Section: Obstetrics and Gynecology

Original Research Article

EVALUATION OF THE PIERS CALCULATOR FOR PREDICTING ADVERSE FETO-MATERNAL OUTCOMES IN HYPERTENSIVE DISORDERS OF PREGNANCY AT A TERTIARY CARE CENTRE IN SOUTH GUJARAT

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ABSTRACT

Background: Hypertensive disorders of pregnancy (HDP), including preeclampsia, are leading causes of maternal and perinatal morbidity and mortality. Early identification of women at risk for adverse outcomes is crucial. The PIERS (Pre-eclampsia Integrated Estimate of Risk) calculator is a validated tool for predicting severe maternal complications in preeclampsia. **Materials and Methods:** This prospective observational study was conducted at a tertiary care centre in South Gujarat. Pregnant women with hypertensive disorders were enrolled. The PIERS calculator was applied at admission, and maternal and foetal outcomes were tracked. Demographic, clinical, and laboratory data were analysed to assess the predictive accuracy of the PIERS tool. **Result:** The PIERS calculator demonstrated high predictive accuracy for adverse outcomes. Most women identified as high-risk by the PIERS model experienced severe complications. Demographic and clinical profiles were consistent with known risk factors for HDP. **Conclusion:** The PIERS calculator is an effective tool for risk stratification in HDP, supporting timely intervention and resource allocation.

INTRODUCTION

Hypertension is one of the most common medical complications during pregnancy. Hypertensive disorders of pregnancy complicate 5-10% of pregnancies worldwide and increasing incidence due to, women are postponing their first pregnancy to later age and increased pre pregnancy weight.[1-3] Hypertensive disorders remain one of the leading causes of maternal and perinatal morbidity and mortality. Early recognition of women at risk of pre-eclampsia will help to identify the high-risk women and the timely diagnosis and intervention may prevent complications and improve the pregnancy outcome.[4-6] The PIERS (Pre-eclampsia Integrated Estimate of Risk) calculator represents a significant advancement in obstetric care, particularly in managing hypertensive disorders during pregnancy. Introduced in 2011 by the PIERS Study Group, the original model—known as fullPIERS—was developed to predict severe maternal complications in women admitted with preeclampsia.[7] This model allowed for the estimation of adverse maternal outcomes within 48 hours of admission, and its predictive capacity was confirmed through initial studies, which showed a high degree of accuracy with an area under the ROC curve (AUC) of 0.88. Over the years, the PIERS calculator has been validated across different populations, including in low and middle-income countries, where maternal morbidity and mortality from hypertensive disorders remain a significant public health concern.[8-10] Its ability to guide clinical decision-making and allocate resources appropriately in overburdened healthcare settings adds to its relevance and importance.[11,12]

Being a tertiary care centre of South Gujarat, with approximately 700-800 vaginal and operative deliveries in a month and a significant prevalence of preeclampsia, we intend to evaluate how accurately full PIERS model performs in our settings to predict adverse feto-maternal outcome.

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MATERIALS AND METHODS

This prospective observational study was done in obstetrics and Gynaecology department of New civil hospital Surat for 1 year period after getting official approval from ethical committee. Consecutive consenting women fulfilling inclusion criteria admitted in labour room and antenatal ward having Gestational hypertension with BP >= 140/90 in antenatal/intranatal period admitted in labour room of New civil hospital Surat will be enrolled in study. Full PIERS score was calculated within 24 hrs of admission. All data related to clinical profile, socioeconomic profile, investigations, any intranatal, postnatal complication, mode of delivery, need for OBICU admission, and fetal outcome of enrolled subject was collected from the case record in a structured proforma. Maternal parameters: Type of admission (emergency, registered, or referred), blood pressure on admission, proteinuria, age, parity, gestational age at the time of delivery, mode of delivery, incidence of operative interventions, complications, and causes of maternal mortality and morbidity. Foetal parameters: Viability (stillbirth or live birth), maturity (term or preterm), birth weight, APGAR score, need for NICU admission, duration of NICU stay, and causes of neonatal mortality and morbidity were recorded. Mode of delivery: Normal delivery, assisted vaginal delivery, Caesarean section Initiation of labour: Spontaneous, Induced. All women were followed till discharge from hospital. The management of all patients was done according to the standard departmental protocol of management. Efficacy of Full PIERS score was calculated as per observed adverse feto maternal outcome of subjects included in study using statistical tests. Adverse Maternal outcomes: Obstetric ICU (OBICU) admission, eclampsia, postpartum haemorrhage (PPH), antepartum haemorrhage (APH), stroke, maternal death, requirement of transfusion of any blood products, acute kidney injury, pulmonary oedema, retinal detachment, cortical blindness, myocardial ischemia, and PRES were documented as adverse maternal outcomes.

Inclusion criteria: Intranatal patients with hypertension disorder admitted in labor room and delivered at NCH having: Gestational hypertension (BP>=140/90 mmhg), Pre-eclampsia without complications, Patients willing to be part of study.

Exclusion criteria: Patients with established adverse outcome, Delivery outside NCHS, Patients having co-morbidities like DM, liver disease lung disease, sickle cell disease/trait, Patients with eclampsia.

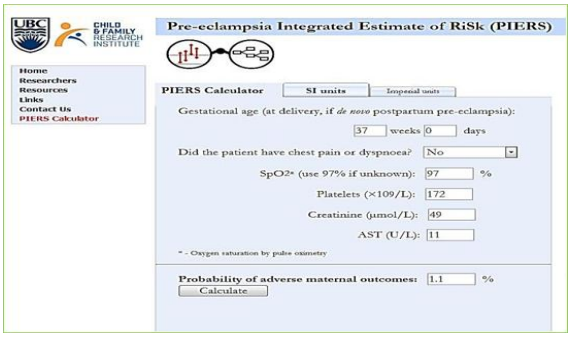

Figure: Piers Calculator

RESULTS & DISCUSSION

Among the 110 subjects enrolled, the majority, 77 women (70%), were aged between 20 to 29 years, which reflects the typical reproductive age group in India. The mean age of the participants was 26 years, with the youngest being 18 years and the oldest 39 years. A large proportion of the study population, 97 women (88.18%), were from urban areas, whereas 13 women (11.82%) came from rural backgrounds. in our study 53 women (48.18%) were registered at NCHS, while 47 (42.74%) were referrals from peripheral or private setups. Five women each (4.54%) were registered outside or came in as emergency cases. Parity distribution showed that 59 women (53.64%) were nulliparous, 25 women (22.73%) were primiparous, 20 (18.18%) were second para, 4 (3.64%) were third para, and only 2 women (1.82%) were fourth para. 5 women (4.55%) had no ANC visits, 30 women (27.27%) had 1 to 3 visits, and the majority, 52 women (47.27%), had 4 to 6 visits. 16 women (14.55%) had 7 to 9 visits, while 7 women (6.36%) had more than 10 visits. we calculated full PIERS score of all subjects which has been shown as below in [Table 1].

Table 1: PIERS SCORE wise Distribution (N=110)

PIERS Score	Subjects	Percentage
<2.5	53	48.18%
2.5-5	21	19.09%
5-10	16	14.55%
10-30	10	9.09%
>30	10	9.09%
Grand Total	110	100.00%

Half of the individuals, 53 subjects (48.18%), had a PIERS score below 2.5, indicating a low risk of severe adverse outcomes. 21 subjects (19.09%) had scores between 2.5 and 5, and 16 subjects (14.55%) scored between 5 and 10, suggesting moderate risk. A smaller proportion, 10 subjects each (9.09%), had scores between 10–30 and above 30. On further analysis, co-relation of applied PIERS score with observed adverse maternal outcome as shown in [Table 2].

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Table 2: Correlation of Adverse maternal outcome with PIERS Score

PIERS Score	Subjects with adverse outcomes	Subjects without adverse outcome	Standard deviation	P-value
<2.5%	4	49	23.06	1.14×10^{-10}
2.5-5%	5	16		
5-10%	10	6		
10-30%	8	2		
>30%	10	0		
Total	37	73		

In our study, out of 110 study subjects, 37 had adverse maternal outcome as predefined in methodology. As the PIERS score increases, the proportion of women experiencing adverse maternal outcomes rises markedly: In the lowest risk group (<2.5%), only 4 out of 53 women (7.54%) developed adverse outcomes. In the 2.5–5% risk group, 5 out of 21 women (23.81%) had adverse outcomes. In the 5–10% risk group, 10 out of 16 women (62.5%) had adverse outcomes. In the 10–30% risk group, 8 out of 10 women (80%) had adverse outcomes. In the highest risk group (>30%), all 10 women (100%) had adverse outcomes. We calculated mean PIERS score of patients with adverse outcome and patients without adverse outcome as well as distribution of adverse outcome amongst study subjects. p-value is 1.14×10^{-10} suggestive of very high significant between PIERS score with Maternal adverse outcome.

Table 3: Correlation of Adverse maternal outcome with Mean PIERS Score

Adverse Maternal Outcomes	Subjects (n)	Percentage (%)	PIERS Score (Mean)	P-value
No Adverse Outcome	73	66.36%	2.276	1.14×10^{-10}
Adverse Outcome (Total)	37	33.64%	27.88	
└── 1 Adverse Outcome	20	18.18%		
└── 2 Adverse Outcomes	9	08.18%		
└── >2 Adverse Outcomes	8	07.28%		
Grand Total	110	100.00%		

Among 110 patients in our study, 73 patients (66.36%) experienced no adverse outcomes. The remaining 37 patients (33.64%) faced varying numbers of adverse outcomes. Among these, 20 subjects (18.18%) had one adverse outcome, 9 subjects (8.18%) had two adverse outcomes, and 8 subjects (7.28%) had more than two adverse outcomes. Table also differentiates between subjects with no adverse outcomes (n=73) and subjects with adverse outcomes (n=37). The mean PIERS score for subjects with no adverse outcomes is 2.276. The mean PIERS score for subjects with adverse outcomes is 27.88. We also analysed mean PIERS score of each individual adverse outcome.

Table 4: Individual adverse maternal outcome with mean PIERS value (N=110)

Adverse maternal outcome	Subjects(frequency=136)	PIERS Score(mean)
No adverse outcomes	73	2.276
APH	8	5.625
PPH	6	13.66
Eclampsia	7	8.32
Pulmonary Edema	11	74.7
ARDS	3	78.66
PPCM	3	68.83
HELLP Syndrome	4	12.7
PRESS	1	10.1
Shock	2	53.25
DIC	8	20.56
AKI	6	24.16
Maternal Mortality	4	75.875

Antepartum Hemorrhage (APH) had a mean PIERS Score of 5.625 in 8 cases. Postpartum Hemorrhage (PPH) had a mean PIERS Score of 13.66 in 6 cases. Eclampsia had a mean PIERS Score of 8.32 in 7 cases. Pulmonary Edema had a notably high mean PIERS Score of 74.7 in 11 cases. Acute Respiratory Distress Syndrome (ARDS) had a mean PIERS Score of 78.66 in 3 cases. Peripartum Cardiomyopathy (PPCM) had a mean PIERS Score of 68.83 in 3 cases. HELLP Syndrome had a mean PIERS Score of 12.7 in 4 cases. Posterior Reversible Encephalopathy Syndrome (PRESS) had a mean PIERS Score of 10.1 in 1 case. Shock had a mean PIERS Score of 53.25 in 2 cases. Disseminated Intravascular Coagulation (DIC) had a mean PIERS Score of 20.56 in 8 cases. Acute Kidney Injury (AKI) had a mean PIERS Score of 24.16 in 6 cases. Maternal Mortality had a mean PIERS Score of 75.875 in 4 cases. We analyzed correlation between adverse fetal outcome and PIERS score.

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Table 5: Correlation of Adverse fetal outcome with PIERS Score

PIERS Score	Adverse fetal outcome		Total	p-value
	YES	NO		
<2.5%	10	43	53	0.024
2.5-5%	7	14	21	
5-10%	6	11	17	
10-30%	7	5	12	
>30%	9	3	12	

In our study, <2.5% category: 10 neonates had complications, 43 neonates had no complications, 2.5-5% category: 7 neonates had complications, 14 neonates had no complications, 5-10% category: 6 neonates had complications, 11 neonates had no complications, 10-30% category: 7 neonates had complications, 5 neonates had no complications, >30% category: 9 neonates had complications, 3 neonates had no complications, Out of 115 total neonates, 39 had complications and 72 had no complications. Then individual parameter of PIERS calculators was analysed to see its relation with adverse outcomes. P-value is 0.024 which is significant suggestive of there is highly significant correlation between PIERS score and adverse fetal outcome.

Table 6: Individual PIERS calculator parameter associated with maternal adverse outcome

Parameter	Range	Subjects with Adverse Outcome	Subjects without Adverse Outcome	P-value
Platelet Count (/mm³)	50,000–1,00,000	6	13	0.3124
	1,00,000–1,50,000	13	23	
	>1,50,000	12	43	
Serum Creatinine (mg/dL)	<0.4	0	9	0.0113
	0.4–0.9	24	55	
	1.0–1.4	12	7	
	>1.4	2	1	
AST (IU/L)	<45	18	59	0.0000855
	45–90	8	10	
	>90	12	3	
SpO_2 (%)	>98	5	52	<0.00001
	96–97	13	12	
	94–95	8	7	
	90–93	4	1	
	<90	7	1	
Gestational Age	$28–31^{+6}$ weeks	5	2	0.0026
	$32–33^{+6}$ weeks	8	6	
	$34–36^{+6}$ weeks	14	14	
	$37–38^{+6}$ weeks	7	33	
	$39–40^{+0}$ weeks	4	14	
	>40 weeks	0	3	

We further analysed individual PIERS calculator parameter and corelation of maternal adverse outcome.

P-value of platelet counts with adverse outcome is 0.3124 which is not significant suggestive of there is no significant correlation between Platelet counts at admission and adverse maternal outcome.

P-value of S.creatinine with adverse outcome is 0.0113, which is significant. This means there is a strong association between S. creatinine and adverse maternal outcomes.

P-value of AST with adverse outcome is 0.0000855, which is highly significant. This means there is a strong association between AST range adverse maternal outcomes.

P-value of Spo2 with adverse outcome is <0.000001, which is significant suggestive of there is significant correlation between Spo2 level at admission and adverse maternal outcome.

P-value of Gestational age with adverse outcome is 0.0026 which is significant suggestive of there is significant correlation between Gestational age at admission and adverse maternal outcome.

Table 7: Correlation Of Adverse maternal outcome with PIERS score in various studies

Study	Present study (N=110) (2025)	Srivastava et al. (2017) (N=125)	Indira bhati et al. (2022) (N=410)	Agarwal et al. (2015) (N=323)	Usha rao et al. (2023) (N=150)	Sreeya bose et al. (2017) (N=100)
PIERS score (p-value)	<0.00001	<0.0001	<0.0001	<0.001	<0.0001	<0.001

In my study (N=110, 2025) there is a highly significant association with PIERS score with adverse maternal outcome (p<0.00001). This finding is strongly supported by other studies, which consistently demonstrates significant relationships between PIERS score and the studied outcome. Srivastava et al. (2017) with 125 participants reported highly significant results (p<0.0001). Indira Bhati et

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al. (2022) studied 410 subjects and found equally significant associations ($p<0.0001$). Agarwal et al. (2015) examined 323 participants and documented significant relationships ($p<0.001$). Usha Rao et al. (2023) analysed 150 subjects with highly significant findings ($p<0.0001$) and Sreeya Bose et al. (2017) studied 100 participants and reported significant results ($p<0.001$).

CONCLUSION

This study confirms the clinical utility of the PIERS model as a reliable predictor of adverse maternal outcomes in pregnancies complicated by hypertensive disorders. A higher PIERS score showed strong correlation with poor maternal prognosis, including serious complications such as pulmonary oedema, ARDS, HELLP syndrome, and even maternal death. The study also underlines the importance of early and adequate antenatal care, as a significant number of high-risk pregnancies. The fullPIERS calculator gave good results in prediction of adverse maternal outcome according to risk score in women with preeclampsia in our study. It may be very useful in our country where women are more likely to develop complications of preeclampsia than women in high-income countries and even die of it. It will help the clinicians better manage the patients with preeclampsia. Biochemical parameters like elevated AST and serum creatinine, and clinical signs such as decreased foetal movements and dyspnoea, were significantly associated with maternal complications. Neonatal outcomes were also affected by maternal condition and quality of care. Hence, integrating the PIERS scoring system into routine obstetric care, especially in resource-limited settings, could serve as an early warning tool to identify women at higher risk, allowing timely intervention to improve both maternal and neonatal outcomes.

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