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PREDICTING ADVERSE MATERNAL AND NEONATAL OUTCOME IN PRE-ECLAMPSIA WOMEN USING FULLPIERS AND MINIPIERS CALCULATOR

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ABSTRACT

Introduction: Favourable maternal and perinatal outcomes for women with pre-eclampsia/ eclampsia depends on early identification and treatment . Also the disorders associated with these conditions need to be evaluated .For this fullPIERS and miniPIERS risk prediction models have been validated and these are used in the present study .

Methodology: An observational study of 100 patients who were admitted in a tertiary care hospital with hypertension in pregnancy after 20 weeks from August 2015 till August 2017 was conducted . Socio-demographic profile, medical history, intrapartum and postpartum parameters , maternal as well as fetal were noted. Risk assessment of the patients for pre-eclampsia outcome prediction was done using the full PIERS and mini PIERS tool.

Results: Most common symptom observed in present study was headache, followed by nausea, chest pain/ dyspnoea, epigastric pain and visual disturbances. Adverse maternal outcome was significantly associated with complaints of headache, visual disturbances and dyspnoea. Weight of the baby less than 2.5 kg, admission of baby to neonatal intensive care unit, gestational age 34 weeks or more at delivery, platelet count less than 1.5 lakh per cumm and lactate dehydrogenase levels 600 IU/L or greater were found to be significantly associated with an adverse maternal outcome. Full PIERS and miniPIERS had an overall diagnostic accuracy of 90% and 91% respectively.

Conclusion: FullPIERS calculator predicted adverse maternal outcome according to risk score in women with preeclampsia. MiniPIERS also performed well to identify women at increased risk and thus could be used in tertiary care centres as well as resource-constraint settings in India.

KEYWORDS : diagnosis, outcome, prediction, pre-eclampsia

INTRODUCTION

Hypertensive disorder of pregnancy (gestational hypertension (GHT), pre-eclampsia (PE) & eclampsia (E) occurs in approximately 6-8 % of all pregnancies.[1] It accounts for approximately a quarter of all antenatal admissions and is strongly associated with foetal growth retardation and prematurity and thus contributes largely to perinatal mortality and morbidity. Preeclampsia is gestational hypertension with proteinuria (at least 300 mg/ 24 hours) and may be associated with certain complications in fetus like intrauterine growth restriction, prematurity and may lead to death of fetus. In some patients preeclampsia may progress to eclampsia and Hemolysis, Elevated Liver enzymes, Low Platelet (HELLP) syndrome (10% to 20% of cases)[2] which is a form of hypertensive disorder of pregnancy with convulsion.

Favourable maternal and perinatal outcomes for women with preeclampsia/ eclampsia depend on how soon the condition is identified and treated. Outcomes are less favourable in women living in developing countries, regardless of gestation or severity of clinical presentation.[3] Despite knowing numerous risk factors associated with an adverse maternal or perinatal outcomes, the risk assessment and prediction is not well quantified.[4] Furthermore, poor understanding about the mutual dependence of various risk factors makes it difficult to predict a pregnancy outcome. Identifying patients who will experience an adverse outcomes from pre-eclampsia would help in intervening appropriately, while minimizing unnecessary and potentially harmful interventions in patients who do not require them. The PIERS (Preeclampsia Integrated Estimate of RiSk) score was designed in 2011 to assess maternal signs, symptoms, and laboratory findings to generate a valid and reliable algorithm for predicting maternal and perinatal outcome in patients with preeclampsia.[5] However, due to the inclusion of laboratory tests, the fullPIERS model was thought not to be suitable for all settings, particularly in primary care settings of low and middle income countries (LMICs).[6] This later led to the development of miniPIERS risk prediction model to provide a simple, evidence-based tool for use in community and primary health care facilities in LMICs, without the need of laboratory investigations.
In the present study we aimed to identify the factors associated with adverse maternal outcomes in pre-eclampsia and to validate fullPIERS and miniPIERS risk prediction calculators to predict complications and adverse maternal outcome in preeclampsia.

METHODOLOGY

Study Design and Setting

We performed an observational study of patients who were admitted in the indoor ward of Department of Obstetrics and Gynecology of a tertiary care centre catering to the healthcare needs of the surrounding districts. with hypertension in pregnancy after 20 weeks from August 2015 till August 2017. . The study was approved by the institutional ethics committee before commencement and was performed according to the guidelines of research on human subjects as prescribed by Indian Council of Medical Research, New Delhi.

Sample population

We randomly selected 100 pregnant females who presented either to outpatient clinic or emergency department and were later admitted to the indoor ward of Department of Obstetrics and Gynecology with blood pressure more than 140/90 mm of Hg after 20 weeks of gestation. We excluded patients who were already diagnosed with eclampsia before admission, had any medical condition other than preeclampsia, or those who refused to consent to be included in the study.

Data Collection and Data Analysis

Using a predesigned semi-structured questionnaire, we collected socio-demographic information of the patient like age, education, occupation, menstrual history and obstetric history from the hospital records. Presenting symptoms and vitals of the patients were recorded and so were the investigations and treatment given as ordered by the treating doctor. Intrapartum and postpartum parameters were noted as well to ascertain any adverse maternal outcomes. Furthermore, details of the baby like gender, weight, APGAR score at one minute and whether admitted to neonatal intensive care unit (NICU) were recorded. Risk assessment of the patients for pre-eclampsia outcome prediction was done using the full PIERS and mini PIERS tool and compared against the observed maternal outcomes to calculate their accuracy.

The fullPIERS calculator includes gestational age at diagnosis, the symptom complex of chest pain and/or dyspnea, oxygen saturation by pulse oximetry and laboratory estimation of platelet count, serum creatinine, and aspartate transaminase. miniPIERS used in the study was: logit (logarithm of the odds)(pi)= 5.77+[-2.98 * 10-1 * indicator for multiparity] + [(-1.07) * log gestational age at admission] + [1.34 * log systolic blood pressure] + [(-2.18 * 10-1) * indicator for 2+ dipstick proteinuria] + [(4.24 * 10-1) * indicator for 3+ dipstick proteinuria] + [(5.12 * 10-1) * indicator for 4+ dipstick proteinuria] + [1.18 * indicator for occurrence of vaginal bleeding with abdominal pain] + [(4.22 * 10-1) * indicator for headache and/or visual changes] + [8.47 *

10-1 * indicator for chest pain and/or dyspnoea].

The collected data were coded in Microsoft Excel sheet and analysed using SPSS (Statistical Package for social sciences) version 20.0 software. Data were described as frequency tables. Means of quantitative variables were compared using student's t test of analysis of variance and qualitative variables were compared using chi square or fisher's exact test for statistical significance, which was defined as p value less than 0.05.

RESULTS

During the study period we enrolled 100 patients. Socio-demographic profile of the study subjects have been described in Table 1. Out of 100 women, 8 presented to us before 34 weeks of gestation and after management 3 of them delivered before 34 weeks. Adverse maternal outcome was seen in 16% cases. Of the 16 women with adverse outcome, three women required blood and blood products transfusion, one had pulmonary edema, two had placental abruption, two had hepatic dysfunction and another three had severe thrombocytompenia. One patient required intubation and another one required ionotropic support while three women had eclamptic seizures. Table 2 describes the symptoms observed in the patients and their association with adverse maternal outcomes. Most common symptom observed in present study was headache, followed by nausea, chest pain/ dyspnoea, epigastric pain and visual disturbances. Adverse maternal outcome was significantly associated with complaints of headache, visual disturbances and dyspnoea. As part of the management, anticonvulsants were given to women with eclampsia to prevent further convulsions and to women with pre-eclampsia, or to prevent first such episode, as per clinical judgement. Of the 83 patients in which anticonvulsants were administered,16 had adverse outcome (p=0.034). Similarly none of the cases developed adverse outcome, where anti-hypertensive was not given.

Table 3 describes the historical factors associated with an adverse maternal outcome. In our patient population, weight of the baby less than 2.5 kgs, admission of baby to neonatal intensive care unit, gestational age 34 weeks or more at delivery, platelet count less than 1.5 lakh per cumm and Lactate dehydrogenase levels 600 IU/L or greater were found to be significantly associated with an adverse maternal outcome. However, no association between age of the mother, gestational age, systolic and diastolic blood pressure, mode of delivery, gender of baby, APGAR score at 1 minute, serum creatinine and presence of proteinuria for predicting an adverse outcome in a pre-eclamptic woman was found. Asparatate aminotransferase levels greater than 40 U/L were weakly associated with an adverse outcome. As compared to observed outcomes, full PIERS was 37% sensitive and 100% specific with a positive and negative predictive value of 100% and 89% respectively, with an overall diagnostic accuracy of 90% (Table 4). Similarly, mini PIERS reported a low sensitivity of 44%, high specificity of 98% and an overall diagnostic accuracy of 91%.

DISCUSSION

The clinical importance of pre-eclampsia is great because of the associated maternal and neonatal mortality and morbidity. Unfortunately, the cause of pre-eclampsia is unclear, which makes the distinction between women who are at higher or lower risk difficult but is possible nevertheless.[7] Previous authors have reported numerous clinical features like similar past history, chronic kidney disease, primigravida, obesity, polycystic ovarian syndrome, hypertension, diabetes mellitus and autoimmune disorders to be strongly associated with preeclampsia to be associated with poor outcomes.[8,9] However, these factors help us in predicting less than one third of all cases of pre-eclampsia.[10] Clinical and lifestyle related factors have also been shown to affect pregnancy outcomes. Furthermore, maternal haematological biomarkers have modest predictive power in early pregnancy and have not been studied extensively.[11] Due to the limited applicability of the above mentioned features and tests, researchers have built multivariable models which integrate these tests. FullPIERS model at the time of its development predicted adverse maternal outcome in women admitted for pre-eclampsia with 88% accuracy.

In our study headache, visual disturbances and chest pain were found to be significantly associated with poor maternal outcome, which is similar to a study by Martin et al who found nausea, vomiting and epigastric pain to be predictive of increased maternal morbidity.[12] Cavkaytar et al also found symptoms of headache, visual changes, epigastric pain and vomiting more predictive of adverse maternal outcome than laboratory values.[13] However, Yen et al found maternal symptoms of preeclampsia not to be predictors of adverse maternal outcome.[14] Furthermore, we found gestational age less than 34 weeks at delivery to be significantly associated with poor outcome. This is similar to findings by Gaugler- Senden et al in their study on maternal and perinatal outcome in early onset preeclampsia.[15] Additionally, the apparent statistical association between anti-convulsants and poor outcome could be a spurious association as the drug was given to only severe cases, of which some developed adverse outcome and no drug was given in relatively stable patients. The severity of the diseases thus acted as confounding variable for this spurious association.

Aspartate aminotransferase levels was borderline significantly associated with a poor maternal outcome in our study population (p = 0.058). This is in contrast to findings of a systematic review of PIERS data which showed that increased liver enzymes were associated with an increased risk of maternal and fetal complications.[16] However, the authors cautioned that normal liver enzyme levels should not rule out the risk. Due to the lack of use of any laboratory investigation, miniPIERS model has potential for use by low and middle level health workers in poor-resourced settings. To increase usability of this model, miniPIERS is being converted to a mobile health application. A risk threshold of 25% predicted probability assigned by the miniPIERS model was found to be 85.5% accurate in identifying women at increased risk of adverse maternal outcomes. Although this model shows great promise, improvements in the model's accuracy may be possible with the addition of more sensitive risk markers.

There are a few limitations of this study. The present study is a single centric study from a tertiary care centre, so the results could not be generalized to entire population. Moreover a larger sample size was desirable to make the study results more robust.

CONCLUSION

Our study demonstrated that fullPIERS calculator can predict adverse maternal outcome according to risk score in women with preeclampsia. It would be specifically 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. Additionally, miniPIERS, which includes simple-to-measure personal characteristics, symptoms, and signs, also performed reasonably well as a tool to identify women at increased risk of adverse maternal outcomes and thus could be used in resource-constraint settings prevalent in most parts of our country.

Table 1. Baseline characteristics of patients included in the study

Age distribution	N
< 20 years	5
20-29 years	70
30-39 years	25
Education status	
Illiterate	47
Primary	22
Secondary	18
HS & above	13
Employment status	
Working	23
Not working	77
Past menstrual history	
Regular	89
Irregular	11
Gravidity	
Primigravida	38
Multigravida	62
Gestational age at presentation	
≤ 34 weeks	8
>34 weeks	92
Gestational age at delivery	
≤ 34 weeks	3
>34 weeks	97
Adverse Maternal Outcome	
No adverse outcome	84
Eclamptic Seizures	3
Thrombocytopenia (< 50,000)	3
Others	10

Table 2. Association of maternal symptoms and medications given with adverse maternal outcome

	N	Adverse maternal outcome	p value
Symptoms			
Nausea/vomiting	20	2	0.89
Headache	30	10	<0.01
Visual disturbances	15	12	<0.01
Epigastric pain	19	3	0.98
Abdominal/vaginal bleeding	6	1	0.96
Chest pain/dyspnea	20	9	<0.01
Medications given			
Anti-hypertensive	89	16	0.20
Anti-convulsant	83	16	0.03

Table 3. Factors associated with adverse maternal outcomes

	Adverse maternal outcome		
	No	Yes	p value
Mode of delivery			
Lower Section Cesarean Section	52	11	0.77
Vaginal	32	5	
Gender of baby			
Female	36	11	0.09
Male	48	5	
Weight of baby			
<2.5 kgs	62	16	0.019
≥ 2.5 kgs	22	0	
APGAR at 1 min			
< 7	20	3	1.0
≥ 7	64	13	
Neonatal Intensive Care Unit stay			
No	68	5	<0.01
Yes	16	11	
Gestational age at presentation			
< 34 weeks	5	3	0.11
≥ 34 weeks	79	13	
Gestational age at delivery			
< 34 weeks	0	3	<0.01
≥ 34 weeks	84	13	
Platelet count			
< 1.5 lakh/cumm	24	12	<0.01
≥ 1.5 lakh/cumm	60	4	
Serum creatinine			
< 1 mg/dl	70	10	0.084
> 1 mg/dl	14	6	
Aspartate aminotransferase levels			
≤ 40 U/L	49	5	0.058
> 40 U/L	35	11	
Proteinuria			
None	16	0	0.088
< +2	50	7	
≥ +2	18	9	
Liver Dehydrogenase levels			
< 600 IU/L	60	4	<0.01
≥ 600 IU/L	24	12	

Table 4. Diagnostic accuracy of predicted adverse maternal outcome by Full and Mini PIERS score

	Observed maternal outcome		Diagnostic accuracy
Full PIERS*	Normal	Adverse	90%
Normal	84	10	
Adverse	0	6	
Mini PIERS			
Normal	82	9	91%
Adverse	2	7	

*PIERS = Pre-eclampsia Integrated Estimate of RiSk

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