

PERIOPERATIVE MATERNAL AND NEONATAL OUTCOMES IN PREECLAMPTIC PARTURIENTS UNDERGOING CESAREAN DELIVERY: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Preeclampsia is a multisystem hypertensive disorder of pregnancy associated with significant maternal and neonatal morbidity and mortality. Cesarean delivery is frequently required in preeclamptic pregnancies due to maternal or fetal compromise. Perioperative management remains challenging because of hemodynamic instability, end-organ dysfunction, and increased risk of adverse neonatal outcomes. **Objective:** To evaluate perioperative maternal and neonatal outcomes among preeclamptic parturients undergoing cesarean delivery at District Hospital Vijayapura, a Tertiary Care DNB Teaching Hospital. **Materials and Methods:** This prospective observational study was conducted from September 2025 to February 2026 at District Hospital Vijayapura, a Tertiary Care DNB Teaching Hospital. A total of 250 pregnant women aged 18–40 years diagnosed with preeclampsia and undergoing elective or emergency cesarean delivery were included. Baseline demographic, obstetric, perioperative, maternal, and neonatal variables were recorded. Maternal outcomes included postpartum hemorrhage, HELLP syndrome, eclampsia, blood transfusion, ICU admission, and maternal morbidity. Neonatal outcomes included birth weight, APGAR score, prematurity, respiratory distress syndrome, and NICU admission. Statistical analysis was performed using SPSS version 26.0. **Results:** Severe preeclampsia was observed in 63.2% of patients. Spinal anesthesia was administered in 84% of cases. Intraoperative hypotension occurred in 28.8% of patients. Postpartum hemorrhage, HELLP syndrome, and ICU admission were observed in 12.8%, 7.2%, and 8% of patients, respectively. Prematurity occurred in 39.2% of neonates, while low birth weight and NICU admission were observed in 46.4% and 29.6%, respectively. Severe preeclampsia was significantly associated with increased maternal and neonatal complications. **Conclusion:** Preeclamptic parturients undergoing cesarean delivery remain at high risk for adverse perioperative maternal and neonatal outcomes. Early identification, multidisciplinary perioperative care, optimized anesthetic management, and vigilant maternal and neonatal monitoring are essential to improve fetomaternal outcomes.

INTRODUCTION

Preeclampsia is a pregnancy-specific multisystem hypertensive disorder characterized by the onset of hypertension after 20 weeks of gestation accompanied by proteinuria and/or evidence of maternal end-organ dysfunction. It remains one of the leading causes of maternal and perinatal morbidity and mortality worldwide, complicating approximately 2–8% of all pregnancies. Despite

advances in obstetric and neonatal care, preeclampsia continues to contribute substantially to adverse maternal and neonatal outcomes, particularly in developing countries where delayed diagnosis and limited healthcare resources increase disease burden. Severe preeclampsia is associated with endothelial dysfunction, vasospasm, coagulation abnormalities, and impaired uteroplacental perfusion, resulting in significant perioperative challenges during cesarean delivery.^[1-3]

Preeclamptic pregnancies sometimes require cesarean delivery due to fetal distress, placental insufficiency, uncontrolled hypertension, unsuccessful induction, or deteriorating maternal health. However, cesarean delivery in these patients is associated with increased perioperative risk due to altered cardiovascular physiology, reduced intravascular volume, exaggerated vasoconstriction, and multisystem involvement. Maternal complications such as intraoperative hypotension, postpartum hemorrhage, eclampsia, HELLP syndrome, pulmonary edema, renal impairment, disseminated intravascular coagulation, and intensive care unit admission are commonly encountered in severe disease.^[1,4,5]

Anesthetic management plays a critical role in determining perioperative outcomes in preeclamptic parturients undergoing cesarean delivery. Spinal anesthesia has become increasingly preferred because it provides rapid onset, effective sensory blockade, decreased airway manipulation, and lower maternal mortality compared with general anesthesia. Earlier concerns regarding severe hypotension after spinal anesthesia in preeclamptic patients have been challenged by recent studies demonstrating relatively better hemodynamic stability compared with normotensive parturients. Getnet et al. and Tadesse et al. observed that the incidence and severity of spinal anesthesia-induced hypotension were lower in preeclamptic women due to increased baseline vascular tone.^[2,3] Similarly, Mele et al. reported acceptable maternal hemodynamic profiles and favorable fetal outcomes among severely preeclamptic patients undergoing cesarean delivery under spinal anesthesia.^[1]

Recent investigations have also focused on optimizing vasopressor therapy to maintain maternal hemodynamic stability during cesarean delivery. Studies by Chen et al. and Xu et al. demonstrated the effectiveness of norepinephrine and phenylephrine infusions in preventing spinal anesthesia-induced hypotension in preeclamptic women while maintaining uteroplacental perfusion and improving neonatal outcomes.^[4,5] Furthermore, Li et al. described characteristic hemodynamic alterations during cesarean delivery in preeclamptic patients, emphasizing the need for vigilant intraoperative monitoring and individualized anesthetic management.^[6]

Neonatal complications associated with preeclampsia remain a major concern. Chronic uteroplacental insufficiency frequently results in fetal growth restriction, prematurity, low birth weight, low APGAR scores, respiratory distress syndrome, and increased NICU admissions. Yuksel et al. demonstrated significantly poorer neonatal outcomes in early-onset preeclampsia, particularly among preterm deliveries.^[7] Likewise, Demis et al. identified emergency cesarean delivery and severe maternal disease as important predictors of adverse neonatal outcomes.^[8]

Although several studies have evaluated hemodynamic responses and anesthetic considerations in preeclamptic women, comprehensive prospective observational studies assessing both perioperative maternal and neonatal outcomes in tertiary care institutions such as District Hospital Vijayapura, a DNB Teaching Hospital, remain limited. Therefore, the present study was undertaken to evaluate perioperative maternal and neonatal outcomes in preeclamptic parturients undergoing cesarean delivery.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted at District Hospital Vijayapura, a Tertiary Care DNB Teaching Hospital, over a period from September 2025 to February 2026. The study was undertaken after obtaining approval from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment. The objective of the study was to evaluate perioperative maternal and neonatal outcomes among preeclamptic parturients undergoing cesarean delivery and to identify factors associated with adverse outcomes.

Study Population

The study included pregnant women diagnosed with preeclampsia who underwent elective or emergency cesarean delivery during the study period.

Preeclampsia was diagnosed according to the American College of Obstetricians and Gynecologists criteria as new-onset hypertension after 20 weeks of gestation with systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg associated with proteinuria or evidence of maternal end-organ dysfunction. Severe preeclampsia was diagnosed in patients with systolic blood pressure ≥ 160 mmHg, diastolic blood pressure ≥ 110 mmHg, severe proteinuria, thrombocytopenia, elevated liver enzymes, renal impairment, pulmonary edema, or neurological manifestations such as persistent headache or visual disturbances.

Sample Size

A sample size of 250 was calculated using the single population proportion formula:

$$n = Z^2 \times p \times q / d^2$$

where:

- n = required sample size
- Z = standard normal deviate at 95% confidence interval (1.96)
- p = expected prevalence of adverse maternal and neonatal outcomes among preeclamptic women undergoing cesarean delivery (20%)
- $q = 1 - p$
- d = margin of error (5%)

After accounting for possible incomplete data and attrition, the final sample size was rounded to 250 participants.

Inclusion Criteria

- Pregnant women aged 18–40 years.
- Diagnosed with preeclampsia.
- Undergoing elective or emergency cesarean delivery.
- Singleton pregnancy.
- Patients willing to provide informed consent.

Exclusion Criteria

- Chronic hypertension.
- Cardiac disease.
- Renal disease unrelated to preeclampsia.
- Multiple pregnancy.
- Known coagulation disorders.
- Patients refusing participation.

Preoperative Evaluation

All enrolled patients underwent detailed preoperative assessment. Demographic characteristics including maternal age, body mass index, gravidity, parity, and gestational age at delivery were recorded. Clinical evaluation included blood pressure at admission, severity of preeclampsia, degree of proteinuria, associated obstetric complications, and indication for cesarean delivery. Relevant laboratory investigations including complete blood count, platelet count, liver function tests, renal function tests, urine protein analysis, and coagulation profile were performed prior to surgery.

All patients were evaluated for magnesium sulphate and antihypertensive therapy. Women with severe preeclampsia received magnesium sulphate prophylaxis as per institutional protocol, with monitoring for signs of toxicity. Antihypertensive treatment, including oral labetalol, oral nifedipine, or intravenous labetalol, was administered according to clinical requirements. Details regarding treatment modality and escalation of therapy were recorded and analyzed.

Maternal Outcome Assessment

Maternal outcomes were assessed during the intraoperative phase as well as during the hospital stay following surgery till discharge. Postpartum hemorrhage, eclampsia, HELLP syndrome, intraoperative hypotension, pulmonary edema, acute renal injury, need for blood transfusion, ICU admission, ventilator support, extended hospital stays, and maternal morbidity were among the maternal complications evaluated.

Postpartum hemorrhage was defined as blood loss greater than 1000 mL following cesarean delivery or bleeding requiring blood transfusion. HELLP syndrome was diagnosed in the presence of hemolysis, elevated liver enzymes, and low platelet count. Acute kidney injury was identified based on elevated serum creatinine and decreased urine output according to standard diagnostic criteria.

Neonatal Outcome Assessment

Neonatal outcomes were evaluated both throughout the hospital stay and right after birth. Birth weight, APGAR scores at 1 and 5 minutes, prematurity, respiratory distress syndrome, length of NICU stay, need for ventilatory support, extended neonatal

admission, and neonatal mortality were among the parameters assessed.

Prematurity was defined as delivery before completion of 37 weeks of gestation, while low birth weight was defined as birth weight less than 2500 grams. Respiratory distress syndrome was diagnosed clinically and confirmed radiologically by the attending neonatologist. Prolonged neonatal admission was considered when NICU stay exceeded seven days.

Perioperative Management

In accordance with institutional procedures, all patients received standardized perioperative care. Prior to the administration of anesthesia, standard monitoring was implemented, which included electrocardiography, pulse oximetry, non-invasive blood pressure monitoring, and respiratory rate monitoring. Fluid administration was standardized, and an 18-gauge cannula was used to establish intravenous access.

The attending anesthesiologist chose the type of anesthetic based on the fetal condition, platelet count, coagulation profile, urgency of the procedure, and maternal clinical status. Spinal anesthesia was preferred in hemodynamically stable patients without contraindications to neuraxial blockade, whereas general anesthesia was administered in patients with contraindications to spinal anesthesia, failed neuraxial block, severe fetal distress requiring urgent delivery, or coagulopathy.

For patients receiving spinal anesthesia, hyperbaric bupivacaine was administered under strict aseptic precautions at the L3–L4 or L4–L5 intervertebral space. Hemodynamic variables including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were monitored continuously throughout the intraoperative period. Intraoperative hypotension was defined as a fall in systolic blood pressure greater than 20% from baseline or systolic blood pressure less than 90 mmHg. Hypotension was managed with intravenous fluids, left uterine displacement, and vasopressor agents such as phenylephrine or norepinephrine whenever required.

Duration of surgery, estimated blood loss, requirement of vasopressors, blood transfusion, and intraoperative complications including hypotension, bradycardia, arrhythmias, pulmonary edema, nausea, and vomiting were documented.

Magnesium sulphate and antihypertensive therapy were continued perioperatively as indicated. Maternal blood pressure was closely monitored, and acute hypertensive episodes were managed according to institutional protocols. Hemodynamic stability was maintained with appropriate fluid management, vasopressor support, and individualized anesthetic care.

Data Collection and Statistical Analysis

A standardized proforma was used to prospectively gather data from patient interviews, anesthetic records, operation notes, laboratory reports, postoperative monitoring charts, and newborn

records. Version 26.0 of the Statistical Package for Social Sciences (SPSS) program was used to evaluate all of the data that had been gathered after it had been imported into Microsoft Excel.

Categorical variables were shown as frequencies and percentages, whilst continuous variables were given as mean \pm standard deviation. The Chi-square test or Fisher's exact test were used to compare categorical variables, whilst the student's t-test was used to evaluate continuous variables. When necessary, multivariate logistic regression analysis was used to find predictors of unfavourable outcomes for mothers and newborns. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 250 preeclamptic parturients undergoing cesarean delivery were included in the study during the study period from September 2025 to February 2026. The majority of patients belonged to the age group of 21–30 years. Severe preeclampsia constituted 63.2% of cases, while 36.8% had mild preeclampsia. Spinal anesthesia was the most frequently administered anesthetic technique.

Baseline Demographic and Obstetric Characteristics

The mean maternal age of the study population was 28.4 ± 5.2 years. The mean body mass index was 29.1 ± 4.8 kg/m². Primigravida women constituted 56.8% of the study population. The mean gestational age at delivery was 35.8 ± 2.6 weeks.

Table 1: Baseline Demographic and Obstetric Characteristics of the Study Population (n = 250)

Variable	Value
Age (years), mean \pm SD	28.4 \pm 5.2
BMI (kg/m ²), mean \pm SD	29.1 \pm 4.8
Gestational age at delivery (weeks), mean \pm SD	35.8 \pm 2.6
Primigravida, n (%)	142 (56.8)
Multigravida, n (%)	108 (43.2)
Mild preeclampsia, n (%)	92 (36.8)
Severe preeclampsia, n (%)	158 (63.2)
Proteinuria $\geq 2+$, n (%)	171 (68.4)
Systolic BP at admission (mmHg), mean \pm SD	162.4 \pm 14.6
Diastolic BP at admission (mmHg), mean \pm SD	104.8 \pm 9.2

Medical Management of Preeclampsia

Among the 250 preeclamptic parturients included in the study, magnesium sulphate prophylaxis was administered to 198 patients (79.2%), predominantly among women with severe preeclampsia. Antihypertensive therapy was required in 226

patients (90.4%). Oral labetalol was the most frequently prescribed antihypertensive agent, followed by oral nifedipine. Intravenous labetalol was required for acute blood pressure control in patients presenting with severe hypertension.

Table 2: Medical Management of Preeclampsia (n = 250)

Variable	Frequency (n)	Percentage (%)
Magnesium sulphate therapy	198	79.2
No magnesium sulphate therapy	52	20.8
Antihypertensive therapy	226	90.4
No antihypertensive therapy	24	9.6
Oral labetalol	124	49.6
Oral nifedipine	76	30.4
Combination therapy	26	10.4
Intravenous labetalol requirement	38	15.2

Indications for Cesarean Delivery

Fetal distress was the most common indication for cesarean delivery and was observed in 78 patients (31.2%). Uncontrolled hypertension accounted for 64 cases (25.6%), while failed induction of labor was noted in 48 patients (19.2%). Previous cesarean section was the indication in 34 patients (13.6%), whereas placental insufficiency accounted for 26 cases (10.4%) of cesarean deliveries among the study population.

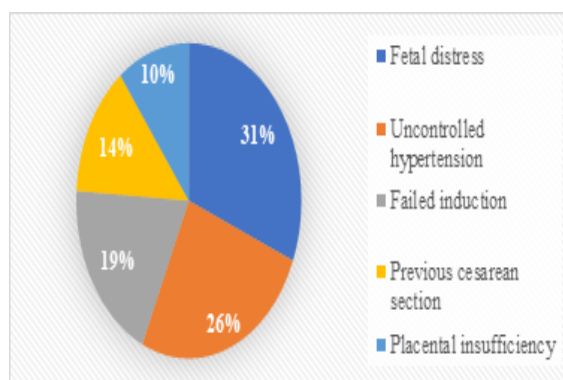


Figure 1: Indications for Cesarean Delivery

Perioperative Characteristics

Spinal anesthesia was administered in 84% of patients, whereas general anesthesia was required in

16% of cases. The mean duration of surgery was 61.5 ± 14.8 minutes.

Table 3: Perioperative Characteristics

Variable	Value
Spinal anesthesia, n (%)	210 (84.0)
General anesthesia, n (%)	40 (16.0)
Duration of surgery (minutes), mean \pm SD	61.5 ± 14.8
Estimated blood loss (mL), mean \pm SD	786 ± 214
Vasopressor requirement, n (%)	88 (35.2)
Blood transfusion requirement, n (%)	26 (10.4)

Intraoperative Complications

Intraoperative hypotension was the most frequently observed perioperative complication and occurred in 72 patients (28.8%). Nausea and vomiting were noted in 36 patients (14.4%), while bradycardia was observed in 18 patients (7.2%). Pulmonary edema developed in 11 patients (4.4%), and arrhythmias were documented in 5 patients (2.0%). Difficult airway management and intubation were encountered in 4 patients (1.6%) who underwent general anesthesia. No major intraoperative cardiac events were reported during the study period.

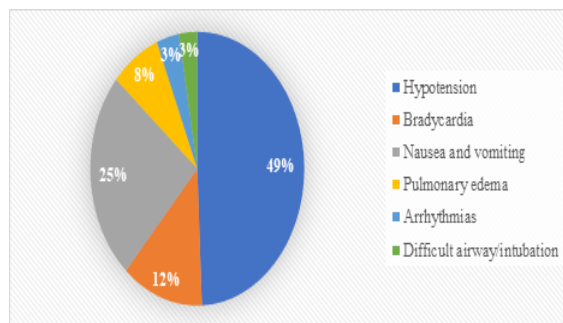


Figure 2: Intraoperative Complications

Maternal Outcomes

Postpartum hemorrhage was observed in 12.8% of patients. HELLP syndrome occurred in 7.2% of cases. Twenty patients required ICU admission. No maternal mortality was observed during the study period.

Table 4: Maternal Outcomes

Maternal Outcome	Frequency (n)	Percentage (%)
Postpartum hemorrhage	32	12.8
Eclampsia	9	3.6
HELLP syndrome	18	7.2
Blood transfusion	26	10.4
ICU admission	20	8.0
Acute kidney injury	12	4.8
Mechanical ventilation	8	3.2
Maternal mortality	0	0

Neonatal Outcomes

The mean neonatal birth weight was 2.24 ± 0.62 kg. Prematurity was observed in 39.2% of neonates.

NICU admission was required in 29.6% of neonates, while respiratory distress syndrome occurred in 16.8%.

Table 5: Neonatal Outcomes

Neonatal Outcome	Value
Birth weight (kg), mean \pm SD	2.24 ± 0.62
APGAR score at 1 min, mean \pm SD	6.8 ± 1.4
APGAR score at 5 min, mean \pm SD	8.1 ± 1.2
Low birth weight (<2.5 kg), n (%)	116 (46.4)
Prematurity, n (%)	98 (39.2)
NICU admission, n (%)	74 (29.6)
Respiratory distress syndrome, n (%)	42 (16.8)
Prolonged NICU stay, n (%)	28 (11.2)
Neonatal mortality, n (%)	6 (2.4)

Comparison of Outcomes Between Mild and Severe Preeclampsia

Patients with severe preeclampsia had significantly higher rates of maternal and neonatal complications compared to those with mild preeclampsia. Incidence

of postpartum hemorrhage, ICU admission, prematurity, NICU admission, and respiratory distress syndrome were significantly higher in the severe preeclampsia group.

Table 6: Comparison of Maternal and Neonatal Outcomes Between Mild and Severe Preeclampsia

Variable	Mild Preeclampsia (n=92)	Severe Preeclampsia (n=158)	p-value
Postpartum hemorrhage	6	26	0.028
HELLP syndrome	2	16	0.019
ICU admission	3	17	0.041
Prematurity	21	77	<0.001
NICU admission	14	60	<0.001
Respiratory distress syndrome	8	34	0.011

Multivariate Logistic Regression Analysis

Multivariate logistic regression analysis was performed to identify independent predictors of adverse maternal and neonatal outcomes. Severe

preeclampsia, gestational age less than 37 weeks, intraoperative hypotension, proteinuria $\geq 2+$, and use of general anesthesia were identified as significant predictors of adverse outcomes.

Table 7: Multivariate Logistic Regression Analysis for Predictors of Adverse Maternal and Neonatal Outcomes

Variable	Adjusted OR	95% CI	p-value
Severe preeclampsia	3.84	1.92–7.66	<0.001
Gestational age <37 weeks	2.96	1.48–5.92	0.002
General anesthesia	2.14	1.01–4.52	0.046
Intraoperative hypotension	2.72	1.33–5.56	0.006
Proteinuria $\geq 2+$	1.88	1.02–3.48	0.041

Multivariate logistic regression analysis demonstrated that severe preeclampsia, prematurity, intraoperative hypotension, and use of general anesthesia were independent predictors of adverse maternal and neonatal outcomes.

Comparison of Current Findings with Previous Studies

To place the findings of the present study in the context of existing literature, a comparison was performed with recently published studies evaluating maternal, neonatal, and hemodynamic outcomes among preeclamptic women undergoing cesarean delivery.

Table 8: Comparison of Present Study Findings with Previously Published Studies

Study	Year	Sample Size	Study Population	Major Outcome Assessed	Key Findings	Comparison with Present Study
Getnet et al. [3]	2020	122	Preeclamptic women undergoing cesarean delivery	Hemodynamic changes after spinal anesthesia	Lower incidence of severe hypotension in preeclamptic women	Similar findings; intraoperative hypotension observed in 28.8% of patients
Li et al. [6]	2020	96	Severe preeclamptic parturients	Maternal hemodynamic characteristics	Increased systemic vascular resistance and altered cardiovascular adaptation	Consistent with perioperative hemodynamic instability observed in the present study
Yuksel et al. [7]	2020	168	Early- and late-onset preeclampsia	Neonatal outcomes	Increased prematurity, low birth weight, and NICU admission	Comparable rates of prematurity (39.2%) and NICU admission (29.6%)
Hauge et al. [11]	2021	80	Women undergoing cesarean delivery	Blood pressure and cardiac output monitoring	Continuous monitoring improved hemodynamic management	Supports need for vigilant perioperative monitoring
Siddik-Sayyid et al. [13]	2021	85	Women receiving spinal anesthesia	Perfusion index and physiological responses	Peripheral perfusion changes associated with spinal anesthesia	Supports altered vascular physiology observed in severe preeclampsia
Mousa et al. [9]	2022	150	Preeclamptic women undergoing cesarean delivery	Maternal outcomes according to anesthesia type	Increased maternal morbidity in severe preeclampsia	Similar rates of ICU admission and maternal complications
Demis et al. [8]	2022	322	Women undergoing emergency cesarean delivery	Early neonatal outcomes	Severe maternal disease associated with adverse neonatal outcomes	Similar association observed in the present study
Jabarulla et al. [10]	2022	120	Elective cesarean deliveries	Prediction of spinal anesthesia-induced hypotension	Perfusion index predicted hypotension risk	Consistent with occurrence of intraoperative hypotension in our cohort

Mele et al. [1]	2022	140	Severe preeclamptic and normotensive women	Hemodynamic changes and fetal outcomes	Acceptable maternal hemodynamic stability under spinal anesthesia	Similar safety profile observed in our study
Tadesse et al. [2]	2023	180	Preeclamptic and normotensive women	Hemodynamic comparison	Lower severity of hypotension among preeclamptic women	Comparable findings with stable perioperative hemodynamics
Chen et al. [4]	2024	100	Preeclamptic women receiving spinal anesthesia	Norepinephrine infusion	Improved blood pressure control and reduced hypotension	Supports vasopressor use in 35.2% of our patients
Xu et al. [5]	2024	90	Preeclamptic women undergoing cesarean delivery	Vasopressor dose optimization	Effective prevention of spinal anesthesia-induced hypotension	Supports current perioperative management practices
Present Study	2026	250	Preeclamptic women undergoing cesarean delivery	Maternal and neonatal outcomes	Severe preeclampsia independently predicted adverse maternal and neonatal outcomes	Largest prospective observational cohort among compared studies

The findings of the present study are largely consistent with previously published literature evaluating perioperative outcomes in preeclamptic women undergoing cesarean delivery. Across studies, severe preeclampsia has consistently been associated with increased maternal and neonatal morbidity, including hemodynamic instability, postpartum hemorrhage, prematurity, respiratory distress syndrome, and increased NICU admission rates. The present study extends current evidence by prospectively evaluating both maternal and neonatal outcomes in a relatively larger cohort of 250 preeclamptic parturients. Furthermore, multivariate logistic regression analysis identified severe preeclampsia, gestational age below 37 weeks, intraoperative hypotension, proteinuria $\geq 2+$, and use of general anesthesia as independent predictors of adverse outcomes, thereby providing clinically relevant information for perioperative risk stratification and management.

DISCUSSION

The present prospective observational study evaluated perioperative maternal and neonatal outcomes among preeclamptic parturients undergoing cesarean delivery at District Hospital Vijayapura, a Tertiary Care DNB Teaching Hospital. The findings of the study demonstrated that severe preeclampsia was associated with significantly increased maternal and neonatal morbidity, including higher rates of postpartum hemorrhage, HELLP syndrome, ICU admission, prematurity, low birth weight, respiratory distress syndrome, and NICU admission. These observations emphasize that preeclampsia continues to represent a major obstetric challenge despite advances in perioperative obstetric care and anesthetic management.

In the current study, the majority of patients had severe preeclampsia, which is comparable to findings reported by Mousa et al., who observed increased perioperative complications among women with severe disease undergoing cesarean delivery.⁹ Severe preeclampsia is associated with widespread

endothelial dysfunction, vasospasm, platelet activation, intravascular volume depletion, and multiorgan involvement, all of which contribute to increased perioperative risk. Li et al. demonstrated that preeclamptic patients exhibit significant alterations in cardiovascular hemodynamics during cesarean delivery, including increased systemic vascular resistance and impaired cardiac adaptation.⁶ The higher incidence of intraoperative hemodynamic instability seen in the current investigation could be explained by these physiological disruptions.

Spinal anesthesia was administered in the majority of patients and was associated with acceptable perioperative hemodynamic stability. Historically, neuraxial anesthesia in severe preeclampsia was considered controversial because of concerns regarding profound hypotension following sympathetic blockade. However, recent literature supports the relative safety of spinal anesthesia in preeclamptic parturients. Getnet et al. reported that the incidence and severity of spinal anesthesia-induced hypotension were lower in preeclamptic women than in normotensive parturients due to increased baseline vascular tone.³ Similar findings were demonstrated by Tadesse et al. and Mele et al., who observed relatively stable maternal hemodynamics during cesarean delivery under spinal anesthesia in severe preeclampsia.^{1,2}

Intraoperative hypotension occurred in 28.8% of patients in our study. This finding is comparable with studies evaluating hemodynamic responses during cesarean delivery under spinal anesthesia. Jabarulla et al. demonstrated that perfusion index could predict the occurrence of spinal anesthesia-induced hypotension in cesarean delivery patients, highlighting the importance of early hemodynamic monitoring.¹⁰ Hauge et al. further emphasized that continuous assessment of maternal blood pressure and cardiac output during cesarean delivery is essential for maintaining uteroplacental perfusion and preventing fetal compromise.¹¹ Likewise, Ngan Kee et al. reported the importance of accurate perioperative blood pressure monitoring in obstetric

anesthesia practice to optimize maternal and fetal outcomes.^[12]

In the present study, magnesium sulphate prophylaxis was administered to 79.2% of patients, while 90.4% required antihypertensive therapy, with oral labetalol being the most commonly used agent. Appropriate use of magnesium sulphate and effective blood pressure control likely contributed to the absence of maternal mortality and the relatively low incidence of severe maternal complications observed in our cohort.^[14,15]

Recent advances in vasopressor therapy have significantly improved perioperative hemodynamic management in preeclamptic women. Chen et al. demonstrated that norepinephrine infusion effectively prevents maternal hypotension while maintaining adequate placental perfusion during spinal anesthesia for cesarean delivery.^[4] Similarly, Xu et al. established effective prophylactic dosing strategies for phenylephrine and norepinephrine infusion in preeclamptic women undergoing cesarean section, resulting in improved maternal cardiovascular stability and neonatal outcomes.^[5] In the present study, vasopressor support was required in more than one-third of patients, emphasizing the importance of vigilant intraoperative monitoring and prompt management of hemodynamic fluctuations.

Postpartum hemorrhage was observed in 12.8% of patients, with significantly higher incidence among women with severe preeclampsia. Severe endothelial dysfunction, thrombocytopenia, hepatic impairment, and coagulation abnormalities associated with advanced disease may contribute to increased hemorrhagic risk. HELLP syndrome occurred in 7.2% of patients, which is comparable to previously reported incidences among severe preeclamptic populations. Mousa et al. reported increased maternal morbidity, blood transfusion requirement, and ICU admission among women with severe preeclampsia and HELLP syndrome undergoing cesarean delivery.^[9] Additionally, Siddik-Sayyid et al. highlighted the significance of peripheral perfusion changes and impaired thermoregulation during cesarean delivery under spinal anesthesia, reflecting altered vascular physiology in preeclamptic women.^[13]

Neonatal morbidity remains a major concern in pregnancies complicated by preeclampsia. In the present study, low birth weight was observed in 46.4% of neonates, while prematurity and NICU admission occurred in 39.2% and 29.6% of cases, respectively. These findings are consistent with studies by Yuksel et al., who demonstrated significantly poorer neonatal outcomes among infants born to mothers with severe and early-onset preeclampsia.^[7] Chronic uteroplacental insufficiency, fetal hypoxia, and iatrogenic preterm delivery contribute significantly to neonatal respiratory complications and prolonged NICU admission. Demis et al. similarly identified severe maternal disease and emergency cesarean delivery as major determinants of adverse neonatal outcomes.^[8]

respiratory distress syndrome observed in the current study may be explained by both prematurity and impaired fetal lung maturation secondary to placental dysfunction.

An important strength of the present study is its prospective design and comprehensive evaluation of both maternal and neonatal perioperative outcomes in a real-world tertiary care setting. Unlike studies focusing exclusively on anesthetic hemodynamics, the present study incorporated broader perioperative variables including postoperative maternal morbidity, transfusion requirement, ICU admission, neonatal respiratory complications, and NICU outcomes, thereby providing clinically relevant insight into the overall disease burden associated with preeclampsia.

However, certain limitations should be acknowledged. The study was conducted at a single tertiary referral center, which may limit generalizability to peripheral healthcare settings. Long-term maternal cardiovascular outcomes and long-term neonatal neurodevelopmental outcomes were not assessed. Additionally, the absence of a normotensive comparison group limits direct comparative interpretation.

Despite these limitations, the present study highlights the substantial perioperative risks associated with preeclampsia and underscores the need for early diagnosis, optimized perioperative anesthetic management, vigilant maternal hemodynamic monitoring, and coordinated multidisciplinary care involving obstetricians, anesthesiologists, neonatologists, and intensivists. Further multicentric prospective studies are warranted to establish standardized perioperative management protocols aimed at reducing maternal and neonatal morbidity associated with preeclampsia.

CONCLUSION

Preeclampsia continues to pose a significant perioperative challenge in obstetric practice and remains strongly associated with increased maternal and neonatal morbidity among women undergoing cesarean delivery. Severe preeclampsia was associated with higher rates of intraoperative hemodynamic instability, postpartum hemorrhage, HELLP syndrome, ICU admission, prematurity, low birth weight, and NICU admission. Despite the high-risk nature of these pregnancies, spinal anesthesia demonstrated acceptable hemodynamic safety when combined with vigilant monitoring and appropriate vasopressor support. Early risk stratification, multidisciplinary perioperative management, optimized anesthetic care, and advanced neonatal support are essential to improve fetomaternal outcomes in preeclamptic parturients.

REFERENCES

1. Mele D, et al. Comparison of hemodynamic changes and fetal outcome between severely preeclamptic and normotensive parturients undergoing elective cesarean delivery under spinal anesthesia. *BMC Anesthesiol.* 2022;22:198.
2. Tadesse M, et al. Comparison of the hemodynamic changes between preeclamptic and normotensive parturients undergoing cesarean section under spinal anaesthesia. *Int J Womens Health.* 2023;15:1245-1253.
3. Getnet T, et al. Hemodynamic changes after spinal anesthesia in preeclamptic patients undergoing cesarean section: prospective cohort study. *Int J Womens Health.* 2020;12:1007-1015.
4. Chen Y, et al. Dose-response study of norepinephrine infusion for maternal hypotension in preeclamptic patients undergoing cesarean delivery under spinal anesthesia. *Clin Pharmacokinet.* 2024;63(4):451-460.
5. Xu S, et al. Determination of ED90s of phenylephrine and norepinephrine infusion for preventing spinal anesthesia-induced hypotension in women with preeclampsia during cesarean delivery. *J Clin Anesth.* 2024;92:111350.
6. Li X, et al. Hemodynamic characteristics in preeclampsia women during cesarean delivery under spinal anesthesia. *Pregnancy Hypertens.* 2020;21:119-124.
7. Yuksel B, et al. Neonatal outcomes of early- and late-onset preeclampsia. *J Matern Fetal Neonatal Med.* 2020;33(21):3767-3773.
8. Demis A, et al. Determinants of early neonatal outcomes after emergency cesarean delivery: prospective observational study. *BMC Pregnancy Childbirth.* 2022;22:602.
9. Mousa WF, et al. The type of anesthesia and outcome in preeclamptic patients undergoing cesarean section delivery: prospective observational study. *Ain-Shams J Anesthesiol.* 2022;14:35.
10. Jabarulla R, et al. Role of perfusion index as a predictor of hypotension following spinal anesthesia in elective cesarean section. *J Obstet Anaesth Crit Care.* 2022;12(2):89-95.
11. Hauge TH, et al. Blood pressure and cardiac output during cesarean delivery under spinal anaesthesia. *BMJ Open.* 2021;11:e046745.
12. Ngan Kee WD, et al. Accuracy of noninvasive blood pressure measured at the ankle during cesarean delivery under spinal anesthesia. *Anesth Analg.* 2020;131(4):1221-1228.
13. Siddik-Sayyid SM, et al. Association between preoperative toe perfusion index and maternal core temperature changes during cesarean delivery under spinal anesthesia. *BMC Anesthesiol.* 2021;21:287.
14. Duley L, Gülmezoglu AM, Henderson-Smart DJ, Chou D. Magnesium sulphate and other anticonvulsants for women with pre-eclampsia. *Cochrane Database Syst Rev.* 2010;(11):CD000025.
15. American College of Obstetricians and Gynecologists. Gestational hypertension and preeclampsia. *ACOG Practice Bulletin No. 222. Obstet Gynecol.* 2020;135(6):e237-e260.