e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(7); 219-228

Original Research Article

Determinants of Maternal and Fetal Outcomes in Preeclampsia: A Retrospective Analytical Study

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Received: 04-06-2026 / Revised: 29-06-2026 / Accepted: 23-07-2026

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Conflict of interest: Nil

Abstract:

Background: Preeclampsia (PE) is a major cause of maternal and perinatal morbidity and mortality, particularly in low-resource settings, with outcomes influenced by clinical and laboratory factors.

Aim: To evaluate determinants of maternal and fetal outcomes in women with preeclampsia.

Methodology: A retrospective analytical study was conducted on 86 women with PE at Department of Obstetrics and Gynaecology, Bankura Sammilani Medical College and Hospital, West Bengal, India, over a period of six months. Maternal demographics, clinical parameters, laboratory findings, and neonatal outcomes were analyzed using SPSS.

Results: Mean age was 26.8±4.9 years; 55.8% had irregular antenatal care. Preterm delivery occurred in 62.8%, and cesarean section in 69.8%. Low birth weight was observed in 45.3%, and 36% required NICU admission. Higher systolic and diastolic BP, elevated urea and creatinine, and severe proteinuria were significantly associated with lower birth weight, earlier gestation, and increased NICU admission ($p<0.05$). Proteinuria showed a strong inverse relationship with birth weight and gestational age.

Conclusion: Elevated BP, renal dysfunction, and severe proteinuria are key predictors of adverse maternal and fetal outcomes in PE. Early detection and regular antenatal care are crucial for improving outcomes.

Keywords: Preeclampsia, maternal outcomes, fetal outcomes, proteinuria, hypertension, NICU, risk factors.

DOI: 10.25258/ijpqa.17.7.31

Introduction

Preeclampsia (PE) is a disorder that manifests in the second half of pregnancy and is characterized by newly elevated blood pressure (BP) after 20 weeks gestation [1]. This is a disorder with multi-organ involvement of the maternal organism, affecting cardiovascular, renal, hepatic and neurologic systems. The condition continues to be a leading cause of maternal and perinatal morbidity and mortality around the world. PE is linked with an array of adverse consequences like hypertension in pregnancy, placental abruption, growth restriction of the foetus, preterm delivery and severe cases may even result in maternal/fetal death. Even with improvements in obstetric care, hypertensive disorders of pregnancy (HDP), particularly preeclampsia, remain a significant burden for healthcare systems globally [2].

Internationally, PE is known to be one of the most common causes of maternal and fetal death due to its unpredictable nature and rapid course of deterioration [3]. Maternal health indicators in India and notably in the states like West Bengal also reflect the continuing challenges posed by hypertensive disorders of pregnancy. The burden of complications associated with PE is high, partly due to socioeconomic disparities, poor access to quality antenatal care, delayed diagnosis and poor referral systems. To tackle these issues is important to control MMR and improve the neonatal situation in the region.

PE is not only a leading cause of death but also an important contributor to severe maternal morbidity. Complications can even remain or worsen despite delivery, the definitive treatment for PE. Symptoms often resolve with the delivery of placenta and fetus, but the postpartum period is a high-risk time where morbidity and mortality can still occur [4]. Women with PE are at higher risk of needing intensive care unit (ICU) admission because of eclampsia, pulmonary edema, renal failure, and severe hypertension. Several studies have documented the long-term health sequelae of protracted ICU stays, including irreversible organ damage and psychological consequences [5].

PE's multisystem nature highlights its severity, as it may result in extensive endothelial dysfunction and multiple organ damage. During the prepartum, peripartum, and postpartum period of time, patients may suffer from unmanageable hypertensive episodes requiring monitoring and treatment [6]. The complexity of the disease often necessitates a multidisciplinary approach in managing PE with obstetricians, intensivists, neonatologists and other specialists. Hence, it is vital to refer such women to tertiary care facilities that have specialized maternal and neonatal intensive care services as one way of enhancing outcomes [7,8]. Strengthening such referral systems and improving access to tertiary care in geographic regions like West Bengal would be a potential means of reducing adverse outcomes.

Investigation and identification of the predictors of maternal and fetal outcomes in the setting of preeclampsia is important to enable early detection of high-risk cases so that appropriate measures can be taken. Several maternal characteristics including obesity, pre-existing hypertension, diabetes mellitus and gestational diabetes mellitus (GDM) have also been shown to be significant risk factors for the onset and progression of PE. Analysis of laboratory parameters and clinical indicators at the time of diagnosis including blood pressure levels, liver function tests, renal function, and hematological indices may provide valuable insights for disease severity and prognosis as well.

We aimed to investigate the association of maternal characteristics (including obesity, diabetes, GDM and laboratory test results and BP level at diagnosis) with a course of pregnancy in patients with PE and outcomes in newborns. This will better inform risk stratification and clinical decision-making by recognising key features associated with poor maternal / fetal outcomes. Moreover, the study aims to identify which laboratory parameters are useful predictors of maternal and neonatal postpartum complications, allowing for improved early diagnosis and prognosis.

These findings will help devise PE prevention and management interventions. Early identification as well as close surveillance and timely intervention in identified high-risk women can greatly alleviate the burden of complications from this condition. Most importantly, insights on disease determinants can guide the creation of personalized care plans for patients with preeclampsia.

This study may also help identify the women most likely to benefit from early referral to tertiary care centers and intense monitoring. Strengthening healthcare delivery systems and raising awareness in West Bengal can ensure better maternal and newborn outcomes. In the end, early identification, appropriate management, and evidence-based clinical practice have the potential to decrease both morbidity and mortality among both preeclamptic women and their neonates.

Methodology

Study Design and Setting: This retrospective observational study was conducted in the Department of Obstetrics and Gynaecology, Bankura Sammilani Medical College and Hospital, West Bengal, India.

Study Duration: The study was conducted over a period of six months.

Sample Size Calculation: The sample size was determined using the standard statistical formula for prevalence studies. The formula used was:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where:

- n = sample size
- Z = standard normal deviate (1.96 for 95% CI)
- p = prevalence of preeclampsia
- q = 1 - p
- d = allowable error

Sample Size: A total of 86 patients diagnosed with preeclampsia were included in the study. The sample size was determined based on the number of eligible cases available in the hospital records during the study period, ensuring adequate representation of the study population.

Study Population: The study population consisted of pregnant women diagnosed with preeclampsia who were admitted to and delivered at Bankura Sammilani Medical College and Hospital. These patients were managed according to standard institutional protocols, and their clinical course, management, and outcomes were documented in hospital records, which served as the primary source of data for this study.

Preeclampsia and Its Severe Complications: Preeclampsia is a multisystem disorder characterized by new-onset hypertension after 20 weeks of gestation with maternal organ dysfunction and/or uteroplacental insufficiency. Severe preeclampsia is associated with significant maternal and fetal complications.

Severe maternal complications include:

- Eclampsia (convulsions)
- HELLP syndrome (Hemolysis, Elevated Liver Enzymes, Low Platelets)
- Acute renal failure
- Pulmonary edema
- Cerebral hemorrhage or stroke
- Placental abruption
- Disseminated intravascular coagulation (DIC)

Fetal complications include:

- Intrauterine growth restriction (IUGR)
- Preterm birth
- Low birth weight
- Fetal distress
- Intrauterine fetal demise

Case Record Proforma: A structured case record proforma was used for systematic data collection from indoor patient records. The proforma included patient demographic details such as age, gravida, and parity, along with clinical history including previous history of preeclampsia and antenatal care status.

Clinical examination parameters included blood pressure and weight gain during pregnancy. Laboratory investigations recorded were hemoglobin level, platelet count, renal function tests, liver function tests, and proteinuria assessment.

Obstetric details included gestational age at delivery, mode of delivery, and duration of labour. Intrapartum complications such as postpartum hemorrhage, convulsions, and fetal distress were documented.

Neonatal outcomes including birth weight, Apgar scores, and NICU admission were also included in the proforma.

Inclusion Criteria

- Pregnant women diagnosed with preeclampsia, with or without severe features
- Patients who were admitted and delivered at the study hospital
- Availability of complete maternal demographic, clinical, laboratory, and neonatal outcome data
- Patients with documented blood pressure records during pregnancy

Exclusion Criteria

- Patients with incomplete or missing clinical records
- Patients who did not deliver at the study hospital
- Women with pre-existing chronic hypertension without superimposed preeclampsia
- Multiple pregnancies (if excluded as per study design, optional based on your need)

Diagnostic Criteria for Preeclampsia (FIGO, RCOG, WHO, ACOG): Preeclampsia was diagnosed based on the latest internationally accepted guidelines provided by FIGO, RCOG, WHO, and ACOG. The diagnosis requires new-onset hypertension after 20 weeks of gestation, defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg recorded on at least two occasions.

In addition to hypertension, the presence of one or more of the following criteria confirms the diagnosis: proteinuria (≥300 mg in 24-hour urine collection, or protein/creatinine ratio ≥0.3, or dipstick ≥1+), maternal organ dysfunction such as thrombocytopenia (platelet count <100,000/μL), renal insufficiency (serum creatinine >1.1 mg/dL), elevated liver enzymes (twice the normal value), pulmonary edema, or new-onset cerebral or visual disturbances.

Uteroplacental dysfunction, including fetal growth restriction or abnormal Doppler findings, is also considered a diagnostic feature. Severe preeclampsia is identified when blood pressure reaches ≥160/110 mmHg or when there is evidence of severe organ dysfunction or eclampsia.

Data Collection: Data for this study were collected retrospectively from indoor patient department (IPD) records. Sources included patient case sheets, labour room registers, operation theatre records, and neonatal intensive care unit (NICU) records. This ensured comprehensive capture of maternal, intrapartum, and neonatal data.

Maternal variables included demographic details, obstetric history, clinical findings, and laboratory investigations. Neonatal outcomes such as birth weight, Apgar score, and NICU admission were also documented systematically from hospital records.

Intrapartum Parameters and Complications: Intrapartum variables were carefully assessed to evaluate the impact of preeclampsia during labour and delivery. The mode of delivery was categorized as vaginal delivery or cesarean section, depending on obstetric indications and maternal-fetal condition.

The duration of labour was noted and categorized as normal or prolonged based on standard obstetric definitions. Intrapartum complications such as fetal distress, placental abruption, and meconium-stained liquor were recorded as indicators of fetal compromise during labour.

Postpartum hemorrhage (PPH), either atonic or traumatic, was documented as a major maternal complication. Additionally, the occurrence of convulsions (eclampsia) during the intrapartum period was recorded to assess disease severity and its acute complications.

Outcome Measures: The primary outcomes of the study were maternal outcomes, which were assessed across antenatal, perinatal, and postpartum periods. Antenatal outcomes included regularity of antenatal visits and history of preeclampsia or gestational diabetes in the current pregnancy. Perinatal outcomes included gestational age at delivery, mode of delivery, and indications for cesarean section. Postpartum outcomes included maternal complications, duration of hospital stay, need for ICU admission, referral to other specialists, and requirement of antihypertensive therapy. Secondary outcomes included fetal and

neonatal outcomes such as birth weight, Apgar scores, preterm birth, NICU admission, and neonatal complications.

Study Procedure: All eligible cases of preeclampsia were identified from hospital records during the study period. Relevant clinical, laboratory, and outcome data were extracted systematically using a structured data collection format. Patients had been managed as per institutional protocols, with close monitoring of maternal and fetal conditions. Decisions regarding timing and mode of delivery were individualized based on clinical status. In cases of anticipated preterm delivery before 34 weeks of gestation, antenatal corticosteroids had been administered to promote fetal lung maturity. The collected data were then compiled and prepared for statistical analysis.

Statistical Analysis: Data were entered into and analyzed using IBM SPSS Statistics version 25.0. The normality of continuous variables was assessed using the Shapiro-Wilk test. Normally distributed data were expressed as mean ± standard deviation, while non-normally distributed data were presented as median with range. Categorical variables were summarized as frequencies and percentages. For comparison between groups, the Student's t-test was used for normally distributed continuous variables, while the Mann–Whitney U test was applied for non-parametric data. For comparisons involving more than two groups, one-way ANOVA or the Kruskal-Wallis test was used as appropriate. Categorical variables were analyzed using the Chi-square test or Fisher's exact test. A p-value of less than 0.05 was considered statistically significant."

Result

Table 1 summarizes the maternal demographic and clinical characteristics, showing a mean age of 26.8 ± 4.9 years, with median gravidity and parity of 2 (range: 1–5) and 1 (range: 0–3), respectively. A history of preeclampsia was present in 18 women (20.9%), while gestational diabetes mellitus was observed in 13 (15.1%). Less than half of the participants, 38 (44.2%), had regular antenatal follow-up, whereas the majority, 48 (55.8%), had irregular or no follow-up. Baseline blood pressure values were within normal limits, with median SBP of 118 mmHg (100–140) and DBP of 76 mmHg (60–90), but showed a marked increase at diagnosis, with SBP rising to 152 mmHg (140–200) and DBP to 96 mmHg (90–120). The mean weight gain during pregnancy was 11.2 ± 3.6 kg. Overall, the data indicate a predominantly young population with a notable proportion having prior obstetric risk factors and inadequate antenatal care, along with significant elevation in blood pressure at diagnosis.

Table 1: Maternal demographic and clinical characteristics (N = 86)

Variables	n (%) / Mean ± SD / Median (Min–Max)
Age (years)	26.8 ± 4.9
Gravidity	2 (1–5)
Parity	1 (0–3)
History of preeclampsia	18 (20.9%)
Gestational diabetes mellitus (GDM)	13 (15.1%)
Regular antenatal follow-up	38 (44.2%)
Irregular/No follow-up	48 (55.8%)
Baseline SBP (mmHg)	118 (100–140)
Baseline DBP (mmHg)	76 (60–90)
SBP at diagnosis (mmHg)	152 (140–200)
DBP at diagnosis (mmHg)	96 (90–120)
Weight gain (kg)	11.2 ± 3.6

Table 2 presents the laboratory parameters at diagnosis, showing a mean hemoglobin level of 10.8 ± 1.6 g/dL and a mean platelet count of 228.5 ± 68.4 $\times 10^3/\mu L$. The mean serum creatinine was 0.72 ± 0.21 mg/dL, while urea had a median value of 24 mg/dL (range: 8–52 mg/dL). Liver enzymes showed median values of 32 U/L (12–210) for AST and 28 U/L (10–198) for ALT, indicating variability among patients. Proteinuria distribution revealed that the highest proportion of patients had severe proteinuria (4+) in 30 cases (34.9%), followed by 3+ in 20 (23.3%), 1+ in 19 (22.1%), and 2+ in 17 (19.8%). Overall, the findings suggest relatively preserved renal function on average, with a notable proportion of patients exhibiting higher grades of proteinuria.

Table 2: Laboratory parameters at diagnosis (N = 86)	
Parameter	**Value**
Hemoglobin (g/dL)	10.8 ± 1.6
Platelet count (×10³/μL)	228.5 ± 68.4
Serum creatinine (mg/dL)	0.72 ± 0.21
Urea (mg/dL)	24 (8–52)
AST (U/L)	32 (12–210)
ALT (U/L)	28 (10–198)
Proteinuria	
- 1+	19 (22.1%)
- 2+	17 (19.8%)
- 3+	20 (23.3%)
- 4+	30 (34.9%)

Table 3 outlines the obstetric and maternal outcomes, showing that a considerable proportion of deliveries occurred preterm, with 28 (32.6%) before 34 weeks and 26 (30.2%) between 34–36 weeks, while only 32 (37.2%) reached term (≥37 weeks). Cesarean section was the predominant mode of delivery in 60 cases (69.8%), compared to 26 (30.2%) vaginal deliveries, with acute fetal distress being the most common indication for cesarean section (22; 36.7%). Maternal ICU admission was required in 7 cases (8.1%), indicating notable maternal morbidity. Postpartum blood pressure control was achieved spontaneously in 35 women (40.7%), whereas the majority, 51 (59.3%), required medication. The median duration of maternal hospital stay was 5 days (range: 2–14 days). Overall, the findings reflect a high rate of preterm delivery, cesarean section, and need for medical management, highlighting significant maternal and obstetric risks.

Table 3: Obstetric and maternal outcomes (N = 86)	
Variables	**n (%) / Median (Min–Max)**
Gestational age at delivery	
<34 weeks	28 (32.6%)
34–36 weeks	26 (30.2%)
≥37 weeks	32 (37.2%)
Mode of delivery	
Cesarean section	60 (69.8%)
Vaginal delivery	26 (30.2%)
Indication for cesarean (n=60)	
Acute fetal distress	22 (36.7%)
Other indications	38 (63.3%)
Maternal ICU admission	7 (8.1%)
Postpartum BP control	
Spontaneous	35 (40.7%)
Medication required	51 (59.3%)
Maternal hospital stay (days)	5 (2–14)

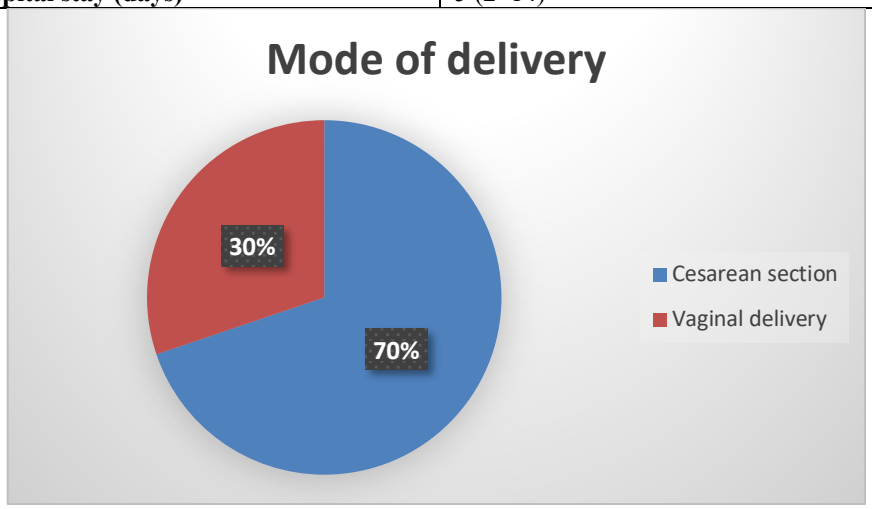

Table 4 summarizes the neonatal outcomes, showing a median birth weight of 2470 g (range: 850–4100 g), with a high proportion of low-birth-weight infants (39; 45.3%). The median Apgar scores were 8 (range: 4–9) at 1 minute and 9 (range: 6–10) at 5 minutes, indicating generally good immediate neonatal adaptation. However, 31 newborns (36.0%) required NICU admission, while 55 (64.0%) did not, reflecting a considerable burden of neonatal complications. The mean head circumference was 32.5 ± 2.8 cm. Overall, the findings indicate a substantial proportion of compromised neonatal outcomes, particularly in terms of low birth weight and NICU admissions.

Table 4: Neonatal outcomes (N = 86)

Variables	Value
Birth weight (g)	2470 (850–4100)
Low birth weight (<2500 g)	39 (45.3%)
Apgar score (1 min)	8 (4–9)
Apgar score (5 min)	9 (6–10)
NICU admission	31 (36.0%)
No NICU required	55 (64.0%)
Head circumference (cm)	32.5 ± 2.8

Table 5 shows a significant association between the degree of proteinuria and adverse maternal and fetal outcomes. As proteinuria increased from 1+ to 4+, there was a progressive decline in median birth weight from 2850 g to 2100 g ($p < 0.001$) and gestational age from 37 weeks to 34 weeks ($p = 0.003$), indicating worsening fetal growth and earlier delivery. Similarly, Apgar scores at 1 minute decreased from 8 to 7 ($p = 0.041$), while the 5-minute Apgar score showed a declining trend though not statistically significant ($p = 0.052$). The proportion of NICU admissions also increased markedly from 21.1% in the 1+ group to 46.7% in the 4+ group ($p = 0.021$). Overall, higher grades of proteinuria were significantly associated with poorer neonatal outcomes, including lower birth weight, reduced gestational age, and increased need for NICU care.

Table 5: Association of proteinuria with maternal and fetal outcomes (N = 86)

Variables	Proteinuria 1+ (n=19)	Proteinuria 2+ (n=17)	Proteinuria 3+ (n=20)	Proteinuria 4+ (n=30)	p-value
Birth weight (g)	2850 (1800–4100)	2600 (1200–3800)	2350 (900–3600)	2100 (850–3200)	<0.001
Apgar 1 score	8 (6–9)	8 (5–9)	7 (4–9)	7 (4–8)	0.041
Apgar 5 score	9 (7–10)	9 (6–10)	8 (6–9)	8 (5–9)	0.052
Gestational age (weeks)	37 (34–40)	36 (32–39)	35 (30–38)	34 (28–37)	0.003
NICU admission (%)	4 (21.1%)	5 (29.4%)	8 (40.0%)	14 (46.7%)	0.021

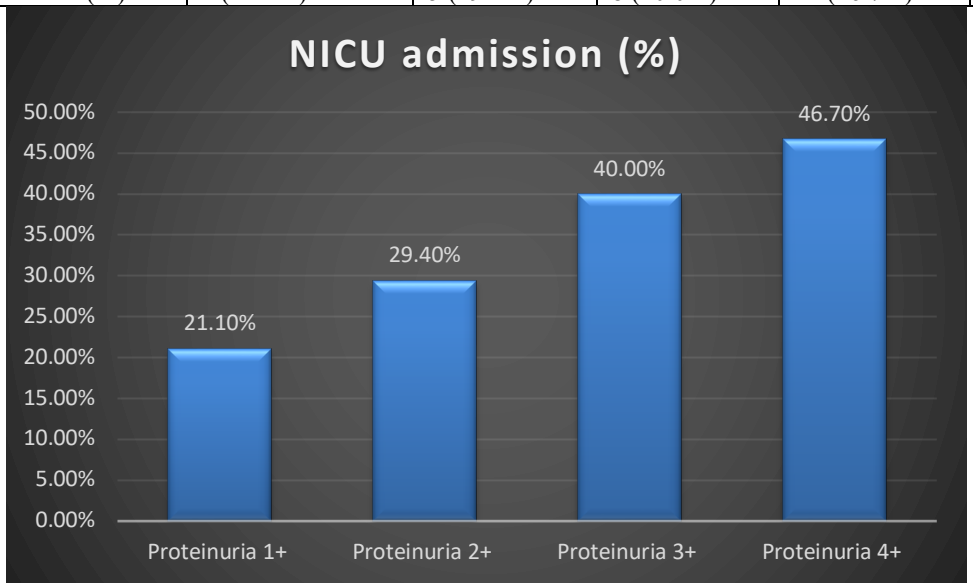

Table 6 demonstrates the association between maternal clinical variables and adverse neonatal outcomes. Systolic blood pressure (SBP) at diagnosis showed a significant negative correlation with

both birth weight (r = −0.28) and gestational age (r = −0.31), and was also significantly associated with NICU admission (p = 0.018). Similarly, diastolic blood pressure (DBP) had a negative correlation with birth weight (r = −0.25) and gestational age (r = −0.29), with a significant association with NICU admission (p = 0.026). Renal function markers showed stronger associations, with serum creatinine negatively correlating with birth weight (r = −0.33) and gestational age (r = −0.27), and significantly associated with NICU admission (p = 0.011). Urea demonstrated the strongest negative correlations with both birth weight (r = −0.36) and gestational age (r = −0.34), along with a significant association with NICU admission (p = 0.009). In contrast, liver enzymes (AST and ALT) showed weak and non-significant correlations with birth weight and gestational age, and no significant association with NICU admission (p > 0.05). Overall, elevated blood pressure and impaired renal function were significantly associated with poorer neonatal outcomes, while liver enzymes were not.

Table 6: Association of maternal clinical variables with adverse outcomes (N = 86)

Variable	Birth Weight (r)	Gestational Age (r)	NICU Admission (p-value)
SBP at diagnosis	-0.28*	-0.31*	0.018
DBP at diagnosis	-0.25*	-0.29*	0.026
Serum creatinine	-0.33**	-0.27*	0.011
Urea	-0.36**	-0.34**	0.009
AST	-0.12	-0.1	0.284
ALT	-0.15	-0.13	0.191

*p < 0.05, **p < 0.01

Discussion

The present study results are consistent with previous literature that preeclampsia (PE) still contributes to significant adverse maternal and neonatal outcomes, occurring in about 2–5% of pregnancies (Lambert et al., 2014) [9]. The mean maternal age of 26.8 years in our cohort is slightly older compared to the report by Khan et al. (2022) [10] in which most PE patients were younger than 24 years. This variation may represent differences in demographics between study regions; however, both analyses substantiate that PE more often occurs in women of early reproductive age groups. Furthermore, the fact that 20.9% of our women had a previous history of preeclampsia is in accordance with previous evidence recognizing prior PE as an important risk factor for recurrence (Brown et al., 2018) [11]. The percentage of patients with non-standard antenatal care (55.8%) in our study is nearly identical to reports from similar populations, which underscore this specific gap in antenatal evaluation and its contribution to more advanced diseases and poorer outcomes."

Clinically, our study showed a significant increase of 52% in systolic and diastolic pressures at diagnosis (median 152/96 mmHg), which significantly correlated with adverse fetal outcomes including lower birth weight and prematurity. This is in line with Brown et al. (2018) [11], who identified hypertension severity as a critical determinant of maternal and perinatal complications. Additionally, our results showed that 59.3% of women required postpartum antihypertensive therapy which supports recommendations by international bodies stating that close postpartum monitoring should be conducted as complications can extend beyond delivery (Tranquilli et al., 2014) [12]. Similar observations were noted in prior studies that found poorly controlled hypertension as the most common cause of maternal morbidity and mortality, with complications such as intracranial hemorrhage (Cantwell et al., 2011) [13].

Table 7: Comparative analysis of postpartum blood pressure control

Study	Spontaneous BP control	Medication required	Key inference
Present study	35 (40.7%)	51 (59.3%)	Majority required antihypertensive therapy
Tranquilli et al., (2014) [12]	Not specifically stated	Required in severe hypertension	BP ≥160/110 mmHg requires urgent antihypertensive therapy
Brown et al., (2018) [11]	Not specifically stated	Continued postpartum	Anti-hypertensive therapy should be maintained and gradually tapered postpartum
Cantwell et al., (2011) [13]	Not reported	Required in significant cases	Poor BP control contributes to maternal morbidity and mortality

In the present study, postpartum blood pressure normalized spontaneously in 40.7% of women, whereas 59.3% required antihypertensive therapy. These findings are consistent with previous studies, which indicate that hypertension often continues into the postpartum period. International guidelines emphasize that severe hypertension requires prompt pharmacological management to prevent complications.

Continued monitoring and gradual tapering of antihypertensive therapy are also recommended, highlighting the need for sustained postpartum care. Inadequate blood pressure control has been identified as a major contributor to maternal morbidity and mortality. Thus, the findings of the present study reinforce the importance of vigilant postpartum monitoring and timely management of hypertension (Table 7).

In our study, renal function markers (serum creatinine and urea) have shown significant negative correlation with gestational age and birth weight. Although mean creatinine levels (0.72 mg/dL) were normal, even mild elevations indicated worse outcomes. This finding is consistent with the physiological understanding that renal impairment in PE arises from endothelial dysfunction and decreased perfusion to the kidney (Cheung & Lafayette, 2013) [14]. The association which we saw was also described in previous studies where deterioration of renal parameters was related to severity of disease and adverse neonatal outcomes. In contrast, we found that in our cohort liver enzymes (AST and ALT) were not significantly associated with neonatal outcomes unlike the findings by Mei-Dan et al. (2013) [15] who reported that the increase in liver enzymes, especially ALT, was predictive for severe PE. These discrepancies may reflect differences in sample size, timing of laboratory evaluation, or population characteristics.

One of the most important conclusions from our study is that there is a strong association between proteinuria severity and poor fetal outcomes. There was a substantial reduction in median birth weight from the 1+ proteinuria group, which weighed 2850 g compared to the 4+, which weighed just 2100 g ($p < .001$), as well as an earlier gestational age at delivery and higher NICU admissions. These results are consistent with studies of Guida et al. by which higher levels of proteinuria were correlated with poor maternal and neonatal outcomes [16,17]. Similarly, Thangaratinam et al. (2009) [18] found that a greater amount of proteinuria is associated with increased risk of complications and further pointing to its prognostic value, while remaining less useful as an aspect of the diagnosis.

However, literature offers contrary evidence. Dong et al. [19] contended that though proteinuria was a marker of disease severity, it may give little information on the risk for adverse outcomes on its own with prematurity being the main driver for neonatal complications. Likewise, Newman et al. In the setting of mild-moderate hypertension, Aliyu et al. (2003) [20] found that massive proteinuria did not directly worsen maternal outcomes but was associated with earlier delivery. In fact, our study showed higher Proteinuria profiles not only to have correlation with adverse neonatal outcomes like increased NICU admission rate (4+ group NICU admissions: 46.7%), but also maternal morbidity (higher need of post-partum antihypertensive therapy.) This aligns with the view that proteinuria, though not considered a diagnostic criterion currently, has very meaningful prognostic information in clinical decision making.

Our results are also consistent with past findings regarding obstetric outcomes. The overall rates of preterm delivery (62.8%) and cesarean section (69.8%) in our study parallels trends noted worldwide following the identification of placental insufficiency as a cause of PE, since it became increasingly possible to prevent maternal or fetal complications through earlier intervention such that early delivery was frequently required for women with PE [9] (Lambert et al., 2014). The high rate of acute fetal distress as an indication for cesarean section in our cohort further showcases the sequelae of placental insufficiency, which is a key feature of PE. Similar investigations have reported elevated rates of operative delivery as a consequence of foetal deterioration.

Among neonatal outcomes in our study, we found the median birth weight to be 2470 g and that 45.3% of neonates were low birth weight while 36% of neonates required NICU admission. These results are in line with preexisting literature indicating that the occurrence of fetal growth restriction and elevated neonatal morbidity is closely linked to PE (Khan et al., 2022) [10]. The gradual drop in Apgar scores and rise in NICU admissions with increasing proteinuria provide additional evidence that disease severity correlates with neonatal compromise.

Overall, the present study both supports and expands upon existing literature by demonstrating that maternal clinical parameters, particularly blood pressure, renal function, and proteinuria, are significant predictors of maternal and fetal outcomes in PE. Specific risk factors, whilst regarded as independent prognostic indicators in some studies, have failed to achieve this status for proteinuria which our data suggests continues to be a useful marker of disease severity and adverse outcome. It highlights the need for early diagnosis, regular antenatal visits and proper maternal monitoring to optimize outcomes in preeclampsia complicated pregnancies.

The findings of this study strongly reinforce the clinical significance of preeclampsia as a major contributor to maternal and perinatal morbidity. The high rates of cesarean delivery, preterm birth, and NICU admissions observed in this study highlight the substantial burden imposed by this condition. Importantly, the clear association between elevated blood pressure, renal dysfunction, and increasing severity of proteinuria with adverse outcomes underscores the need for early risk stratification. From a clinical standpoint, these findings advocate for aggressive monitoring, timely intervention, and

strengthening of antenatal care services. Early identification and appropriate referral to higher centers can significantly alter disease trajectory and improve both maternal and neonatal outcomes. Thus, this study provides valuable evidence to guide policy-making and clinical protocols, especially in resource-limited settings.

Conclusion

This current retrospective study emphasizes the fact that maternal and fetal outcomes in preeclampsia are dependent on the combination of clinical, hematobiochemical indices and factors related to healthcare. Higher blood pressure levels at the time of diagnosis, along with elevated serum creatinine (0.72 ± 0.21 mg/dL) and increased urea levels (median 24 mg/dL), were significantly associated with adverse fetal outcomes including lower birth weight, earlier gestational age at delivery, and increased need for NICU admission. Stratification of proteinuria into increasing severity demonstrated a clear association with poor neonatal outcomes; this further supports the use of proteinuria as a marker of disease severity. Also, poor antenatal follow-up services contribute to delayed diagnosis and treatment which might have worsened the prognosis. Thus, the results highlight the importance of appropriate early diagnosis and systematic antenatal follow-up of clinical and laboratory parameters in enhancing maternal and neonatal outcomes.

References

1. Pridjian G, Puschett JB. Preeclampsia. Part 1: clinical and pathophysiologic considerations. Obstet Gynecol Surv. 2002;57(9):598-618.
2. Nyflot LT, Ellingsen L, Yli BM, Oian P, Vangen S. Maternal deaths from hypertensive disorders: lessons learnt. Acta Obstet Gynecol Scand. 2018;97(8):976-987.
3. Glazer KB, Howell EA. A way forward in the maternal mortality crisis: addressing maternal health disparities and mental health. Arch Womens Ment Health. 2021;24(5):823-830.
4. Khan S, Siddique AB, Jabeen S, Hossain AT, Haider MM, Zohora FT, Rahman MM, El Arifeen S, Rahman AE, Jamil K. Preeclampsia and eclampsia-specific maternal mortality in Bangladesh: levels, trends, timing, and care-seeking practices. J Glob Health. 2023;13:07003.
5. Simpson NB, Shankar-Hari M, Rowan KM, Cecconi M, von Dadelszen P, Huning EY, Magee LA, Payne BA, Quinn AC, Harrison DA. Maternal risk modeling in critical care: development of a multivariable risk prediction model for death and prolonged intensive care. Crit Care Med. 2020;48(5):663-672.
6. Bakrania BA, Spradley FT, Drummond HA, LaMarca B, Ryan MJ, Granger JP. Preeclampsia: linking placental ischemia with maternal endothelial and vascular dysfunction. Compr Physiol. 2021;11(1):1315-1349.
7. Jakhar R, Choudhary A. Study of maternal outcome in referral obstetric cases in a tertiary care centre. J Family Med Prim Care. 2019;8(9):2814-2819.
8. Singh S, Scott W, Yeager C, Rambaran M, Singh NC, Nelin LD. Implementation of a level III neonatal intensive care unit was associated with reduced NICU mortality in a resource-limited public tertiary care hospital in Guyana, South America. PLoS Glob Public Health. 2023;3(2):e0000651.
9. Lambert G, Brichant JF, Hartstein G, Bonhomme V, Dewandre PY. Preeclampsia: an update. Acta Anaesthesiol Belg. 2014;65(4):137-149.
10. Khan B, Yar RA, Khan Khakwani A, Karim S, Ali HA, Khakwani A, Karim S. Preeclampsia incidence and its maternal and neonatal outcomes with associated risk factors. Cureus. 2022;14(11):e31234. (if DOI/article number available, keep as per journal)
11. Brown MA, Magee LA, Kenny LC, Karumanchi SA, McCarthy FP, Saito S, Hall DR, Warren CE, Adoyi G, Ishaku S. Hypertensive disorders of pregnancy: ISSHP classification, diagnosis, and management recommendations for international practice. Hypertension. 2018;72(1):24-43.
12. Tranquilli AL, Dekker G, Magee L, Roberts J, Sibai BM, Steyn W, Zeeman GG, Brown MA. The classification, diagnosis and management of the hypertensive disorders of pregnancy: a revised statement from the ISSHP. Pregnancy Hypertens. 2014;4(2):97-104.
13. Cantwell R, Clutton-Brock T, Cooper G, Dawson A, Drife J, Garrod D, Harper A, Hulbert D, Lucas S, McClure J, Millward-Sadler H. Saving mothers' lives: reviewing maternal deaths to make motherhood safer: 2006–2008. BJOG. 2011;118(Suppl 1):1-203.
14. Cheung KL, Lafayette RA. Renal physiology of pregnancy. Adv Chronic Kidney Dis. 2013;20(3):209-214.
15. Mei-Dan E, Wiznitzer A, Sergienko R, Hallak M, Sheiner E. Prediction of preeclampsia: liver function tests during the first 20 gestational weeks. J Matern Fetal Neonatal Med. 2013;26(3):250-253.
16. Guida JP, Parpinelli MA, Surita FG, Costa ML. The impact of proteinuria on maternal and perinatal outcomes among women with pre-eclampsia. Int J Gynecol Obstet. 2018;143(1):101-107.
17. Yıldız GA, Yılmaz EP. The association between protein levels in 24-hour urine samples and maternal and neonatal outcomes of pregnant women with preeclampsia. J Turk Ger Gynecol Assoc. 2022;23(3):190-195.

18. Thangaratinam S, Coomarasamy A, O'Mahony F, Sharp S, Zamora J, Khan KS, Ismail KM. Estimation of proteinuria as a predictor of complications of pre-eclampsia: a systematic review. BMC Med. 2009;7:10.
19. Dong X, Gou W, Li C, Wu M, Han Z, Li X, Chen Q. Proteinuria in preeclampsia: not essential to diagnosis but related to disease severity and fetal outcomes. Pregnancy Hypertens. 2017;8:60-64.
20. Newman MG, Robichaux AG, Stedman CM, Jaekle RK, Fontenot MT, Dotson T, Lewis DF. Perinatal outcomes in preeclampsia complicated by massive proteinuria. Am J Obstet Gynecol. 2003;188(1):264-268.