iii) **Pulmonary oedema:** Accumulation of fluid in the lungs due to endothelial damage and leaky capillaries along with reduced oncotic pressure which requires cautious fluid management during anaesthesia. [4]

Both general and spinal Anaesthesia can be used for caesarean section but each has its own advantages and disadvantages to both mother and foetus

Anaesthetic Techniques and Considerations:

- **Spinal Anaesthesia:** This may be suitable for caesarean delivery, offering rapid onset and reliable block. However, careful evaluation of platelet count and coagulation function is crucial due to potential bleeding risks.
- **Epidural Anaesthesia:** Provides flexibility for labour analgesia and can be converted to surgical anaesthesia for caesarean delivery. However, slower onset and potential for patchy block require close monitoring. [5]

General Anaesthesia: Reserved for specific situations where regional techniques are contraindicated or unsuccessful, such as: **Severe coagulopathy:** When regional blocks pose a high bleeding risk, **Failed or inadequate regional block:** If adequate pain relief or surgical anaesthesia cannot be achieved with regional techniques. Requires meticulous airway management and strict blood pressure control due to the potential for further hemodynamic instability. [6] We are comparing study of spinal anaesthesia versus general anaesthesia in severe pre-eclampsia patients undergoing caesarean section.

Material and Methods

The present Interventional study was conducted in the Tertiary care hospital amongst 60 patients having severe preeclampsia undergoing caesarean section were divided into two groups 30 each. The study was conducted for 18 months. Baseline demographic variables were collected: age, weight, height, BMI, education, occupation, religion, income, address, type of family, socioeconomic status, and co-morbidities.

Inclusion Criteria: The patients with ASA grade II and III, ages between 18 yrs. to 40 yrs, willing to participate in the study, without any comorbidities and patients with a single full-term pregnancy.

Exclusion Criteria: Patients with ASA grade IV and V, Patients not willing to participate, any other comorbidities and patients with specific situations like multiple pregnancies, and preterm pregnancy.

Data Collection:

All participants were explained about the procedure, its advantages and disadvantages, other options explained and written informed consent was taken. Study participants included in the study based on the inclusion criteria. Data was collected by using a pre designed questionnaire which consist of standard questions related to clinical condition, socio demographic factors, and so on, were interviewed. In addition, questions related to past and present medical history and health seeking behaviour were also studied. Clinical examination, diagnosis, investigations details of previous operative procedure was done.

For all patients' Pre-anaesthetic checkup was done. Basic laboratory investigation such as Complete blood count, Liver function test, Kidney function test, coagulation profile such as PT INR, Platelet count done.

Patient taken inside OT, all standard monitors attached to the patients. Premedication with inj. ondansetron 0.1mg /kg, inj metoclopramide 10 mg and inj glycopyrrolate 0.2 mg given to all the patients.

A. In group-I all patient preoxygenated with 100% oxygen, Rapid sequence induction done using induction agent inj. Thiopentone sodium 5mg/kg and muscle relaxant inj. Succinylcholine 1.5mg/kg given. Endotracheal tube was inserted, bilateral air entry checked and tube was fixed and connected closed circuit. Then the patients maintained on muscle relaxant using inj. atracurium 0.1mg/kg, oxygen 50% and air 50% and isoflurane at the rate of 0.5% to 0.75%. Then after delivery of baby in inj. Pitocin 20 IU, inj. midazolam 0.05 mg/kg and inj. fentanyl 2mcg/kg given and isoflurane increased up to 1 to 2%. After completion of procedure patients were reversed. In recovery room patient was monitored half hourly till patient shifted to ward. Patients who were unable to extubate those patients were shifted intubated and connected to ventilatory support. These patients were monitored till extubation was done and all events were recorded till patient shifted to ward.

B. For Group II - Under all aseptic precautions spinal block was given using inj. Bupivacaine dextrose [heavy] 2 ml and level obtained uptoT4. Then

after the delivery of the baby inj. Pitocin 20 IU given and inj. midazolam 1mg was given as anxiolytic. In both groups vasopressor inj. Mephentermine sulphate 6mg given if BP fall below >20% than baseline. After completion of procedure patient transferred to recovery room and monitored. Later patient shifted to ward, if patient was hemodynamically stable. Patient was shifted to PACU if hemodynamically unstable. a. The foetal outcome analysed in the form of APGAR Score at 1 min, at 5 min after delivery

Data Analysis: The categorical data will be expressed as rates, ratios, and proportions and the continuous data will be expressed as mean ± standard deviation. The comparison of categorical data will be performed using the Chi-square test and Fisher's exact test and the comparison of continuous data will be done using an independent sample t-test. $P \leq 0.05$ at a 95% confidence interval will be considered statistically significant.

Results:

Table 1: Distribution of patients according to intra operative PULSE RATE

PR AT	Group Spinal AX N=30	General AX N=30	P-Value
	Mean ± SD	Mean ± SD	
Baseline	94.3±2.82	93.46±4.24	p>0.05
0 Min	96.43±10.60	108.46±7.77	p<0.001
5 Min	91.36±4.24	113.56±1.41	p<0.001
10 Min	89.03±5.65	103.73±8.48	p<0.001
15 Min	89.63±4.24	98.86±4.94	P<0.001
20 Min	89.16±6.36	97.03±7.77	P<0.001
30 Min	88.56±5.65	95.36±6.36	P<0.001
40 Min	88.66±4.24	95.7±6.36	p<0.001

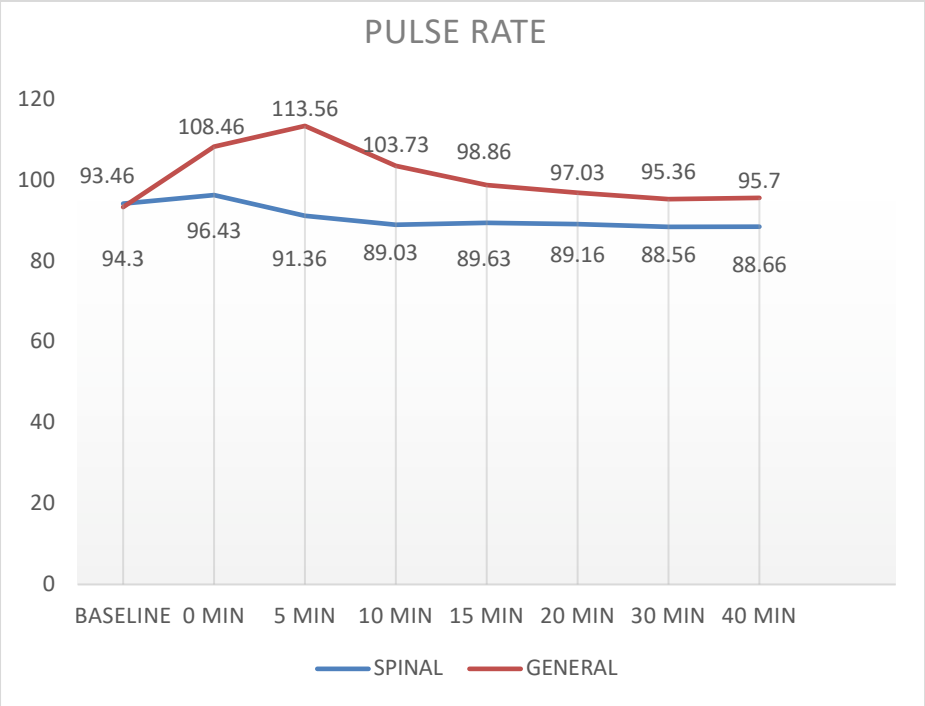


Chart - 1

Table and Chart no.1 represents pulse rate (PR) values for two groups, Spinal anesthesia(AX) and General anesthesia (AX), over a 40-minute period. The data reveals a consistently higher pulse in the General AX group compared to the Spinal AX group at all time points. A statistical analysis using a t-test demonstrated a highly significant difference ($p<0.001$) in PR between the two groups at every measurement, indicating a substantial variation in Pulse rate between the two Groups.

Table 2: distribution of patients according to intra operative maternal systolic blood pressure

SBP AT	Group Spinal AX N=30 Mean ±SD	General AX N=30 Mean ± SD	P-Value
Baseline	166.93±3.55	168.66±6.62	p>0.05
0 Min	139.46±7.50	174.66±8.07	p<0.05
5 Min	138.33±5.92	176.33±7.84	p<0.05
10 Min	137.06±4.02	171.26±6.61	p<0.05
15 Min	135.06±4.05	167.86±7.96	p<0.05
20 Min	131.06±4.09	164.53±6.88	p<0.05
30 Min	130.66±3.2	162.33±4.17	p<0.05
40 Min	128.93±2.91	162.46±3.77	p<0.05

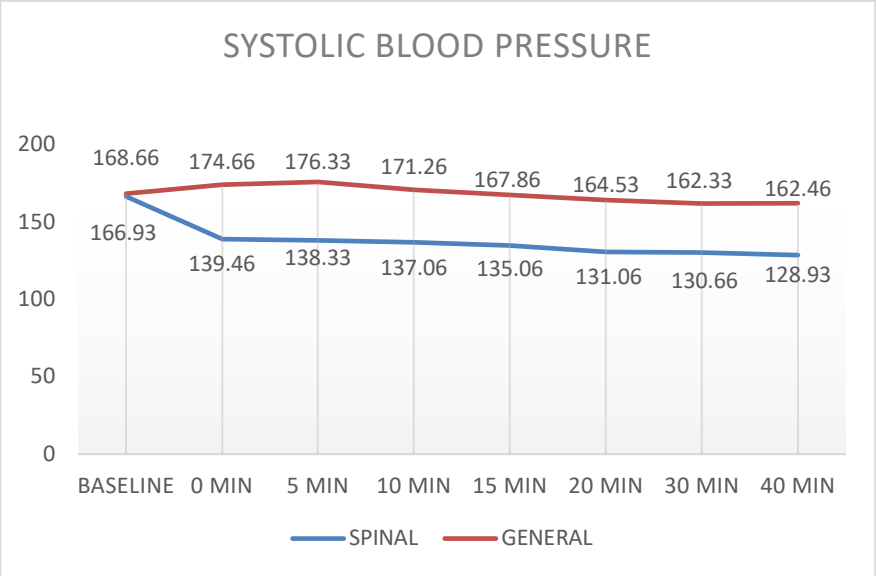


Chart 2: maternal systolic blood pressure

Table and Chart no.2 represents a consistently higher SBP in the General AX group compared to the Spinal AX group at all time points. A statistical analysis using a t-test demonstrated a highly significant difference ($p<0.001$) in SBP between the two groups at every measurement, indicating a substantial variation in blood pressure management between the two treatment approaches.

Table 3: distribution of patients according to intra operative maternal diastolic blood pressure

DBP AT	Group Spinal AX N=30 Mean ± SD	General AX N=30 Mean ± SD	P-Value
Baseline	112.2±3.71	113.26±8.36	p>0.05
0 Min	95±4.54	115.56±9.98	p<0.05
5 Min	93.06±2.49	117.6±8.36	p<0.05
10 Min	91.43±2.43	111.8±7.19	p<0.05
15 Min	90.13±3.32	110.8±8.51	p<0.05
20 Min	88.6±2.59	110.06±6.62	p<0.05
30 Min	88.03±3.21	109±7.19	p<0.05
40 Min	86.2±3.34	109.33±6.06	p<0.05

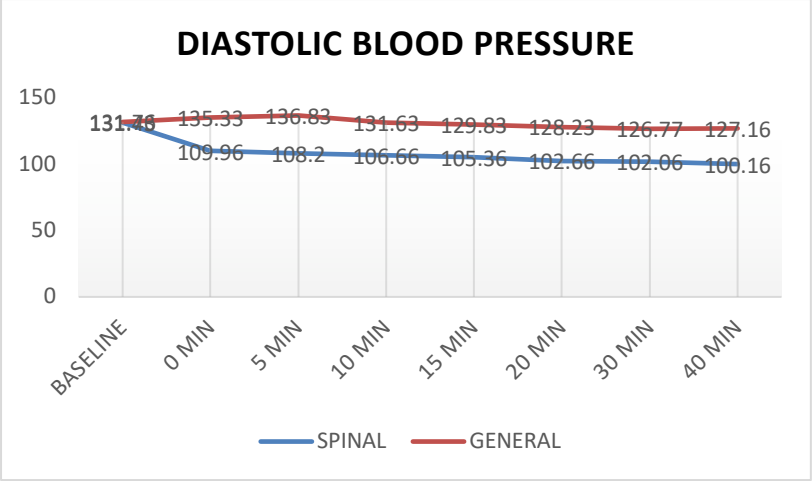


Chart 3: maternal diastolic blood pressure

Table and Chart no. 3 represents higher DBP levels in the General AX group compared to the Spinal AX group at all time points. A statistically significant difference in DBP between the two groups was found at every measurement ($p<0.05$), suggesting that the Spinal AX approach effectively controlled diastolic blood pressure better than the General AX approach.

Table 4: distribution of patients according to intra operative maternal mean arterial blood pressure

MAP AT	Group Spinal AX N=30 MEAN ± SD	General AX N=30 MEAN±SD	P-Value
Baseline	131.43±3.94	131.76±6.70	p>0.05
0 Min	109.96±3.59	135.33±7.91	p<0.05
5 Min	108.2±2.45	137.07±6.79	p<0.05
10 Min	106.66±2.46	131.63±6.78	p<0.05
15 Min	105.26±2.90	129.83±6.77	P<0.05
20 Min	102.66±2.41	128.23±6.56	P<0.05
30 Min	102.06±2.64	126.77±7.61	P<0.05
40 Min	100.16±2.55	127.16±4.92	p<0.05

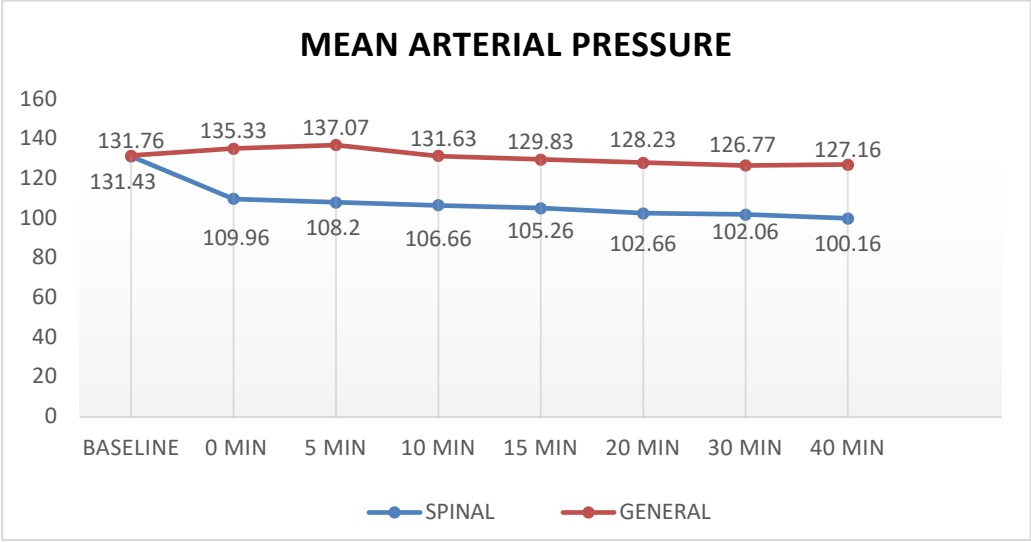


Chart 4: distribution of patients according to intra operative maternal mean blood pressure

Table and Chart no.4 represents that the MAP was consistently higher in the General AX group compared to the Spinal AX group at all time points. A t-test confirmed a statistically significant difference ($p<0.05$) in MAP between the two groups at every measurement, suggesting a substantial variation in blood pressure management between the Spinal AX and General AX treatment approaches.

Table 5: Distribution of patients according to MATERNAL COMPLICATIONS

	Spinal AX (Numbers)	General AX (Numbers)
Nausea and Vomiting	3	6
Delayed Discharge	1	6
Pulmonary oedema	0	0
CVA	0	0
PRESS	0	0
No complication	26	19
Total	**30**	**30**

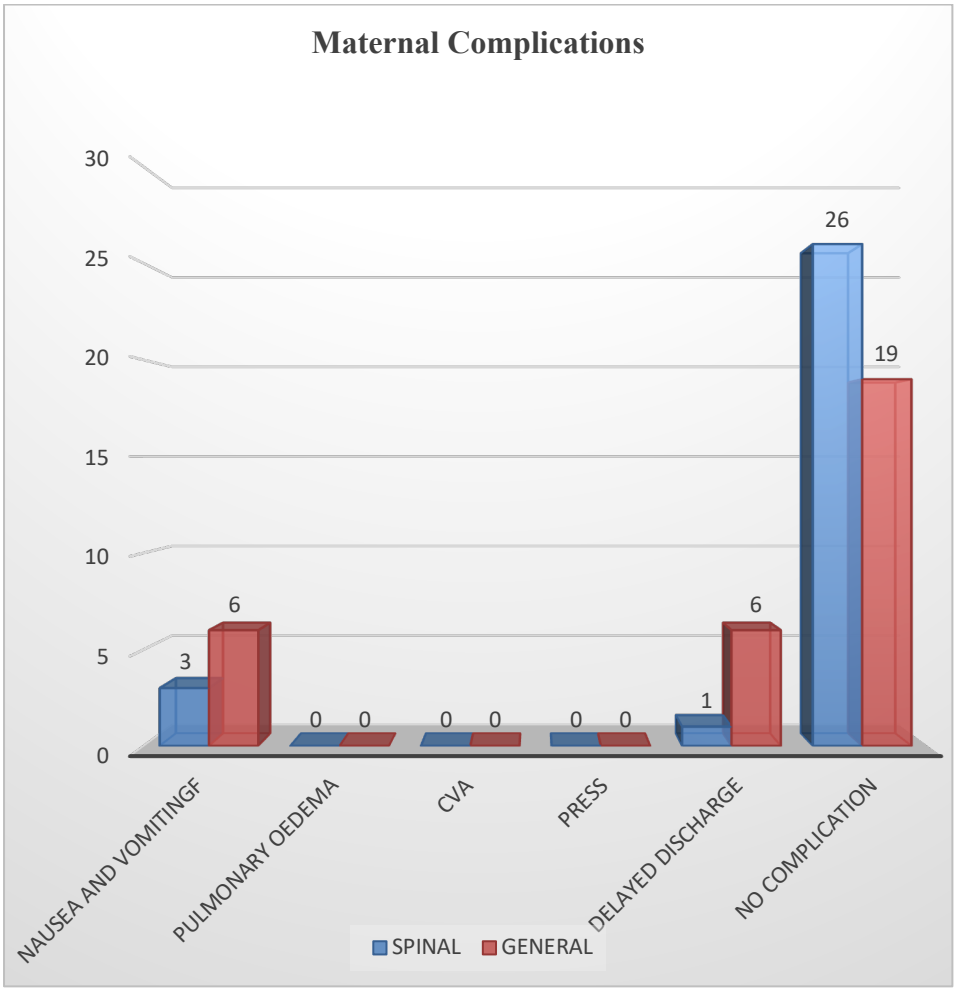


Chart 5: maternal complication

Table and Chart no.5 represents various complications such as Nausea and vomiting, delayed discharge is more in group GA than group spinal. Other complications like CVA, Pulmonary oedema, PRESS. However, it's important to note that a larger number of patients in the Spinal AX group experienced no complications compared to the General AX group. Statistical analysis would be necessary to determine if these differences in complication rates are statistically significant.

Table 6: Distribution of patients according to maternal ICU ADMISSIONS

ICU	Spinal AX (Numbers)	General AX (Numbers)
Yes	1	6
No	29	24
Total	30	30

P VALUE = 0.045, statistical significance seen

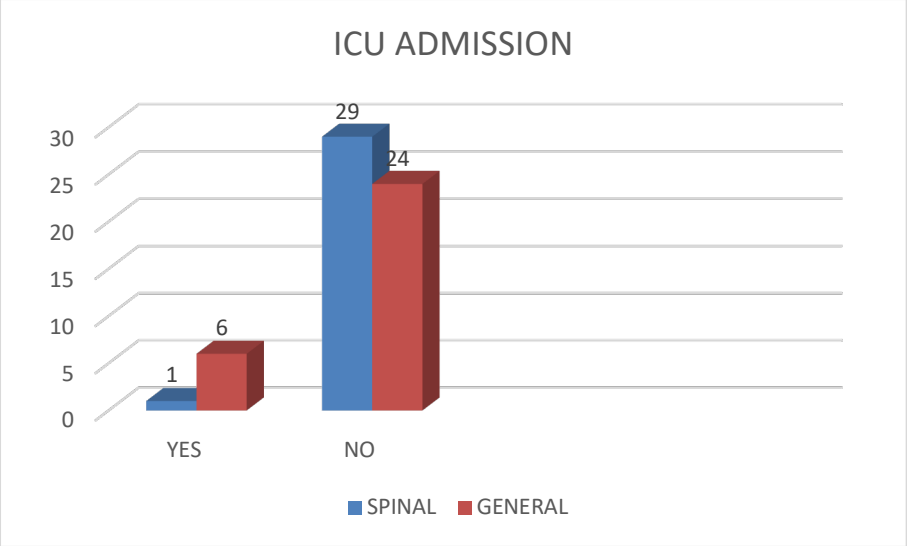
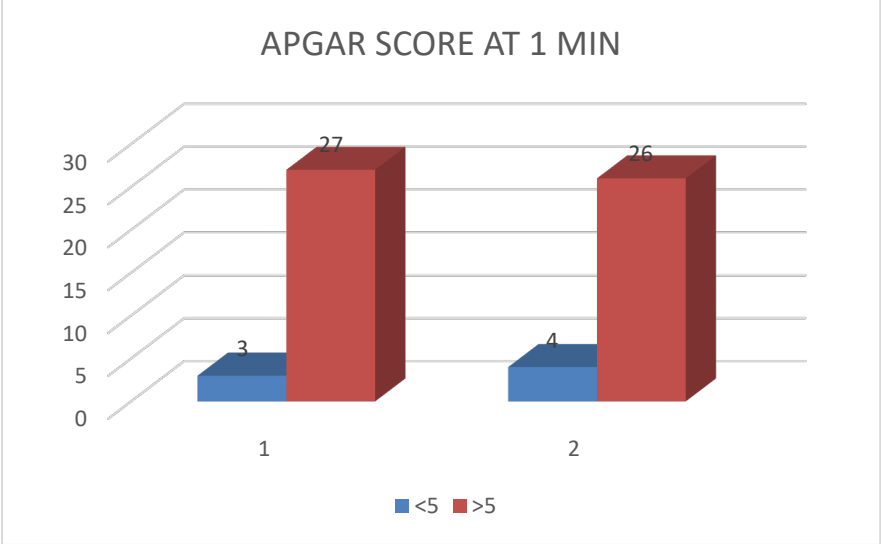


Chart 6: icu admission of mother

Table and Chart no.6 represents that a significantly higher number of patients in the General AX group required ICU admission compared to the Spinal AX group. Out of 30 patients only 1 patient in spinal require ICU admission. In GA group out of 30 patient 6 patients require ICU admission. Statistical analysis (p-value = 0.045) indicates that this difference is statistically significant, suggesting a potential association between the type of anaesthesia and the need for intensive care.

Table 7: Distribution of newborns according to APGAR SCORE AT 1 MIN AND 5MIN

APGAR at 1 min	Spinal AX (Numbers)	General AX (Numbers)	P value
<5	3	4	<0.001
>5	27	26	
Total	30	30	
Mean +SD	7.80+1.26	6.0 +0.89	
APGAR at 5 min			
<7	8	27	<0.001
>7	22	3	
Total	30	30	
Mean +SD	8.26 + 1.03	6.25 + 0.69	



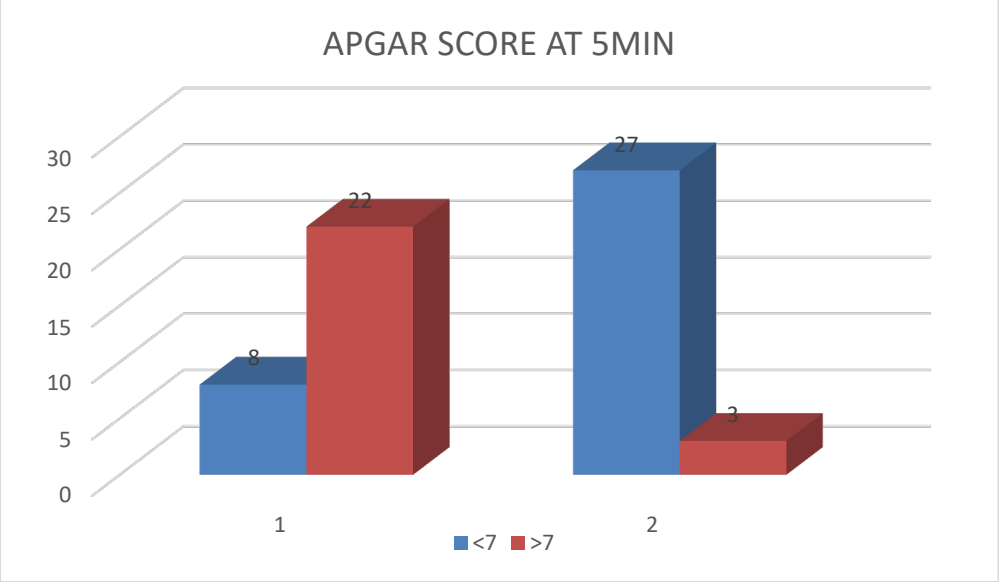


Chart 7b: Apgar score at 5 min

Table and Chart no.7 represents the Apgar score significantly higher proportion of newborns in the Spinal AX group with Apgar scores greater than 5 at 1 minute compared to the General AX group ($p<0.001$). Similarly, at 5 minutes, a significantly higher proportion of newborns in the Spinal AX group had Apgar scores greater than 7 compared to the General AX group ($p<0.001$). These findings suggest that newborns of mothers who underwent Spinal AX anaesthesia had better overall physical conditions immediately after birth compared to those born to mothers who underwent General AX anaesthesia.

Discussion

In the present study mean age was similar between the two groups (24.5 vs 25.78 years, $p=0.32$), as was gestational age (32.04 vs 34.02 weeks, $p=0.83$) and ASA distribution ($p=0.59$).

Visalyaputra et al. (2005) [7] also compared spinal and general anaesthesia in larger groups of 53 and 47 patients, respectively. Demographic variables including age, weight, height, gravidity, and gestational age were similar between the groups. Both studies found similar demographic profiles.

In the present study results showed significantly higher mean arterial pressure, systolic blood pressure, and diastolic blood pressure in the general anaesthesia group compared to the spinal anaesthesia group at all time points after induction of anaesthesia ($p<0.05$).

Shailendra Et al (2020) [1] found that mean baseline hemodynamic parameters of all mothers were high, although in the acceptable range for preeclampsia ($p>0.05$) while the mean blood pressure (SBP, DBP, and MAP) of mothers in group General was higher than group Spinal throughout the intraoperative period.

Kapure KK Et al (2023) [8] in their study concluded that subarachnoid block in preeclampsia patients was associated with better perioperative hemodynamic stability, less hypotension, less vasopressor consumption, and more gradual blood pressure changes.

Rupwate K Et al (2023) [9] conducted study on effect of the type of anaesthesia (general anaesthesia [GA] or spinal anaesthesia [SA]) on maternal haemodynamic and maternal and foetal outcomes in preeclamptic female patients posted for cesarean section delivery. In their study they found that baseline SBP was comparable in the two groups, but baseline DBP was significantly higher in the GA group. The intraoperative rise in SBP and DBP was significantly more in the GA than in the SA group. The vasopressor requirement was statistically higher in the SA group.

In our study, we compared pulse rate between two groups. Aregawi Et al (2018) & Saha SC Et al (2023) also compared pulse rate between spinal anaesthesia and general anaesthesia. In their study, consistent raised in pulse rate in general group than spinal group. Similar to their study, our study also shows significantly higher pulse rate among general group than spinal group. Vaghasia Et al (2021) [10] studied comparison of the maternal and foetal outcomes following cesarean section in pre-eclamptic patients under general and spinal anaesthesia among 60 patients. Their result shows after the induction, maternal heart rate and blood pressure were higher side (still within 30% from baseline) in group General as compared to group spinal Our study shows similar to both the study

show significant high pulse rate among general group compared to spinal group. [10]

The present study compared maternal and neonatal outcomes between spinal and general anaesthesia groups. The spinal group had significantly fewer maternal complications, including nausea & vomiting, delayed discharge and lower rates of ICU admission compared to the general group.

In our study it is found that, neonates born to mothers who underwent spinal anaesthesia had higher Apgar scores at 1 and 5 minutes.

Saowapark Chumpathong et al. (2016) [11] conducted a larger study comparing maternal and neonatal outcomes between spinal and general anaesthesia. Their findings were consistent with the present study, showing significantly lower rates of maternal complications, ICU admission in the spinal group. Neonates born to mothers who underwent spinal anaesthesia had better Apgar scores compared to the general anaesthesia group.

Sung TY Et al (2021) [12] also compared maternal and foetal outcomes between general and spinal anaesthesia for cesarean section based on perioperative haemodynamic parameters (pre- and postoperative systolic blood pressure, heart rate), mean difference of haematocrit and estimated blood loss, and neonatal Apgar scores at 1 and 5 min. They found the result that postoperative haemodynamic parameters were significantly higher in the general group than in the spinal group (systolic blood pressure: 136.8 ± 16.7 vs. 119.3 ± 12.7 mmHg, heart rate: 93.2 ± 16.8 vs. 71.0 ± 12.7 beats/min, respectively, $P < 0.001$).

There was a significantly larger proportion of newborns with 5-min Apgar scores < 7 in the general than in the spinal group (6/141 [4.3%] vs. 0/146 [0%], respectively, $P = 0.012$). They obtained the result that better maternal and foetal outcome in spinal group than general group. Similar to above studies our study consistently demonstrated superior maternal and neonatal outcomes in the spinal anaesthesia group compared to the general anaesthesia group.

In our study, VAS score in spinal group is 1 in all 30 patients in recovery room. In general group, out of 30 patients 10 patient have VAS score 1, 9 patients have VAS score 2, 9 patients have VAS score 3 and 2 patients have VAS score 4 immediately after surgery in recovery room.

A-M Kelly et al. (2008) [13] assessed pain levels using a visual analogue scale and found no significant differences in pain scores among patients with mild, moderate, or severe pain.

Both studies consistently demonstrated lower postoperative pain in the spinal anaesthesia group compared to the general anaesthesia group. While the specific numbers differ, the overall trend of favourable outcomes with spinal anaesthesia is evident in both studies.

Visalyaputra et al. (2005)[7] studies indicate comparable pain experiences between spinal and general anaesthesia groups at various time interval in postoperative period. While the present study assessed pain scores immediately after surgery. Kelly et al. focused on overall pain severity categories. Both studies, however, lack evidence of significant pain differences between the two anaesthetic methods.

In our study Visual Analogue Scale scores indicated significantly lower pain in the spinal group compared to the general group.

Conclusion

In our study, we found that spinal anaesthesia is associated with lower maternal complications compared to general anaesthesia except transient hypotension. Early post operative recovery is good in spinal anaesthesia compared to general anaesthesia in terms of early mobility and post operative ICU requirement. Neonatal outcome in terms of APGAR score is better in spinal anaesthesia compared to general anaesthesia.

Conflict of interest: None

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