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PREDICTING THE ADVERSE MATERNAL OUTCOMES IN SUBJECTS WITH PREECLAMPSIA USING THE FULL PIERS MODEL

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ABSTRACT

Background: Nearly 10% of all pregnancies in the World present with complications of hypertensive disorders of pregnancy and preeclampsia. Preeclampsia is also been linked to high mortality rates and near-miss maternal morbidity cases. PIERS or preeclampsia integrated estimate of risk scoring model was made to monitor females with preeclampsia and to assess the risk of stratification which can help in improving the treatment.

Aim: The present clinical study aimed to assess the adverse maternal outcomes in subjects with preeclampsia using the full PIERS model.

Methods: The study assessed female subjects who presented to the institute with preeclampsia and were willing to participate in the study. All the subjects were assessed with a full PIERS calculator in the prediction of the risk for adverse maternal outcomes following the assessment of the variables of prediction.

Results: The total number of obstetric admissions in the institute during the study period was 1669 where preeclampsia was seen in 10% (n=167) of study subjects. The subjects included in the study were 300 females with preeclampsia and maximum performance in the prediction of adverse maternal outcomes was seen at a fullPIERS scale of 35. Adverse maternal outcomes were seen in 36.66% (n=110) of subjects whereas death was seen in 1 subject. The relative risk in the prediction of adverse maternal outcomes in females with a fullPIERS score of ≥35 was 4.4 with a 95% CI of (2.5-8.2).

Conclusions: The present study concludes that in females with preeclampsia, adverse maternal outcomes are significantly associated with the fullPIERS score of ≥35.

Keywords: Hypertension, full PIERS score preeclampsia, maternal outcomes

INTRODUCTION

HDPs or hypertensive disorders of pregnancy are among the most common reasons for perinatal and maternal mortality and morbidity on a global scale. Nearly 10% of all the complications reported in all pregnancies globally include chronic hypertension, chronic hypertension with superimposed preeclampsia, eclampsia, preeclampsia, and gestational hypertension. Preeclampsia is a disorder including multiple systems and is a unique condition of pregnancy. Nearly 50,000 to 60,000 deaths yearly in pregnant females are attributed to preeclampsia worldwide. For every death related to preeclampsia in pregnancy, the majority of females experience near-miss maternal morbidity.[1]

Preeclampsia-related maternal illness can present with varying symptoms from mild and asymptomatic hypertension to life-threatening hypertension involving cardiopulmonary, renal, and neurological compromise showing severe cases. Favorable perinatal and maternal outcomes in females with preeclampsia are largely governed by early identification of preeclampsia and its prompt management. The fetal and maternal outcomes of hypertensive disorders of pregnancy pose a global concern in the healthcare sector, particularly in low-income and middle-income countries where approximately >90% of deaths related to hypertensive disorders of pregnancy are reported.[2]

An adequate assessment of risk in females with preeclampsia is done using evidence-based tools that help in triaging females who are at high risk of adverse maternal outcomes. This can help in decreasing the burden of hypertensive disorders of pregnancy-related mortality and morbidity in pregnant females. The PIERS (preeclampsia integrated estimate of risk scoring) model was developed in 2011 to monitor females with preeclampsia. The PIERS model was developed to help the caregivers in triage, treatment, and transport of pregnant females having preeclampsia combined with assessing the risk in neonates at that gestational age.[3]

The fullPIERS model considers the maternal signs and symptoms along with the laboratory findings in subjects with preeclampsia. The six predicting variables in the fullPIERS model include laboratory parameters such as serum aspartate transaminase, serum creatinine, and platelet counts, symptoms such as oxygen saturation by pulse oximetry, chest pain, and dyspnea, and gestational age at delivery.[4] Delphi consensus was used to develop the components of composite adverse maternal outcomes that are predicted with the model. It includes maternal mortality or one or more serious components such as hematological, cardiovascular, hepatic, renal, central nervous system., or other morbidity. The fullPIERS model when used in high-income tertiary hospitals depicts excellent discriminatory ability.[5]

The present study was aimed at assessing the efficacy of the fullPIERS model in predicting the adverse maternal outcomes in females with preeclampsia where the variables for prediction were considered within 24 hours of admission.

MATERIALS AND METHODS

The present prospective clinical study was aimed to assess the efficacy of the fullPIERS model in predicting the adverse maternal outcomes in females with preeclampsia where the variables for prediction were considered within 24 hours of admission. The study was done at Department of

Obstetrics and Gynecology, JNU Institute of Medical Science and Research Center, Jaipur, Rajasthan after the clearance was given by the concerned institutional Ethical committee. The study population was from subjects visiting the Outpatient Department of the Gynecology Institute after obtaining written and verbal informed consent from all the participants.

The inclusion criteria for the study were females that had confirmed diagnosis of preeclampsia ad gave consent for study participation. The exclusion criteria were subjects that did not give consent for participation, females in spontaneous labor, and subjects that experienced adverse outcomes before collecting the predictor variables. For all the females included in the study, a detailed study was recorded followed by clinical study and laboratory investigations including the oxygen saturation using pulse oximetry, 24-hour urine protein, dipstick method for urine albumin, uric acid, serum creatinine, blood urea, lactate dehydrogenase, serum alkaline phosphatase, alanine transaminase, serum aspartate, serum bilirubin, 75g oral glucose tolerance test, complete blood count, and other routine antenatal investigations.

After these assessments, all subjects were assessed using the fullPIERS risk prediction model. The six predictor variables assessed were serum AST (aspartate transaminase), serum creatinine, platelet count, SpO2 (oxygen saturation), dyspnea or chest pain, and gestational age. All the predictor variables were assessed within 24 hours of admission of study subjects. The worst indicator value was used in the present study either the lowest or highest, whichever was appropriate to evaluate the performance of the full PIERS model.

Following the institutional protocol, females with preeclampsia having a gestational age of <34 weeks were given 6mg dexamethasone injection in 4 doses at the difference of 12 hours to promote fetal lung maturity. Females with preeclampsia and severe features were given magnesium sulfate as an antihypertensive agent to control the blood pressure and an anticonvulsant agent for prophylaxis. Non-stress test was also done for fetal surveillance, doppler velocimetry for fetoplacental circulation every 2 weeks as and when required, amniotic fluid index, ultrasonography to assess fetal weight and biometry, and daily fetal movement counts. Also, following institution protocol, females with preeclampsia were aimed to reach non-severe features at ≥ 37 weeks and females with preeclampsia and severe features at ≥ 34 weeks. In females with unfavorable cervix, agents for cervical ripening were used and in cases with obstetrical indications, cesarean section was done.

The data gathered were statistically analyzed using SPSS software version 21.0 (IBM Corp., Armonk, NY, USA) with student t-test and Chi-square test. The data were expressed as mean and standard deviation and frequency and percentage. The significance level was kept at a p-value of <0.05.

RESULTS

The present prospective clinical study was aimed to assess the efficacy of the fullPIERS model in predicting the adverse maternal outcomes in females with preeclampsia where the variables for prediction were considered within 24 hours of admission. The total number of obstetric admissions in the institute during the study period was 1669 where preeclampsia was seen in 10% (n=167) of study subjects. The subjects included in the study were 300 females with

preeclampsia and maximum performance in the prediction of adverse maternal outcomes was seen at a fullPIERS scale of 35. Adverse maternal outcomes were seen in 36.66% (n=110) of subjects whereas death was seen in 1 subject.

The mean age of females with adverse maternal outcomes and without adverse maternal outcomes was 26.3±4.2 years and 27.2±4.3 years respectively which was non-significant with p=0.43. The mean hospital stay duration was 6.4±3.6 and 6.5±6.4 days respectively with and without adverse maternal outcomes with p=0.91 depicting statistically non-significant results. The parity was 1.2±0.3 in adverse maternal outcomes and 1.2±0.3 in females with no adverse maternal outcomes showing non-significant results with p=0.75. Diastolic blood pressure was significantly higher in females having preeclampsia and adverse maternal outcomes with 102.4±10.6 mmHg compared to 99.4±8.9 in females with no adverse maternal outcomes with p=0.03. Similarly, significantly higher systolic blood pressure was seen in females with preeclampsia and adverse maternal outcomes compared to females with no adverse maternal outcomes with p=0.01. Non-significant differences were seen in mean GA at delivery and mean GA in females with adverse maternal outcomes and no adverse maternal outcomes with respective p-values of 0.23 and 0.34 as shown in Table 1.

For adverse maternal outcomes, biochemical markers, and maternal symptoms in study subjects, the results are summarized in Table 2. In biochemical markers, dipstick proteinuria of ≥2+ was seen in 98 subjects where 50 subjects had adverse maternal outcomes and 48 subjects without it. The odds ratio (95% CI) was 2.2 (1.4-4.7). The difference was statistically significant with p=0.01. Serum creatinine level of >1.1 mg/dl was seen in 22 subjects where 20 subjects had adverse maternal outcomes and 2 did not have, Odds ratio (95% CI) was 20.6 (2.3-168.4) depicting significant results with p=0.003. AST levels of >40 IU/L were seen in 168 subjects where 82 subjects had adverse maternal outcomes and 86 subjects had no adverse maternal outcomes which was significant with p=0.0006. Platelet counts of <1.5l/cumm were seen in 116 subjects where 62 subjects had adverse maternal outcomes and 54 had no adverse maternal outcomes with OR (95% CI) of 3.4 (1.4-6.3) showing significant results with p=0.0008 (Table 2).

For symptoms, dyspnea was seen in 16 study subjects with adverse maternal outcomes having OR (95% CI) of 34.3 (1.7-604.6) which was statistically significant with p=0.01. Epigastric pain was seen in 60 subjects where 20 had adverse maternal outcomes and 40 had no adverse maternal outcomes, OR (95% CI) of 0.6 (0.1-1.7) showing non-significant results with p=0.65. Visual disturbance and headache were seen in 6 and 96 subjects respectively. The results for visual disturbance and headache were statistically non-significant in subjects with and without adverse maternal outcomes with respective p-values of 0.32 and 0.36 as depicted in Table 2.

Concerning the assessment of predictors for predicting adverse maternal outcomes in females with preeclampsia, for >=2+ dipstick proteinuria, Univariate analysis (95% CI) was 0.7 (0.27-0.84) showing significant results with p=0.01. Similar significant results were seen for serum creatinine, serum ALP, ALT, AST, diastolic blood pressure, systolic blood pressure, and age with

respective p-values of 0.03, 0.001, 0.001, 0.001, 0.03, and 0.01 Non-significant results were seen for age with Univariate analysis (95% CI) of 1.2 (0.93-1.2) and p=0.3 (Table 3).

On assessing the correlation of adverse maternal outcomes to fullPIERS score, it was seen that for a fullPIERS score of ≥ 35 in 148 subjects 58 subjects had no adverse maternal outcomes and 90 subjects had adverse, maternal outcomes, whereas 142 subjects had fullPIERS scores of <35. Among these subjects, 132 subjects had no adverse maternal outcomes, and 20 subjects had adverse maternal outcomes RR 95% CI was 4.4 (2.3-8.2) depicting significant results with p<0.0001 (Table 4).

DISCUSSION

In the present study, the mean age of females with adverse maternal outcomes and without adverse maternal outcomes was 26.3±4.2 years and 27.2±4.3 years respectively which was non-significant with p=0.43. The mean hospital stay duration was 6.4±3.6 and 6.5±6.4 days respectively with and without adverse maternal outcomes with p=0.91 depicting statistically non-significant results. The parity was 1.2±0.3 in adverse maternal outcomes and 1.2±0.3 in females with no adverse maternal outcomes showing non-significant results with p=0.75. Diastolic blood pressure was significantly higher in females having preeclampsia and adverse maternal outcomes with 102.4±10.6 mmHg compared to 99.4±8.9 in females with no adverse maternal outcomes with p=0.03. Similarly, significantly higher systolic blood pressure was seen in females with preeclampsia and adverse maternal outcomes compared to females with no adverse maternal outcomes with p=0.01. Non-significant differences were seen in mean GA at delivery and mean GA in females with adverse maternal outcomes and no adverse maternal outcomes with respective p-values of 0.23 and 0.34. These data were similar to the studies of Payne B et al[6] in 2013 and Ukha UV et al[7] in 2018 where authors assessed subjects with demographics comparable to the present study.

The study results showed that for biochemical markers, dipstick proteinuria of ≥2+ was seen in 98 subjects where 50 subjects were with adverse maternal outcomes and 48 subjects without it. The odds ratio (95% CI) was 2.2 (1.4-4.7). The difference was statistically significant with p=0.01. Serum creatinine level of >1.1 mg/dl was seen in 22 subjects where 20 subjects had adverse maternal outcomes and 2 did not have, Odds ratio (95% CI) was 20.6 (2.3-168.4) depicting significant results with p=0.003. AST levels of >40 IU/L were seen in 168 subjects where 82 subjects had adverse maternal outcomes and 86 subjects had no adverse maternal outcomes which was significant with p=0.0006. Platelet counts of <1.5l/cumm were seen in 116 subjects where 62 subjects had adverse maternal outcomes and 54 had no adverse maternal outcomes with OR (95% CI) of 3.4 (1.4-6.3) showing significant results with p=0.0008. These results were consistent with the studies of Bose S et al[8] in 2018 and Agarwal S et al[9] in 2016 where authors reported biochemical markers comparable to the present study in their respective studies.

It was also seen that for symptoms, dyspnea was seen in 16 study subjects with adverse maternal outcomes having OR (95% CI) of 34.3 (1.7-604.6) which was statistically significant with p=0.01. Epigastric pain was seen in 60 subjects where 20 had adverse maternal outcomes and 40

had no adverse maternal outcomes, OR (95% CI) of 0.6 (0.1-1.7) showing non-significant results with p=0.65. Visual disturbance and headache were seen in 6 and 96 subjects respectively. The results for visual disturbance and headache were statistically non-significant in subjects with and without adverse maternal outcomes with respective p-values of 0.32 and 0.36. These findings were in agreement with Millman AL et al[10] in 2011 and Kozik JR et al[11] in 2011 where adverse symptoms reported in females with preeclampsia and adverse maternal outcomes similar to the present study were reported by the authors.

It was seen that concerning the assessment of predictors for predicting adverse maternal outcomes in females with preeclampsia, for >=2+ dipstick proteinuria, Univariate analysis (95% CI) was 0.7 (0.27-0.84) showing significant results with p=0.01. Similar significant results were seen for serum creatinine, serum ALP, ALT, AST, diastolic blood pressure, systolic blood pressure, and age with respective p-values of 0.03, 0.001, 0.001, 0.001, 0.03, and 0.01 Non-significant results were seen for age with Univariate analysis (95% CI) of 1.2 (0.93-1.2) and p=0.3. These results were in line with Srivastava S et al[12] in 2011 and Thangaratinam S et al[13] in 2011 where similar results were seen concerning the predictors for predicting adverse maternal outcomes in females with preeclampsia as in the present study.

The study results showed that regarding the correlation of adverse maternal outcomes to fullPIERS score, it was seen that for a fullPIERS score of ≥ 35 in 148 subjects 58 subjects had no adverse maternal outcomes and 90 subjects had adverse, maternal outcomes, whereas 142 subjects had fullPIERS scores of <35. Among these subjects, 132 subjects had no adverse maternal outcomes, and 20 subjects had adverse maternal outcomes RR 95% CI was 4.4 (2.3-8.2) depicting significant results with p<0.0001. These findings correlated with Thangaratinam S et al[14] in 2011 and Firoz T et al[15] in 2011 where fullPIERS scores of ≥ 35 were reported with significantly higher adverse maternal outcomes in females with preeclampsia.

CONCLUSIONS

Considering its limitations, the present study concludes that in females with preeclampsia, adverse maternal outcomes are significantly associated with the fullPIERS score of ≥35. Also, the fullPIERS model is an excellent and reliable tool as a rule in testing the developing adverse maternal outcomes in females with preeclampsia. However, further longitudinal studies are needed to reach a definitive conclusion.

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TABLES

Characteristics	Adverse maternal outcomes	No adverse maternal outcomes	p-value
Mean age (years)	26.3±4.2	27.2±4.3	0.43
Hospital stays	6.4±3.6	6.5±6.4	0.91
Parity	1.2±0.3	1.2±0.3	0.75
Diastolic BP	102.4±10.6	99.4±8.9	0.03
Systolic BP	156.5±14.1	151.0±11.5	0.01
Mean GA at delivery	36.1±2.9	37.2±2.5	0.23
Mean GA	36.3±3.4	36.4±3.4	0.34

Table 1: Demographic and disease characteristics of study subjects

Factors	Adverse maternal outcomes		Odds ratio (95% CI)	p-value
	Present	Absent		
Biochemical parameters				
Dipstick proteinuria (≥2+ (98)	50	48	2.2 (1.4-4.7)	0.01
Sr. creatinine >1.1 mg/dl (22)	20	2	20.6 (2.3-168.4)	0.003
AST >40 IU/L (168)	82	86	3.3 (1.5-7.1)	0.0006
Platelet count <1.5l/cumm (116)	62	54	3.4 (1.4-6.3)	0.0008
Symptom				
Dyspnea (16)	16	0	34.3 (1.7-604.6)	0.01
Epigastric pain (60)	20	40	0.6 (0.1-1.7)	0.65
Visual disturbances (6)	4	2	3.3 (0.1-40.2)	0.32
Headache (96)	30	66	0.5 (0.1-1.2)	0.36

Table 2: Adverse maternal outcomes, biochemical markers, and maternal symptoms in study subjects

Predictor	Univariate analysis (95% CI)	p-value
>=2+ dipstick proteinuria	0.7 (0.27-0.84)	0.01
Serum creatinine	0.4 (0.03-0.95)	0.03
SALP	0.7 (0.97-0.97)	0.001
ALT	0.7 (0.94-0.96)	0.001
AST	0.7 (0.93-0.96)	0.001
DBP	0.7 (0.91-0.97)	0.03
SBP	0.7 (0.92-0.97)	0.01
Age	1.2 (0.93-1.2)	0.3

Table 3: Predictors for predicting adverse maternal outcomes in females with preeclampsia

fullPIERS score	Adverse maternal outcomes		RR (95% CI)	p-value
	Absent n=190	Present n=110		
≥ 35 (148)	58	90	4.4 (2.3-8.2)	<0.0001
<35 (142)	132	20		

Table 4: Correlation of adverse maternal outcomes to fullPIERS score