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TO STUDY THE PERIOPERATIVE OUTCOME OF SPINAL ANAESTHESIA VERSUS GENERAL ANAESTHESIA IN PREECLAMPSIA PATIENT-AN OBSERVATIONAL STUDY

Anaesthesiology

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ABSTRACT

Background: Preeclampsia is a major hypertensive disorder of pregnancy associated with increased maternal and neonatal morbidity during caesarean section. Selection of an appropriate anaesthetic technique is essential for maintaining perioperative hemodynamic stability and improving fetomaternal outcomes.**Objectives:** To compare perioperative outcomes of spinal anaesthesia and general anaesthesia in preeclamptic patients undergoing caesarean section.**Materials and Methods:** A prospective observational comparative study was conducted over one year in the Department of Anaesthesiology and Critical Care Medicine, BRD Medical College, Gorakhpur. A total of 140 preeclamptic patients undergoing caesarean section were allocated into spinal anaesthesia (SA, n=70) and general anaesthesia (GA, n=70) groups. Perioperative hemodynamic parameters, complications, postoperative recovery, and neonatal outcomes were assessed and analysed using SPSS version 24.0. **Results:** Heart rate and systolic blood pressure remained significantly lower and more stable in the SA group during the intraoperative period ($p<0.001$). Intraoperative vasopressor requirement was higher in the SA group (37.1%), whereas postoperative antihypertensive support was significantly greater in the GA group (45.7%) ($p<0.001$). Hypotension was more common with spinal anaesthesia, while hypertension, tachycardia, and difficult intubation occurred more frequently with general anaesthesia. Postoperative recovery was significantly better in the SA group, with higher Modified Aldrete Scores (8.76 ± 0.43 vs 7.26 ± 3.07; $p<0.001$). Neonatal APGAR scores at 1 and 5 minutes were also significantly higher in the SA group ($p<0.001$).**Conclusion:** Spinal anaesthesia provided better perioperative hemodynamic stability, improved postoperative recovery, and superior neonatal outcomes compared to general anaesthesia in preeclamptic patients undergoing caesarean section.

KEYWORDS

Preeclampsia, Spinal Anaesthesia, General Anaesthesia, Caesarean Section, Hemodynamic Stability, Apgar Score.

INTRODUCTION

Preeclampsia is a complex hypertensive disorder of pregnancy characterized by endothelial dysfunction, increased systemic vascular resistance, and multiorgan involvement, which significantly influence perioperative hemodynamics during cesarean delivery[1]. The condition alters cardiovascular physiology, coagulation pathways, and fluid balance, necessitating meticulous anaesthetic planning to ensure maternal stability and fetal well-being[2]. It typically presents after 20 weeks of gestation and is classified into preeclampsia and severe preeclampsia, the latter associated with complications such as HELLP syndrome, renal dysfunction, and cerebrovascular events[3].

From a clinical standpoint, the choice of anaesthetic technique plays a crucial role in determining intraoperative and postoperative outcomes. Comparative evaluations have demonstrated distinct physiological responses between spinal and general anaesthesia, particularly in severely preeclamptic parturients undergoing cesarean section[4]. Observational data further indicate that spinal anaesthesia is often associated with improved perioperative stability and fewer complications compared to general anaesthesia[5]. Hemodynamic variations remain central to management, as preeclamptic patients exhibit altered vascular reactivity and reduced intravascular volume[6].

The burden of preeclampsia is substantial, especially in developing countries. Studies have shown that the type of anaesthesia significantly influences maternal and neonatal outcomes in these high-risk patients[7]. In tertiary care settings, differences in neonatal outcomes, postoperative recovery, and complication rates have been reported between spinal and general anaesthesia techniques[8]. Furthermore, anaesthetic choice impacts fetomaternal outcomes, including ICU requirement and early neonatal adaptation[9]. Coagulation abnormalities associated with preeclampsia also contribute to perioperative risk and influence anaesthetic decision-making[10].

Despite available evidence, there remains inconsistency in perioperative monitoring practices and limited integration of maternal hemodynamic data with neonatal outcomes in a unified prospective framework. Systematic analyses have highlighted the variability in results across different anaesthetic strategies, underscoring the need for context-specific evaluation[11]. Additionally, regional studies have demonstrated differing hemodynamic responses to spinal anaesthesia in preeclamptic patients, suggesting that population-specific factors may influence outcomes[12].

In view of these gaps, there is a need for a structured prospective study in an Indian tertiary care setting to comprehensively compare spinal and general anaesthesia in preeclampsia. Such evidence is essential to optimize perioperative management and improve maternal and neonatal outcomes, thereby forming the basis for the present study.

MATERIAL AND METHODS

Study Design:

A prospective observational comparative study was conducted to evaluate perioperative outcomes in preeclamptic parturients undergoing caesarean section under spinal anaesthesia (SA) and general anaesthesia (GA).

Study Setting:

The study was carried out in the Department of Anaesthesiology and Critical Care Medicine at BRD Medical College, Gorakhpur, a tertiary care centre catering to a Tier-II urban–semi-urban population of Eastern Uttar Pradesh.

Study Population:

Pregnant women diagnosed with preeclampsia and scheduled for caesarean section were included. Patients were categorized into two groups: spinal anaesthesia (n=70) and general anaesthesia (n=70).

Sample Size: The sample size was calculated using the formula:

$n = Z^2 \times P(1-P) / d^2$

With Z = 1.96, P = 0.046, and d = 0.05, the calculated sample size was 68. To enhance statistical validity, 70 patients were included in each group, totalling 140 participants.

Inclusion Criteria:
- ASA physical status II–III
- Age between 18–45 years
- Gestational age ≥34 weeks
- Blood pressure ≥150/90 mmHg
- Planned postoperative ICU admission

Exclusion Criteria:
- Refusal to participate
- Eclampsia or preoperative ventilatory requirement
- Contraindications to spinal anaesthesia (coagulopathy, severe hypovolemia, local infection)
- Known hypersensitivity to study drugs

Data Collection and Investigations:
After obtaining informed consent, patients underwent pre-anaesthetic evaluation. Participants were randomly allocated into SA and GA groups using a computer-generated randomization table.

Standard ASA monitoring (ECG, SpO_2, NIBP) was applied.

Spinal Anaesthesia:
Administered with 12 mg of 0.5% hyperbaric bupivacaine at L3–L4 after preloading with Ringer lactate (10 ml/kg).

General Anaesthesia:
Induction with thiopentone and succinylcholine, followed by maintenance with oxygen, nitrous oxide, isoflurane, and vecuronium. Hemodynamic parameters (HR, SBP, DBP, MAP, SpO_2) were recorded preoperatively and intraoperatively at 5, 15, 30, and 45 minutes.

Postoperative assessment included:
- Hemodynamic parameters
- Modified Aldrete score for recovery
- ICU stay duration and ventilatory requirement

Neonatal outcomes included APGAR scores at 1 and 5 minutes, birth weight, and NICU admission. Maternal and neonatal complications were also recorded.

Ethical Consideration:
The study was approved by the Institutional Ethics Committee and College Research Council of BRD Medical College. Written informed consent was obtained from all participants.

Statistical Analysis:
Data were analysed using SPSS version 24.0. Continuous variables were expressed as mean ± standard deviation and compared using Student's t-test or Mann–Whitney U test. Categorical variables were analysed using the Chi-square test. A p-value ≤0.05 was considered statistically significant.

RESULTS

Table 1: Intraoperative Heart Rate Trend (N = 140).

Statistical test: Repeated measures ANOVA

Time Interval	SA (n = 70) mean ± SD	GA (n = 70) mean ± SD	p-value
Baseline	98.6 ± 7.5	101.2 ± 8.1	**0.091**
5 minutes	94.2 ± 6.4	110.8 ± 8.6	**<0.001***
15 minutes	92.1 ± 5.8	105.4 ± 7.8	**<0.001***
30 minutes	91.4 ± 5.6	102.8 ± 7.1	**<0.001***
45 minutes	91.8 ± 5.7	101.6 ± 6.9	**<0.001***

Table 1 demonstrates the intraoperative heart rate trend among study participants. Baseline heart rate was comparable between the spinal anaesthesia (SA) and general anaesthesia (GA) groups (98.6 ± 7.5 vs 101.2 ± 8.1 beats/min; p=0.091). However, heart rate remained significantly lower in the SA group at 5, 15, 30, and 45 minutes compared to the GA group (p<0.001), indicating better intraoperative hemodynamic stability with spinal anaesthesia.

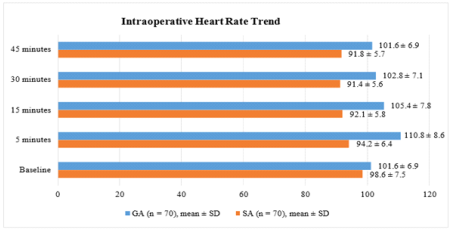

Figure 1: Comparison of intraoperative trend of heart rate

Table 2: Intraoperative Systolic Blood Pressure Trend (N = 140).

Statistical test: Repeated measures ANOVA

Time Interval	SA (n = 70), mean ± SD	GA (n = 70), mean ± SD	p-value
Baseline	159.4 ± 9.2	162.8 ± 10.4	**0.082**
5 minutes	140.6 ± 8.2	170.2 ± 11.4	**<0.001***
15 minutes	136.8 ± 7.6	150.4 ± 9.6	**<0.001***
30 minutes	138.2 ± 7.0	146.2 ± 8.4	**<0.001***
45 minutes	136.6 ± 6.8	144.4 ± 8.0	**<0.001***

Table 2 demonstrates the intraoperative systolic blood pressure trend among study participants. Baseline systolic blood pressure was comparable between the spinal anaesthesia (SA) and general anaesthesia (GA) groups (159.4 ± 9.2 vs 162.8 ± 10.4 mmHg; p=0.082). However, systolic blood pressure remained significantly lower in the SA group at 5, 15, 30, and 45 minutes compared to the GA group (p<0.001), indicating superior intraoperative blood pressure control with spinal anaesthesia.

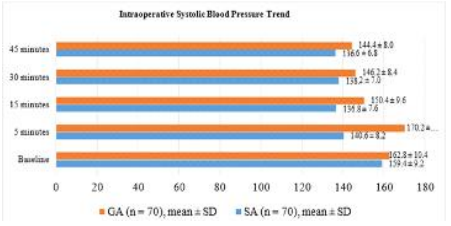

Figure 2: Comparison of intraoperative trend of systolic blood pressure

Table 3. Drug Requirement for Hemodynamic Control (N = 140). Statistical test: Chi-square test

Variable	SA(n= 70) n (%)	GA (n=70) n (%)	p-value
Intraoperative vasopressor use	26 (37.1)	0 (0.0)	**<0.001***
No intraoperative vasopressor	44 (62.9)	70 (100.0)	
Postoperative antihypertensives use	3 (4.3)	32 (45.7)	**<0.001***
No postoperative support required	67 (95.7)	38 (54.3)	

Table 3 demonstrates the drug requirement for hemodynamic control among study participants. Intraoperative vasopressor requirement was significantly higher in the spinal anaesthesia (SA) group compared to the general anaesthesia (GA) group (37.1% vs 0%; p<0.001), reflecting spinal-induced hypotension. Conversely, postoperative antihypertensive support was significantly greater in the GA group (45.7% vs 4.3%; p<0.001), indicating comparatively greater postoperative hemodynamic instability following general anaesthesia.

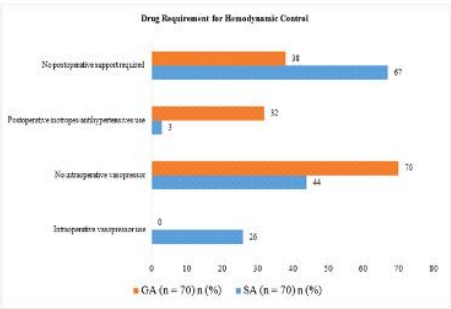

Figure 3: drug requirement for Hemodynamic Control

Table 4. Intraoperative Complications (N = 140).
Statistical test: Chi-square test.

Intraoperative complication	SA (n = 70) n (%)	GA (n = 70) n (%)	p-value
Hypotension	21 (30)	0 (0.0)	**<0.001***
Nausea	8 (11.42)	0 (0.0)	**0.006***
Shivering	8 (11.4)	0 (0.0)	**0.006***
Bradycardia	2 (2.85)	0 (0.0)	**0.496**
Hypertension	0 (0.0)	19 (27.14)	**<0.001***
Tachycardia	0 (0.0)	9 (12.9)	**0.003***
Difficult intubation	-	8 (11.42)	**0.006***
Hemorrhage	0 (0.0)	5 (7.1)	**0.058**
No intraoperative complication	35 (50.0)	35 (50.0)	**1.000**

Table 4 demonstrates the intraoperative complications observed among study participants. Hypotension, nausea, and shivering were significantly more common in the spinal anaesthesia (SA) group ($p<0.05$), whereas hypertension, tachycardia, and difficult intubation were observed significantly more in the general anaesthesia (GA) group ($p<0.05$). Bradycardia and hemorrhage showed no statistically significant difference. Overall, spinal anaesthesia was associated with manageable hypotensive events, while general anaesthesia showed greater airway-related and hypertensive complications.

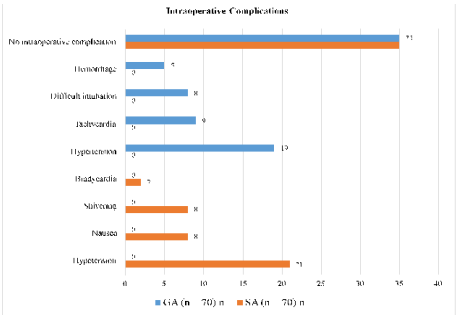

Figure 4: Comparison of intraoperative complications

Table 5. Postoperative Recovery According to Modified Aldrete Score (N = 140)

Statistical test: Independent samples t-test

Parameter	SA (n = 70),	GA (n = 70),	p-value
Modified Aldrete score	8.76 ± 0.43	7.26 ± 3.07	**<0.001***

Table 5 demonstrates postoperative recovery according to the Modified Aldrete Score among study participants. The mean Modified Aldrete score was significantly higher in the spinal anaesthesia (SA) group compared to the general anaesthesia (GA) group (8.76 ± 0.43 vs 7.26 ± 3.07; $p<0.001$). These findings indicate superior early postoperative recovery and better restoration of physiological functions in patients receiving spinal anaesthesia.

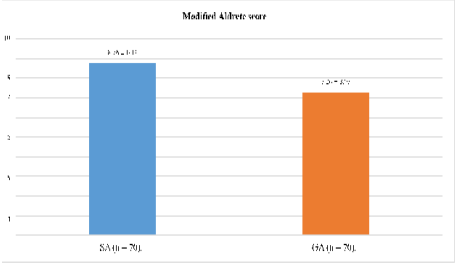

Figure 5: Postoperative Recovery According to Modified Aldrete Score

Table 6. Neonatal Outcomes (N = 140).

Statistical test: Independent samples t-test / Chi-square test

Parameter	SA(n =70), mean ± SD	GA (n = 70), mean ± SD	p-value
Birth weight (kg)	2.63 ± 0.24	2.60 ± 0.28	**0.482**
APGAR score at 1 min	7.05 ± 0.83	6.46 ± 1.03	**<0.001***
APGAR score at 5 min	8.70 ± 0.46	8.21 ± 0.68	**<0.001***

Table 6 demonstrates the neonatal outcomes among study participants. Mean birth weight was comparable between the spinal anaesthesia (SA) and general anaesthesia (GA) groups (2.63 ± 0.24 vs 2.60 ± 0.28 kg; p=0.482). However, APGAR scores at 1 minute and 5 minutes were significantly higher in the SA group compared to the GA group ($p<0.001$), indicating better immediate neonatal adaptation and improved neonatal outcomes with spinal anaesthesia.

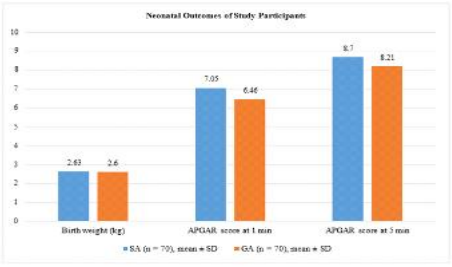

Figure 6: Neonatal Outcomes of study Participants

DISCUSSION

The intraoperative heart rate trend demonstrated significantly better hemodynamic stability with spinal anaesthesia compared to general anaesthesia. Baseline heart rate was comparable between both groups (98.6 ± 7.5 vs 101.2 ± 8.1 beats/min; p=0.091), whereas significantly lower heart rates were observed in the spinal anaesthesia group at 5, 15, 30, and 45 minutes ($p<0.001$). Similar findings were reported by Manaspurikar et al. (2024)[5], who observed significantly higher pulse rates with general anaesthesia throughout surgery. Thakar et al. (2024)[4] also documented increased intraoperative cardiovascular parameters in the general anaesthesia group. Rupwate et al. (2023)[7] similarly found greater hemodynamic fluctuations under general anaesthesia. Elawad et al. (2024)[3] reported persistent perioperative tachycardia with general anaesthesia, whereas Belachew et al. (2023)[6] found comparatively similar heart rate changes following spinal anaesthesia.

The intraoperative systolic blood pressure trend showed significantly better blood pressure control with spinal anaesthesia. Baseline systolic blood pressure was comparable between both groups (159.4 ± 9.2 vs 162.8 ± 10.4 mmHg; p=0.082), while significantly lower systolic pressures were observed in the spinal anaesthesia group at 5, 15, 30, and 45 minutes ($p<0.001$). Similar findings were reported by Thakar et al. (2024)[4], who observed marked perioperative systolic blood pressure elevations under general anaesthesia. Manaspurikar et al. (2024)[5] also demonstrated significantly higher systolic and mean arterial pressures in patients receiving general anaesthesia. Rupwate et al. (2023)[7] similarly documented greater systolic blood pressure increases with general anaesthesia. Saha et al.[8] reported lower intraoperative blood pressure values with spinal anaesthesia. In contrast, Cheng et al. (2021)[11] found no significant difference in mean arterial pressure between anaesthetic techniques.

The requirement for hemodynamic control drugs differed significantly between both groups. Intraoperative vasopressor use was significantly higher in the spinal anaesthesia group (37.1% vs 0%; $p<0.001$), whereas postoperative antihypertensive support was markedly higher in the general anaesthesia group (45.7% vs 4.3%; $p<0.001$). Similar observations were made by Elawad et al. (2024)[3], who reported increased vasopressor requirement following spinal anaesthesia due to sympathetic blockade-induced hypotension. Thakar et al. (2024)[4] also documented more frequent vasopressor administration in patients receiving spinal anaesthesia. Rupwate et al. (2023)[7] similarly observed greater vasopressor utilization with spinal anaesthesia but improved maternal outcomes overall. Cheng et al. (2021)[11] reported lower vasopressor consumption with general anaesthesia. A notable finding was that 95.7% of patients in the spinal anaesthesia group required no postoperative hemodynamic support.

The pattern of intraoperative complications differed significantly between both anaesthetic techniques. Hypotension occurred in 30% patients receiving spinal anaesthesia, whereas no patient in the general anaesthesia group developed hypotension ($p<0.001$). Similar findings were reported by Thakar et al. (2024)[4] and Elawad et al. (2024)[3], who documented higher hypotension and vasopressor requirement with

spinal anaesthesia. Rupwate et al. (2023)[7] and Saha et al.[8] also observed greater hypotensive episodes following spinal anaesthesia, while hypertension and tachycardia were more common under general anaesthesia. Difficult intubation was observed in 11.42% patients receiving general anaesthesia, consistent with Dennis et al. (2025)[2] emphasizing airway difficulty in preeclampsia. Nausea and shivering were uniquely observed only in the spinal anaesthesia group.

Postoperative recovery assessed by Modified Aldrete Score was significantly better with spinal anaesthesia compared to general anaesthesia (8.76 ± 0.43 vs 7.26 ± 3.07; p<0.001). Similar findings were reported by Manaspurikar et al. (2024)[5], who observed superior postoperative recovery and reduced postoperative morbidity with spinal anaesthesia. Thakar et al. (2024)[4] also documented improved maternal recovery and fewer postoperative complications in patients managed with spinal anaesthesia. Neme et al. (2022)[9] similarly demonstrated shorter hospital stay and better maternal outcomes with spinal anaesthesia. Saha et al.[8] further reported lower postoperative morbidity and critical care requirement following spinal anaesthesia. The substantially lower standard deviation in the spinal anaesthesia group indicated more consistent and predictable postoperative recovery.

Neonatal outcomes were significantly improved in patients receiving spinal anaesthesia. Although birth weight was comparable between both groups (2.63 ± 0.24 vs 2.60 ± 0.28 kg; p=0.482), APGAR scores at 1 minute and 5 minutes were significantly higher in the spinal anaesthesia group (p<0.001). Similar observations were reported by Manaspurikar et al. (2024)[5], who demonstrated higher neonatal APGAR scores following spinal anaesthesia. Thakar et al. (2024)[4] and Rupwate et al. (2023)[7] also reported superior neonatal outcomes and reduced neonatal compromise with spinal anaesthesia. Elawad et al. (2024)[3] documented fewer neonatal resuscitation requirements in patients receiving spinal anaesthesia. In contrast, Cheng et al. (2021)[11] found no significant difference in 5-minute APGAR scores between anaesthetic techniques.

CONCLUSION

The overall findings indicate that spinal anaesthesia provided superior perioperative outcomes compared to general anaesthesia in preeclamptic patients undergoing caesarean section. Patients receiving spinal anaesthesia demonstrated more stable intraoperative hemodynamics, improved postoperative recovery, reduced postoperative support requirements, and better neonatal adaptation reflected by significantly higher APGAR scores. Although transient hypotension and vasopressor requirement were more frequent with spinal anaesthesia, these events were manageable and did not adversely influence maternal or neonatal outcomes. In contrast, general anaesthesia was associated with greater perioperative cardiovascular fluctuations, increased postoperative antihypertensive requirement, airway-related complications, and less favorable recovery parameters. The observed findings support the hypothesis that spinal anaesthesia is a safer and more effective anaesthetic technique for caesarean delivery in preeclamptic patients when administered with vigilant monitoring and appropriate perioperative management.

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