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ASSESSMENT OF RISK OF COMPLICATIONS IN WOMEN WITH PREECLAMPSIA

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Abstract

Background: *Preeclampsia, particularly early-onset, remains a leading cause of maternal and perinatal morbidity. Accurate prediction models like PREP-S are essential for early identification, timely intervention, and improved outcomes, yet their short-term predictive utility remains underexplored.*

Objectives: *To determine the positive predictive value of PREP-S model in women with early onset pre- eclampsia taking outcome at 48 hours as gold standard.*

Duration: *Three months for data collection w.e.f 26-02-2025 to 26-05-2025*

Methodology: *Research was conducted on 120 patients following approval from the hospital's ethical review committee. Informed consent was obtained from each participant. Demographic details, including name, age, gestational age, parity, BMI, education level, residence, and socioeconomic status, were recorded. The PREP-S model was then applied to assess the risk of complications. Patients were monitored for 48 hours, after which they were evaluated for any complications. All data were collected using a standardized proforma.*

Results: *This study assessed 120 women with early-onset preeclampsia using the PREP-S model. Demographic and clinical variables were diverse, yet the model showed high predictive accuracy, with a PPV of 81.7%. No significant associations were found across subgroups or clinical characteristics.*

Conclusion: *The PREP-S model showed high predictive accuracy, confirming early-onset preeclampsia in 81.7% of cases within 48 hours. Positive predictive values ranged from 72.0% to 88.2% across all subgroups, with no significant variation by demographic or clinical factors. These findings support the PREP-S model as a reliable tool for early risk assessment, aiding timely clinical decision-making in women with suspected early-onset preeclampsia.*

INTRODUCTION

Hypertensive disorders during pregnancy, such as preeclampsia, complicate about 10% of pregnancies globally, significantly contributing to both maternal and fetal morbidity and mortality.[1] Preeclampsia is a pregnancy-specific, multisystem condition that manifests variably.[2] It is classified into early-onset preeclampsia, occurring before 34 weeks gestation, and late-onset, after 34 weeks. Early-onset preeclampsia, though less frequent, accounts for a disproportionate share of pregnancy complications.[3,4]

The only definitive treatment is delivery, which often results in preterm birth and associated neonatal risks, complicating management. Timely identification of women at risk for adverse outcomes is essential to provide appropriate care.[5]

The PREP-S model was developed to predict the risk of complications within 48 hours in women with early-onset preeclampsia, helping clinicians to identify those needing urgent maternal and neonatal intensive care.[6-9] Research by Thangaratinam et al. found that 18% of mothers developed complications within 48 hours, with the PREP-S model demonstrating strong predictive accuracy (AUC 0.87).[8] Given the scarcity of validation studies in local populations, this study aims to assess the utility of the PREP-S model in predicting short-term complications among women with early-onset preeclampsia in our setting, to guide treatment decisions and improve maternal and fetal outcomes.

METHODOLOGY

The study was a descriptive cross-sectional design conducted at the Department of Obstetrics and Gynecology, Ghurki Trust Teaching Hospital. Data collection was completed in three months after approval of synopsis. A sample size of 120 cases was calculated using a 95% confidence level, 7% margin of error, and an 18% complication rate within 48 hours after early-onset preeclampsia diagnosis using the PREP-S model.[8] Early-onset preeclampsia was defined as new hypertension (>140/90 mmHg on two occasions 4 hours apart) occurring between 22 and 34 weeks of gestation, along with one or more additional criteria such as proteinuria, low platelets, elevated creatinine, liver enzyme abnormalities, pulmonary edema, neurological symptoms, or severe hypertension confirmed promptly. Women with a PREP-S predicted complication risk above 50% were classified as high risk, requiring closer care or transfer, while those below 50% could avoid unnecessary referral. Clinical outcomes were assessed at 48 hours and included hepatic dysfunction, renal impairment, need for blood transfusion or oxygen, pulmonary edema, abnormal uterine artery Doppler findings, and fetal growth restriction. Positive predictive value was calculated by the proportion of true positives among all predicted high-risk cases. Non-probability consecutive sampling was used, including women aged 18-40 years with parity under 5, diagnosed according to the criteria. Women were excluded if they had adverse events before completing PREP-S assessment, did not consent, or were admitted in spontaneous labor. Data from 120 patients was collected after ethical approval and informed consent. Demographic and clinical details were recorded. PREP-S scoring was applied, and complications were monitored for 48 hours using a standardized proforma. Data analysis was done with SPSS v26. Normality was tested using Shapiro-Wilk. Means and standard deviations were computed for continuous variables, and frequencies and percentages for categorical variables. Stratification by age, gestational age, BMI, parity, education, residence, and socioeconomic status was performed to identify effect modifiers. Chi-square tests were applied post-stratification with p-values <0.05 considered significant.

RESULTS

The study included a total of 120 women who were diagnosed with early-onset preeclampsia using the PREP-S model. The mean age of the participants was 28.73 ± 4.94 years, with 47.5% aged between 18–30 years and 52.5% between 31–40 years. The mean gestational age at diagnosis was 28.16 ± 3.17 weeks, with 53.3% diagnosed between 22–28 weeks and 46.7% between 29–33 weeks of gestation. The mean body mass index (BMI) was 25.37 ± 3.42 kg/m², with 40.0% of the women classified as having normal weight and 60.0% as overweight or obese. The mean parity was 2.06 ± 1.17, with 55.0% of women having a parity of 2 or less, and 45.0% having a parity between 2 and 4. Regarding educational status, 30.0% had education up to 5th grade, 20.8% had completed grades 6 to 12, and 49.2% had received college or university-level education. In terms of occupation, 49.2% were housewives and 50.8% were employed. With respect to place of residence, 32.5% lived in rural areas, 29.2% in semi-urban areas, and 38.3% in urban settings. Socioeconomic status was categorized as low in 28.3%, middle in 39.2%, and high in 32.5% of the participants. Data is given in Table 1.0. The diagnosis of preeclampsia was confirmed in 81.7% of cases at 48 hours, giving a positive predictive value (PPV) of 81.7%, which indicates high predictive

accuracy of the PREP-S model for early-onset preeclampsia as shown in Table 2.0. Positive predictive values (PPVs) for preeclampsia confirmation at 48 hours were consistently high across all subgroups, ranging from 72.0% to 88.2%. The highest PPVs were seen in women with normal BMI (87.5%) and low socioeconomic status (88.2%). No variable, including age, gestational age, parity, education, occupation, residence, or SES, showed a statistically significant association with diagnostic confirmation (all p-values > 0.05). Data is given table 8.3.

Table 1.0: Demographic Characteristics of Patients Included in the Study

Characteristics	Total (120)
Age (years)	28.73±4.94
• 18-30 years	57 (47.5%)
• 31-40 years	63 (52.5%)
Gestational Age (weeks)	28.16±3.17
• 22-28 weeks	64 (53.3%)
• 29-33 weeks	56 (46.7%)
BMI (kg/m^2)	25.37±3.42
• Normal Weight	48 (40.0%)
• Overweight/Obese	72 (60.0%)
Parity	2.06±1.17
• ≤2	66 (55.0%)
• 2-4	54 (45.0%)
Education	
• Upto 5th Grade	36 (30.0%)
• 6-12 Grade	25 (20.8%)
• College/University	59 (49.2%)
Occupation	
• House Wife	59 (49.2%)
• Employed	61 (50.8%)
Residence	
• Rural	39 (32.5%)
• Semi-Urban	35 (29.2%)
• Urban	46 (38.3%)
Socioeconomic Status (SES)	
• Low	34 (28.3%)
• Middle	47 (39.2%)
• High	39 (32.5%)

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Table 2.0: Confirmation of Diagnosis of PE at 48 hrs and its PPV

Diagnosis at 48 hrs	Frequency (n)	Percentage (%)

***PE** (True Positive)*	98	81.7 %
No (False Positive)	22	18.3 %
Total	120	100.0 %

PPV= True Positive/True Positive + False Positive)x100=81.7%

Table 3.0: Stratification of Positive Predictive Value of PREP-S Model Stratified for Subgroups

Variable	Sub Groups	48 hrs Analysis		PPV	p-value
		True Positive (n=98)	False Positive (n=22)		
Age	18-30 years	44 (72.2%)	13 (22.8%)	72.2%	0.228
	31-40 years	54 (85.7%)	9 (14.3%)	85.7%	
Gestational Age	22-28 weeks	53 (82.8%)	11 (17.2%)	82.8%	0.729
	29-33 weeks	45 (80.4%)	11 (19.6%)	80.4%	
BMI	Normal Weight	42 (87.5%)	6 (12.5%)	87.5%	0.178
	Overweight/Obese	56 (77.8%)	16 (22.2%)	77.8%	
Parity	≤2	54 (81.8%)	12 (18.2%)	81.8%	0.962
	2-4	44 (81.5%)	10 (18.5%)	81.5%	
Education	Upto 5th Grade	29 (80.6%)	7 (19.4%)	80.6%	0.288
	6-12 Grade	18 (72.0%)	7 (28.0%)	72.0%	
	College/University	51 (86.4%)	8 (13.6%)	86.4%	
Occupation	House Wife	48 (81.4%)	11 (18.6%)	81.4%	0.931
	Employed	50 (82.0%)	11 (18.0%)	82.0%	
Residence	Rural	32 (82.1%)	7 (17.9%)	82.1%	0.953
	Semi-Urban	28 (80.0%)	7 (20.0%)	80.0%	
	Urban	38 (82.6%)	8 (17.4%)	82.6%	
SES	Low	30 (88.2%)	4 (11.8%)	88.2%	0.408
	Middle	36 (76.6%)	11 (23.4%)	76.6%	
	High	32 (82.1%)	7 (17.9%)	82.1%	

Chi-square test, observed difference was statistically insignificant, PPV: Positive Predictive Value

DISCUSSION

Preeclampsia remains a major cause of maternal and fetal morbidity and mortality worldwide, particularly in cases of early-onset disease.[9] Accurately predicting which women will develop severe complications is critical for timely intervention and improved outcomes. Despite advances in clinical risk models like PREP-S, there is limited evidence on their predictive performance, especially in diverse populations.[10-12] The scarcity of validation studies evaluating short-term outcomes, such as confirmation at 48 hours, limits the clinical utility of these tools. This study addresses this gap by assessing the positive predictive value of the PREP-S model in women with early-onset preeclampsia.

This study involved 120 women diagnosed with early-onset preeclampsia using the PREP-S model. Participants had a mean age of 28.73 ± 4.94 years and a mean gestational age of 28.16 ± 3.17 weeks. The mean BMI was 25.37 ± 3.42 kg/m², with 60% overweight or obese. Parity averaged 2.06 ± 1.17. Educational levels varied, with nearly half completing college or university. Residence and socioeconomic status were diverse. Preeclampsia diagnosis was confirmed within 48 hours in 81.7% of cases, yielding a high positive predictive value (PPV). PPVs ranged from 72.0% to 88.2% across subgroups, with no significant association to demographic factors.

Despite the limited literature specifically addressing the PREP-S model for early-onset preeclampsia, the present study underscores its clinical relevance by placing it in context with other predictive tools. Thangaratinam et al. analyzed a cohort in which 169 women (18 %) experienced adverse outcomes within 48 hours, rising to 633 (67 %) by discharge. The PREP-S model achieved a C-statistic of 0.84 (95 % CI 0.81–0.87) for 48-hour prediction and 0.82 (0.80–0.84) when extended to discharge using the PREP-L version. PREP-S incorporates maternal age, gestational age, medical history, systolic blood pressure, deep tendon reflexes, urine protein-creatinine ratio, platelets, ALT, urea, creatinine, oxygen saturation, and treatment with antihypertensives or magnesium sulfate. PREP-L omits reflexes, ALT, and creatinine. External validation in the PIERS dataset showed the reduced PREP-S model had reasonable calibration (slope 0.80) and discrimination (C-statistic 0.75) for 48-hour outcomes. The reduced PREP-L model performed excellently in two external cohorts (PIERS and PETRA), with calibration slopes of 0.93 and 0.90 and C-statistics of 0.81 and 0.75 for prediction by discharge. These findings suggest that PREP models can reliably forecast adverse maternal outcomes including early preterm delivery by 48 hours (PREP-S) or by discharge (PREP-L). Consequently, they hold clinical utility in triaging women who may require tertiary care for intensive maternal or neonatal management.[8]

Another important investigation by Duhig et al. evaluated the predictive performance of PREP-S and placental growth factor (PlGF) in late-preterm preeclampsia. PREP-S's estimated probability of early delivery was compared with observed event rates using calibration and logistic regression methods. Although PlGF testing showed high sensitivity (97.9 %) for delivery within seven days, specificity was very low (8.4 %) and negative predictive value only 71.4 %. The areas under the curve were moderate: PREP-S at 0.64 (SE 0.03), PlGF at 0.60 (SE 0.03), and their combination at 0.65 (SE 0.03). The authors concluded that in women with late-preterm preeclampsia, PlGF does not enhance clinical risk assessment for timing of delivery, and that models like PREP-S developed for early-onset disease should not be applied to late-preterm presentations.[13]

Singh et al. assessed the full-PIERS model in a cohort of hypertensive pregnancies, where approximately one-third (33.3 %) experienced adverse maternal outcomes. All patients requiring preterm delivery were managed with antihypertensives and corticosteroids to promote fetal lung maturity. The PIERS model demonstrated strong predictive validity: AUC was 0.903 (95 % CI 0.855–0.951; SE 0.024), with optimal cutoffs providing maximum sensitivity and specificity. These results underscore PIERS's high reliability for predicting adverse maternal and fetal outcomes in a clinical setting.[14]

Yang et al. emphasized the importance of adapting predictive models for serial clinical use, noting that future models should maintain accuracy over repeated assessments. They suggested that performance

comparisons with existing models will help quantify the added value of novel tools.[15]

CONCLUSION

The study concludes that the PREP-S model demonstrates high predictive accuracy for early-onset preeclampsia, with a confirmed diagnosis in 81.7% of cases at 48 hours. Positive predictive values remained consistently high across all subgroups, irrespective of demographic or clinical variables. These findings support the utility of the PREP-S model as a reliable tool for early identification and risk stratification in women with suspected early-onset preeclampsia, enabling timely interventions and improved maternal outcomes.

LIMITATIONS & RECOMMENDATIONS

This study's strengths include its focus on short-term predictive validation of the PREP-S model and its application in a clinically relevant population with diverse sociodemographic backgrounds. Limitations include its single-center design, limited sample size, and absence of external validation or biochemical marker integration. Future research should aim at larger, multicenter studies with diverse populations, incorporating serial assessments and biomarkers to improve model accuracy, enhance clinical utility, and support wider adoption of risk-based triage in early-onset preeclampsia.

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