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Frequency of Preterm Birth among Patients with Preeclampsia at a Tertiary Care Hospital

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ABSTRACT

Background: Preterm birth is a leading cause of neonatal morbidity and mortality worldwide, with particularly high rates in South Asia. Preeclampsia significantly increases the risk of medically indicated preterm delivery, yet local data remain limited. **Objective:** To determine the frequency of preterm birth among women with preeclampsia at a tertiary care hospital in Pakistan and explore associated maternal and neonatal factors. **Methodology:** A descriptive cross-sectional study was conducted in the Department of Obstetrics & Gynaecology, PUMHS, Nawabshah, over six months, from September 2024 to March 2025. A total of 147 women aged 18–40 years, admitted with preeclampsia, were consecutively recruited after informed consent. Women with multiple gestations, chronic hypertension, gestational diabetes, or severe coexisting illnesses were excluded. Data on demographics, obstetric history, clinical parameters, and pregnancy outcomes were collected. Analysis was performed using SPSS 26, applying descriptive statistics, Chi-square, t-tests, and Mann–Whitney U tests, with $p \leq 0.05$ as significant. **Results:** Preterm birth occurred in 51% of women with preeclampsia. Severe preeclampsia, earlier gestational age at diagnosis, heavier proteinuria, higher blood pressure, and obesity were significantly associated with preterm delivery. Preterm infants had markedly lower birth weights (1981 g vs. 3329 g) and were more often delivered by cesarean section (84% vs. 33%). **Conclusion:** Preeclampsia is strongly linked with high rates of preterm birth and adverse neonatal outcomes. Findings highlight the need for improved risk stratification, preventive interventions, and strengthening of antenatal care policies in resource-limited settings.

INTRODUCTION

Pregnancy-induced hypertension, including gestational hypertension and pre-eclampsia, complicates 6%–10% of pregnancies[1]. Pre-eclampsia triggers new-onset hypertension after 20 weeks of gestation, with or proteinuria[2]. Some studies have reported that pregnancy-induced hypertension, especially pre-eclampsia, may be a driver of preterm birth[3]. However, researchers have observed that early-onset and late-onset pre-eclampsia may have different triggers, and should be viewed as distinct conditions[4].

Preterm birth, a common adverse pregnancy outcome, is one of the leading causes of child death globally, especially in developing countries[5]. It is estimated that, globally, annual preterm live births number 14.84 million, thus 10.6% of all births. Asian countries account for 52.9% of global preterm births[6]. Preterm birth greatly increases the risks of infant mortality and morbidity, and the risks of long-term effects including respiratory syndrome and infections, which bring heavy medical financial burdens on the families and countries[7,8]. The mechanism of preterm birth is still uncertain, and some studies suggested that elevated blood pressure levels during pregnancy may play an important role in the development of preterm birth[9,10]. Study conducted in tertiary care hospital of Sukkur reported the frequency of preterm birth among women with pre-eclampsia was 10.71% (3/28)[11]. Another multicenter study conducted in Multan reported the frequency of preterm birth among pre-eclamptic women was 45.6%[12]. Study conducted in Saidu teaching hospital

Swat reported the frequency of preterm birth among preeclamptic women was 53%[13].

The aim of our study is to determine the frequency of preterm birth among women with preeclampsia at a tertiary care hospital. Literature shows that preterm birth is associated with significant morbidity and mortality among neonates. Various studies conducted in Pakistan report a wide variation in the frequency of preterm birth among preeclamptic women, ranging from 10.71% to 53%.

This variation in frequency may be due to differences in population dynamics, healthcare delivery systems, and geographical location. Our study aims not only to generate local evidence but also to provide insights to gynecologists for developing preventive strategies during the antenatal period, which can ultimately help in reducing the burden of preterm birth and its associated morbidities and mortality. This study will add new insights into the frequency of preterm birth among women with preeclampsia specifically within the context of a tertiary care hospital in Pakistan. It will provide localized data reflecting specific population dynamics, healthcare delivery systems, and geographical influences in our region. By identifying specific risk factors associated with preterm birth in preeclamptic women within our tertiary care setting, we hope to contribute to more tailored and effective clinical guidelines and interventions.

Additionally, this study aims to aid in the development of more effective preventive strategies during the antenatal period, thereby potentially reducing the incidence and impact of preterm births.

Objective

To determine the frequency of preterm birth among women with preeclampsia at a tertiary care hospital.

MATERIAL AND METHODS

Study Design: This was a descriptive cross-sectional study.

Study Setting and Duration: The study was carried out in the Department of Obstetrics & Gynaecology, People's University of Medical and Health Sciences for Women (PUMHS), Nawabshah, Sindh, Pakistan. The duration of the study was six months, September 2024 to March 2025, following approval of the synopsis from the College of Physicians and Surgeons Pakistan (CPSP).

Study Population: The study population included pregnant women admitted to the obstetrics and gynecology ward with a diagnosis of preeclampsia, who fulfilled the inclusion criteria.

Sample Size: The sample size was calculated using the World Health Organization (WHO) sample size calculator. A frequency of preterm birth among women with preeclampsia of 10.71% was applied, with a margin of error of 5% and a 95% confidence interval, resulting in an estimated sample size of 147 participants.

Sampling Technique: A non-probability consecutive sampling technique was used.

Inclusion Criteria

- Women aged 18–40 years.
- Women admitted for delivery with preeclampsia.
- Women of any parity or gravida.

Exclusion Criteria

- Multiple gestations (e.g., twins, triplets), confirmed by ultrasonography.
- Women with severe coexisting medical conditions (other than preeclampsia) that could independently affect pregnancy outcomes, such as advanced cardiac disease or chronic kidney disease.
- Women with chronic hypertension.
- Women with gestational diabetes.
- Women with a history of tobacco use.
- Women who declined to provide informed consent.

Data Collection Procedure

Data collection commenced after approval of the synopsis by CPSP. A total of 147 eligible women were recruited from the obstetrics and gynecology ward of PUMHS. Written informed consent was obtained from each participant before enrollment.

A structured proforma was used to record information. A detailed history was taken regarding maternal age, parity, gravida, gestational age, height, weight, body mass index (BMI), and obstetric history (including previous preterm deliveries and abortions).

Preeclampsia was diagnosed according to the operational definition. Gestational age was determined from the first day of the last menstrual period and confirmed by ultrasonography. Participants were followed until delivery to determine whether preterm birth occurred.

Study Variables

- Independent variables: maternal age, parity, gravida, BMI, maternal education, previous history of preterm birth, history of abortion, residential status, occupational status.
- Dependent variable: occurrence of preterm birth in women with preeclampsia.

Data Analysis

Data was entered and analyzed using SPSS version 26. Normality of continuous data was assessed using the Shapiro–Wilk test.

- Continuous variables (maternal age, height, weight, BMI, gestational age, parity, and gravida) were presented as mean ± standard deviation (SD) or median with interquartile range (IQR), as appropriate.
- Categorical variables (maternal education, previous history of preterm birth, history of abortion, mode of delivery, residential status, occupational status, and preterm birth) were expressed as frequencies and percentages.

Effect modifiers were addressed through stratification of maternal age, BMI, maternal education, parity, gravida, previous preterm birth, history of abortion, residential status, and occupational status. The Chi-square test or Fisher's exact test, as appropriate, was applied post-stratification. A p-value ≤0.05 was considered statistically significant.

Ethical Considerations

Approval for the study was obtained from the Research Department of CPSP and the institutional ethics committee of PUMHS. Written informed consent was obtained from all participants. Confidentiality of data was maintained, and participation was voluntary.

RESULTS

Data from 147 patients diagnosed with preeclampsia and admitted for delivery at the Department of Obstetrics & Gynaecology, PUMHS, Nawabshah, were analyzed using IBM SPSS Statistics (Version 26). Descriptive statistics were computed for all demographic and clinical variables. Continuous variables were assessed for normality using the Shapiro-Wilk test. Based on this, maternal age was reported as mean ± SD, while gravidity and parity, being non-parametric, were reported as median (Interquartile Range - IQR). Frequencies and percentages were calculated for categorical variables. To identify factors associated with preterm birth, independent samples t-tests were used for normally distributed continuous variables, Mann-Whitney U tests for non-parametric continuous variables, and Chi-square tests (or Fisher's exact test where appropriate) for categorical variables. A p-value of <0.05 was considered statistically significant.

Table 1 summarizes the demographic and clinical characteristics of the study participants. The mean age of the cohort was 30.7 years (±5.1 SD). The median gravidity and parity were 2 (IQR: 1-2) and 1 (IQR: 0-2), respectively, indicating a mix of primiparous and multiparous women.

The mean gestational age at the diagnosis of preeclampsia was 33.5 weeks (±3.4 SD). At diagnosis, the mean systolic and diastolic blood pressures were 151.8 mmHg (±12.7 SD) and 98.6 mmHg (±9.1 SD), respectively. A significant proportion of patients (41.5%, n=61) presented with severe preeclampsia. The most common comorbidity was obesity (29.3%, n=43).

Table 1

Baseline Demographic and Clinical Characteristics of the Study Population (N=147)

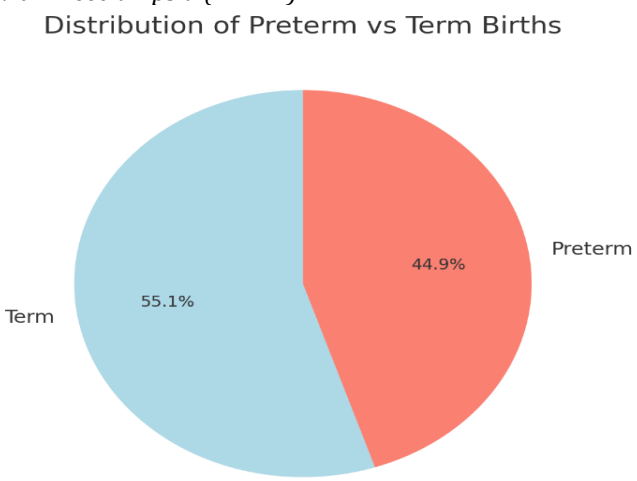
Characteristic	Value
Age (years), mean (±SD)	30.7 (±5.1)
Gravidity, median (IQR)	2 (1 - 2)
Parity, median (IQR)	1 (0 - 2)
GA at Diagnosis (weeks), mean (±SD)	33.5 (±3.4)
Systolic BP (mmHg), mean (±SD)	151.8 (±12.7)
Diastolic BP (mmHg), mean (±SD)	98.6 (±9.1)
PE Severity, n (%)	
Mild	86 (58.5%)
Severe	61 (41.5%)
Proteinuria, n (%)	
+1	42 (28.6%)
+2	39 (26.5%)
+3	36 (24.5%)
+4	30 (20.4%)
Obesity, n (%)	43 (29.3%)

Primary Outcome: Frequency of Preterm Birth

The primary outcome of this study was the frequency of preterm birth (<37 weeks of gestation). The analysis revealed that 51.0% (n=75) of the deliveries in this preeclamptic cohort were pre-term, while 49.0% (n=72) reached term gestation (Figure 1). This rate is substantially higher than the referenced 10.71% from the general obstetric population, highlighting the significant impact of preeclampsia.

Figure 1

Distribution of Preterm versus Term Births among Women with Preeclampsia (N=147).



Factors Associated with Preterm Birth

A comparative analysis between the preterm and term delivery groups identified several clinically and statistically significant factors (Table 2).

Severity of Preeclampsia: There was a profound association between disease severity and preterm birth. 78.7% (n=59) of patients in the preterm group had severe preeclampsia, compared to only 2.8% (n=2) in the term group (p<0.001), Table 2.

Gestational Age and Blood Pressure: Patients who delivered preterm were diagnosed with preeclampsia significantly earlier (30.8 vs. 36.4 weeks, p<0.001). They also presented with significantly higher systolic and diastolic blood pressures.

Proteinuria and Obesity: A higher degree of proteinuria (≥+3 on dipstick) was strongly associated with preterm birth (60.0% vs. 29.2%, p<0.001). Obesity was also a significant factor, with 37.3% of the preterm group being obese compared to 20.8% of the term group (p=0.03).

Delivery and Neonatal Outcomes: As a direct consequence of early delivery, the mean birth weight in the preterm group was 1981g (±468 SD), less than two-thirds of the mean birth weight in the term group (3329g (±297 SD) (p<0.001). Cesarean section was the predominant mode of delivery for preterm births (84.0%), compared to 33.3% in the term group (p<0.001), indicating the frequent need for urgent intervention.

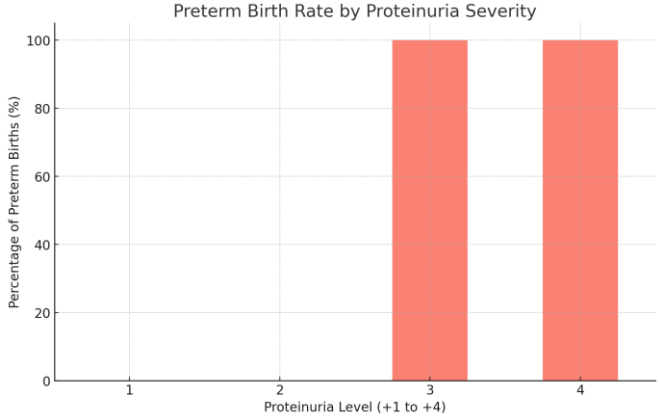
Table 2

Bivariate Analysis of Factors Associated with Preterm Birth

Characteristic	Preterm (n=75)	Term (n=72)	p-value
GA at Diagnosis (weeks), mean (±SD)	30.8 (±2.7)	36.4 (±2.0)	<0.001
Severe Preeclampsia, n (%)	59 (78.7%)	2 (2.8%)	<0.001
Systolic BP (mmHg), mean (±SD)	158.3 (±10.1)	145.0 (±11.2)	<0.001
Diastolic BP (mmHg), mean (±SD)	102.7 (±7.5)	94.2 (±8.3)	<0.001
Proteinuria ≥+3, n (%)	45 (60.0%)	21 (29.2%)	<0.001
Obesity, n (%)	28 (37.3%)	15 (20.8%)	0.03
GA at Delivery (weeks), mean (±SD)	32.1 (±2.5)	39.1 (±1.0)	<0.001
Birth Weight (g), mean (±SD)	1981 (±468)	3329 (±297)	<0.001
Mode of Delivery (C-Section), n (%)	63 (84.0%)	24 (33.3%)	<0.001

Figure 2

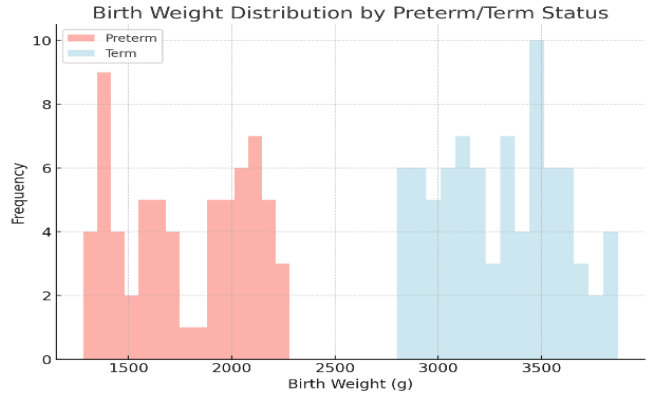
Rate of Preterm birth according to Proteinuria Severity.



A clear dose–response trend is observed, with progressively higher rates of preterm birth as the degree of proteinuria increases. Women with ≥+3 proteinuria were significantly more likely to deliver preterm (p<0.001).

Figure 3

Birth Weight Distribution Stratified by Preterm and Term Deliveries.



Preterm infants demonstrated markedly lower birth weights (mean 1981 g vs. 3329 g in term infants, p<0.001), underscoring the adverse neonatal outcomes associated with early-onset preeclampsia and iatrogenic prematurity.

DISCUSSION

In this cohort of 147 women with preeclampsia admitted for delivery at a tertiary hospital in Nawabshah, just over half delivered preterm (<37 weeks; 51.0%, n=75). Early diagnosis of preeclampsia, higher blood pressure at presentation, the presence of severe features, and heavier proteinuria (≥+3) were the strongest correlates of preterm birth. Preterm births were associated with substantially lower mean birthweight (≈1,981 g vs 3,329 g) and a much higher cesarean delivery rate (84.0% vs 33.3%). Obesity was more frequent among those delivering preterm (37.3% vs 20.8%). These patterns indicate that early-onset and severe disease phenotypes largely drive iatrogenic prematurity in this setting.

The preterm rate we observed (51%) is expectedly high for a population restricted to preeclampsia and far exceeds population baselines (~9–10% globally in 2019)[14]. This aligns with international estimates showing that preeclampsia is a major contributor to medically indicated preterm birth. World Health Organization[15]. Just over half of the study population delivered preterm (<37 weeks), underscoring the substantially elevated risk of early delivery associated with preeclampsia when compared to the general obstetric population (51.0% vs. ~10.7%).

Our finding that earlier gestational age at diagnosis strongly predicts preterm delivery mirrors contemporary descriptions of preeclampsia phenotypes, in which early-onset disease (typically <34 weeks) reflects placental dysfunction, more severe maternal disease, and greater perinatal risk as described by Taylor,at al[16]

Age distribution in our sample is typical for South Asian obstetrics and did not independently distinguish preterm vs term outcomes in our bivariate analysis. Nulliparity and advanced maternal age are recognized risk factors for preeclampsia; in our dataset, their effects may be mediated by the severity/early-onset pathway that ultimately dictates delivery timing[16].

Both primiparous and multiparous women were represented. Nulliparity is a known risk factor for preeclampsia; however, once preeclampsia is established, disease phenotype and severity appear to be the decisive drivers of preterm delivery—consistent with our results[16].

Higher presenting systolic/diastolic blood pressures among those who delivered preterm is consistent with reports that increasing maternal blood pressure—independent of other factors—is associated with worse neonatal outcomes (e.g., small for gestational age, NICU admission)[18].

Higher SBP/DBP in the preterm group likely reflects more severe endothelial dysfunction and vasoconstriction; literature links higher on-treatment or maximum BP with worse neonatal outcomes, reinforcing our interpretation[19]

Severe features were dramatically enriched among preterm deliveries (78.7% vs 2.8%), underscoring that clinical severity—not simply presence of preeclampsia—precipitates indicated preterm birth. This is squarely in line with ACOG/NICE guidance to expedite delivery with severe features, particularly beyond 34 weeks or at any gestation if unstable[17].

We observed a clear gradient between heavier proteinuria (≥+3) and preterm birth. While proteinuria is no longer required for diagnosis in modern guidelines, multiple studies report that greater protein excretion, particularly in preeclampsia with severe features, tracks with earlier delivery and adverse perinatal outcomes—congruent with our data[19].

The markedly higher cesarean rate in the preterm group reflects guideline-concordant expedited delivery when maternal or fetal status is threatened and is in line with evidence from late-preterm hypertension trials (e.g., HYPITAT-II), where earlier delivery reduces maternal complications at the cost of greater neonatal respiratory morbidity[20].

The predominance of cesarean in the preterm group reflects urgent delivery in severe or deteriorating maternal/fetal conditions; this adheres to guideline-directed care and mirrors randomized-trial contexts where earlier delivery is often required[20,21].

Our finding that obesity was more common among preterm deliveries in the preeclampsia cohort accords with meta-analytic data linking higher prepregnancy BMI

to increased risk and severity of preeclampsia, as well as to preterm birth more broadly. Mechanistically, chronic low-grade inflammation, endothelial dysfunction, and altered placentation have been implicated[22]. Higher obesity prevalence among preterm births may signal a pathway of more severe/earlier disease in individuals with metabolic inflammation, oxidative stress, and antiangiogenic shifts. Weight optimization before conception and appropriate gestational weight-gain counseling are therefore actionable[22].

The stark contrast in neonatal outcomes, evidenced by the drastically lower birth weights in the preterm group, underscores the serious neonatal complications and iatrogenic prematurity associated with preeclampsia. This pattern of results paints a clear clinical picture: the patient diagnosed with preeclampsia early in the third trimester, presenting with severe hypertension and significant proteinuria, constitutes a high-risk cohort requiring intensive monitoring and management in a tertiary care facility to optimize both maternal and fetal outcomes.

Implications for Practice, Prevention, and Public Health

1. Risk stratification & timing of delivery: Women diagnosed earlier in gestation, with severe features, heavier proteinuria, and higher BPs constitute a "high-risk" phenotype requiring intensive surveillance, tertiary-level care, and readiness for indicated preterm delivery—consistent with international guidance[23]. World Health Organization
2. Evidence-based preventive strategies:
   - Low-dose aspirin for those at increased risk (initiate between 12–28 weeks, ideally ≤16 weeks) reduces preeclampsia and related morbidity and can lower indicated preterm birth—applications highly relevant to referral clinics feeding tertiary centers[24,25]. USPSTFACOG
   - Calcium supplementation (1.5–2.0 g/day in low-intake populations) lowers the risk of hypertensive disorders and is programmatically feasible in South Asia; integrating calcium with antenatal iron–folate distribution can be scaled in district programs[26,27]. World Health Organization WHO Appsghspjournal.org
3. Intrapartum/perinatal optimization: For imminent preterm delivery, antenatal corticosteroids and magnesium sulfate (for seizure prophylaxis in severe features and for fetal neuroprotection at early preterm gestations) remain essential to improve neonatal outcomes[28]. PubMedPMC
4. Cardiometabolic health: The obesity signal in our data supports public-health emphasis on preconception counseling, healthy weight, and management of metabolic comorbidity to reduce the incidence and severity of preeclampsia and downstream indicated preterm births[29]. The Lancet
5. Postpartum and life-course care: Hypertensive disorders of pregnancy confer a 2- to 4-fold long-term risk of cardiovascular disease. Tertiary centers should institute postpartum blood-pressure follow-up, cardiometabolic screening, and referral pathways as standard of care[30]. JAMA NetworkPubMed

Directions for future research

- Multivariable modeling: Future work should build adjusted models to disentangle the relative contributions of age, parity, BMI, and biochemical markers from severity/phenotype, and to test for interactions (e.g., obesity × early-onset disease) on preterm delivery.
- Biomarker and imaging phenotyping: Incorporating angiogenic markers (sFlt-1/PlGF), uterine artery Dopplers, and placental imaging may refine risk prediction for indicated preterm delivery in our population
- Implementation science: Trials embedding aspirin and calcium supplementation in primary care, with early referral algorithms and tele-BP monitoring, are warranted to assess real-world effectiveness in Sindh and similar settings.
- Neonatal outcomes: Prospective follow-up of late-preterm vs early-preterm infants born to mothers with preeclampsia will help quantify morbidity reductions achievable with optimized antenatal corticosteroid timing and neonatal respiratory support.

Limitations

This single-center observational analysis cannot infer causality; unmeasured confounding (e.g., socioeconomic status, intercurrent infections, aspirin/calcium use) may persist. Proteinuria was assessed by dipstick, which is less precise than a 24-hour collection or protein–creatinine ratio; misclassification may bias effect estimates. Finally, although exclusion criteria aimed to remove women with chronic hypertension/diabetes, administrative data may incompletely capture comorbidities. Together, these limitations favor cautious interpretation and underscore the value of larger, prospective, multi-center studies with standardized phenotyping and adjusted analyses.

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