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Original research article

Study on prediction of hypertensive disorders of pregnancy using gestosis score

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Abstract

Background: Hypertensive disorders in pregnancy are rising at an increasing pace worldwide. Identification of pregnant females who are at risk for developing the life threating disorders like eclampsia and pre-eclampsia is the need of hour. Assessment of risk factors and scoring them using the HDP gestosis score can identify the "at risk " patients so as to provide special attention and care. **Materials and Methods:** A total of 250 pregnant women were included in this prospective observational study which was conducted in the Department of Obstetrics and Gynaecology of Kamineni Academy of Medical Sciences and Research Centre, L.B. Nagar, Hyderabad, over a period of 2 years.

Results: Gestosis score (> = 3) carried sensitivity, specificity, PPV, and NPV of 81.5%, 71.7%, 25.9%, and 97%, respectively, for predicting the development of PE.

Conclusion: The study holds importance in raising the awareness of the prevalence of PE and how a simple scoring system may be able to predict the development of pre-eclampsia—thereby providing an opportunity of adequate management of the patients to curb adverse outcomes associated with PE.

Keywords: pre- eclampsia, eclampsia, hypertensive disorders of pregnancy, gestosis score.

Introduction

Hypertensive disorders of pregnancy is a spectrum of disorders ranging from plain gestational hypertension to life threatening multiorgan involving disorders like pre-eclampsia, eclampsia and HELLP syndrome.

The American College of Obstetrics and Gynaecology (ACOG), defined gestational hypertension as systolic blood pressure of ≥140 mmHg or diastolic blood pressure of ≥90mmHg on two instances of at least four hours apart, after 20 weeks of gestation of pregnancy in previously normotensive women. When this high blood pressure is associated with proteinuria, it is known as preeclampsia [1]. Eclampsia is the occurrence of seizures in pre-eclampsia.

Pre-eclampsia (PE) is one of the commonest complications of pregnancy, with an incidence of preeclampsia was found to be 10.3% (NER-2013). Incidence of eclampsia is 1.9% out of which more than 50% of the cases are antepartum, and approximately 13% of the cases occurred post-partum. Maternal Mortality attributed to eclampsia is 4-6%.

Severe preeclampsia and these complications are the major causes of maternal and perinatal morbidity and mortality. Among all maternal deaths 19% deaths are due to hypertension in pregnancy (WHO 2014) [1] despite the phenomenal numbers of mothers seeking hospital-based delivery care, substantial gap is identified in the quality of care executed.

Many maternal risk factors have been identified to be cause pre-eclampsia, some of which include higher age, parity, comorbidities, family history, any significant previous personal history, investigation parameters like thyroid profile, and certain systemic conditions. Considering all of them into account and devising a scoring system for predicting hypertensive disorders in pregnancy were the need of the hour, especially for countries with limited resources and lack of testing facility [2, 4].

One such scoring system is the HDP Gestosis score is developed by Dr. Gorakh Mandrupkar and modified by committee that includes Dr. Sanjay Gupte, Dr. Suchitra Pandit, Dr. Alpesh Gandhi and Dr. Girisha Wagh.

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It is a simplified, dynamic and feasible quantification scoring system of maternal risk factors for effectively screening hypertensive disorders of pregnancy.
Each clinical risk factor is given a score of 1, 2, or 3 based on its severity in the development of preeclampsia. A total score is obtained from detailed history and examination of the woman.
When a pregnant woman's total score is $\geq$ 3, she was labeled as "at risk for pre-eclampsia [5]".

Table 1: HDP Gestosis Score

Risk factor	Score
Age > 35 years	1
Age < 19 years	1
Maternal anemia	1
Obesity (BMI > 30)	1
Primigravida	1
Short duration of sperm exposure (cohabitation)	1
Woman born as small for gestational age	1
Family history of cardiovascular disease	1
Polycystic ovary syndrome	1
Inter pregnancy interval more than 7 years	1
Conceived with Assisted Reproductive (IVF/ ICSI) Treatment	1
MAP > 85 mm of Hg	1
Chronic vascular disease (Dyslipidemia)	1
Excessive weight gain during pregnancy	1
Maternal hypothyroidism	2
Family history of preeclampsia	2
Gestational diabetes mellitus	2
Obesity (BMI > 35 kg/m^2)	2
Multifetal pregnancy	2
Hypertensive disease during previous pregnancy	2
Pregestational diabetes mellitus	3
Chronic hypertension	3
Mental disorders	3
Inherited/Acquired Thrombophilia	3
Maternal chronic kidney disease	3
Autoimmune disease(SLE/APLAS/RA)	3
Pregnancy with Assisted reproductive Treatment	3

The literature on identifying risk factors in clinical setting using a scoring system is very scarce. Hence, this study was done to assess number of pregnancies falling in to the category of "at risk for pre- eclampsia" by using Gestosis score.

Materials and Methods

This prospective observational study was conducted in the department of Obstetrics and Gynaecology of Kamineni Academy of Medical Sciences and Research Centre, L.B. Nagar, Hyderabad. The study was conducted over 2 years (March 2021 to march 2023) and it included all the pregnant women attending the antenatal outpatient department in their 1st trimester. Pregnant patients with COVID-19 disease, malignancy, liver disease, intake of alcohol, smoking, substance abuse, loss to follow up were excluded**.** A total of 250 pregnant females were included in this study after taking their written informed consent. Risk factor assessment was done at first visit, then at 12 weeks, at 24 weeks, and at 36 weeks of gestation and at each visit, the clinical risk factor given by HDP- gestosis score was assesed. The mean arterial pressure (MAP) and amount of weight gain was also assessed. Scoring was done and risk category was allotted to each patient. Women were followed throughout the entire course of pregnancy, during labour and up to 6 weeks postpartum to look for development of HDP.
Other routine antenatal investigations like hematological (complete blood picture, renal function tests, liver function tests, etc.), and radiological (antenatal USG and Doppler) were done.
Post-partum, the details of baby such as birth weight, Apgar score, need of NICU admission were taken.
Score of 1, 2 and 3 was allotted to each clinical risk factor as per its severity in development of preeclampsia. When total score was $\geq$ 3; pregnant woman were marked as 'At risk for pre-eclampsia'. Women who were classified into "At risk" category were given 75mg of Aspirin [6] daily (to be started from as early as 12 weeks [7] gestational age ideally) along with Calcium 1 gram [8].

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The final data were entered in Microsoft EXCEL spreadsheet and analyzed by "SPSS (Statistical Package for The Social Sciences) version 21.0". A *p*-value of < 0.05 was considered statistically significant. The data presentation was done in the form of frequency numbers or percentages with mean (SD) and median values. Fisher's test or Chi-Square test was used for determining the association between variables. Sensitivity (Sn), Specificity (Sp), Positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of HDP-gestosis score for predicting the development of PE was determined.

Results

Most of the pregnant women belonged to 21- 25 years of age (n= 107; 42.8%). There were 8 females above 35 years of age and 7 females below 20 years of age.

38% of the pregnant patients were primigravida and 62% were multigravida.

Out of the 250 females, 27 (10.8%) females had BP at first visit ≥ 140 / 90 mmHg and the rest 89.2% females were normotensive.

The mean age, gestational age, and BMI of the enrolled women were 26.6±3.98 years, 11.2±1.04 weeks, and 21.7±1.99 kg/m2, respectively. The mean SBP and DBP were 102.6±9.05 mm Hg and 69.4±7.50 mm Hg, respectively.

Table 2: Demographic Characteristics

Demographic characteristics	Mean ± SD/ n (%)
Age (years)	26.6±3.98
Age groups (years)	
<20	07 (2.80)
21-25	107 (42.8)
26-30	97 (38.8)
31-35	31 (12.4)
>36	08 (3.20)
Gestational age (weeks)	11.2±1.02
Gravida	95 (38.0)
Primi Multi	155 (62.0)
BMI (Kg/m2)	21.7±1.99
SBP (mmHg)	102. 6±9.05%
DBP(mmHg)	69.4±7.50%

Table 3: Demographic Variables at Each Visit

Variables	1st visit (Mean ± SD)	2nd visit (12 WKS GA (Mean ± SD)	3rd visit (24 WKS GA) (Mean ± SD)	4th visit (32 wks GA) (Mean ± SD)
Gestosis score	0.85±1.07	1.53±1.26	2.16±1.40	2.43±1.07
BMI (kg/m)	21.7±1.99	21.9±1.98	24.9±1.88	27.9±2.29
SBP (mmHg)	102.6±9.05	103.2±8.84	104.8±8.69	107.1±12.8
DBP (mmHg)	69.4±7.50	72.9±6.62	72.4±6.97	74.7±8.88

Table 4: Distribution of Study Subjects Based on Risk Factors

Risk factor	No. of pregnant women	% of Association
GDM	7	2.8%
MAP>85	25	10%
BMI>30	11	4.4%
PIH in previous pregnancy	4	1.6%
Pre gestational DM	2	0.8%
Chronic HTN	1	0.4%
hypothyroidism	13	5.2%
Anemia	3	1.2%
ART	1	0.4%
Multiple pregnancy	1	0.4%
PCOD	1	0.4%

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Among the risk factors identified, most commonly found risk factors were MAP > 85 mmHg during their first visit (10%) and hypothyroidism (5.2%).

Table 5: Distribution of Study Subjects Based on Proteinuria

Proteinuria	1st visit	2nd visit	3rd visit	4th visit
Absent	242 (96.8%)	245 (98%)	240 (96%)	231 (92.4%)
1+	06 (2.4%)	05 (2%)	09 (3.6%)	10 (4%)
2+	02 (0.8%)	0 (0%)	1 (0.4%)	0 (0%)
3+	0 (0%)	0 (0%)	0 (0%)	2 (0.8%)
Total	250 (100.0)	250 (100.0)	250 (100.0)	250 (100.0)

96.85 had no proteinuria during 1st visit; however by end of last visit the number reduced to 92.4%. At last visit 0.8% had 3+ proteinuria.

Table 6: Distribution of Study Subjects Based on Gestosis Score

Gestosis score	1st visit	2nd visit	3rd visit	4th visit
0	114 (45.6%)	60 (24%)	18 (7.20%)	14 (5.60%)
1	93 (37.2%)	67 (26.8%)	64 (25.6%)	52 (20.8%)
2	21 (8.40%)	76 (30.4%)	97 (38.8%)	99 (39.6%)
≥3	22 (8.80%)	47 (18.8%)	71 (28.4%)	85 (34%)
Total	250 (100.0)	250 (100.0)	250 (100.0)	250 (100.0)

Gestosis score > 3 at first visit was seen in 8.8% of female patients and by 4th visit, the number increased to 34%. During the follow-up, PE developed in 10.8% ($n = 27$) participants.

Table 7: Association of Age Groups and Parity with Development of Preeclampsia

Age group	Pre-eclampsia n (%)							
	1st Visit (YES)	1st Visit (NO)	2nd Visit (YES)	2nd Visit (NO)	3rd Visit (YES)	3rd Visit (NO)	4th Visit (YES)	4th Visit (NO)
<20yrs	0	7 (2.8%)	0	7 (2.8%)	0	7 (2.8%)	1 (3.7%)	6 (2.7%)
21-25yrs	0	107 (42.8%)	0	107 (42.8%)	0	107 (42.8%)	14 (51.9%)	93 (41.7%)
26-30yrs		97 (38.8%)	0	97 (38.8%)	0	97 (38.8%)	8 (29.6%)	89 (39.9%)
31-35yrs	0	31 (12.4%)	0	31 (12.4%)	0	31 (12.4%)	3 (11.1)	28 (12.6)
>36yrs	0	8 (3.2%)	0	8 (3.2%)	0	8 (3.2%)	1 (3.7%)	7 (3.1%)
Total	0	250 (100%)	0	250 (100%)	0	250 (100%)	27 (100%)	223 (100%)
Parity	Pre- eclampsia n (%)							
Primi	0	95 (38.0)	0	95 (38.0)	0	95 (38.0)	14 (51.9)	81 (36.3)
Multi	0	155 (62.0)	0	155 (62.0)	0	155 (62.0)	13 (48.1)	142 (63.7)
Total	0	250 (100.0)	0	250 (100.0)	0	250 (100.0)	27(100.0)	223 (100.0)

Among the 27 women developing Pre- eclampsia, 20 were correctly predicted by HDP-gestosis score > = 3, while out of the remaining 7 cases of Preeclampsia, four patients had HDP-gestosis score of 2 and three patients had HDP-gestosis score of 1.

For the HDP-gestosis score of > = 3, true positives were 20, false positives were 48 and false negatives were 7. Based on it, the Sensitivity, Specificity, PPV, NPV and Diagnostic accuracy of HDP-gestosis score (> = 3) for predicting PE were 81.5%, 71.7%, 25.9%, 97% and 72.8% respectively. Taking the HDP-gestosis score cutoff of 2 or more (moderate), the Sensitivity, Specificity, PPV and NPV and diagnostic accuracy were 100%, 29.6%, 14.7% and 100%, and 37.2% respectively.

Table 8: Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of Gestosis score for predicting pre-eclampsia

Variables	Gestosis score of ≥2	Gestosis score of ≥3
Sensitivity (%)	100.0	81.5
Specificity (%)	29.6	71.7
Positive predictive Value (%)	14.7	25.9

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Negative predictive Value (%)	100.0	97.0
Diagnostic accuracy (%)	37.2	72.8

Discussion

In present study, the prevalence of PE was 10.8%. Recently, Mou *et al* [9] found that the overall prevalence rate of PE was 14.4%. In a recent study, the lower rate of prevalence of PE was reported in Sweden and China (3.98% and 4.02%, respectively) [10]. Mayrink *et al* [11] found that PE was present in 7.5% participants. Similarly, Mishra *et al* [12]. Also reported incidence of HDP to be 15.4% among Indian women. Overall, PE ranges from 3 to 16% and is more common in the developing countries.

We found that HDP- gestosis score > = 3 carried a sensitivity of 81.5% for predicting pre-eclampsia. This remains of use since for screening such high values may hold importance from the point of view of management. Though HDP-gestosis score > = 2 carried a higher sensitivity of 100%, but the specificity fell short to 29.6% in comparison to HDP-gestosis score > = 3 which showed a specificity of 71.7% for predicting PE- thereby indicating that HDP- gestosis score > = 3 very accurately rules out the development of PE.

Factors significantly associated with PE included MAP > 85 mmHg, BMI >30 kg/m2, age > 35 years, maternal hypothyroidism, primigravida, PIH in previous pregnancy, GDM.

The literature search shows that one such screening scoring system is already validated in the international community which inculcate mean arterial pressure (MAP), uterine artery PI (UTPI) and serum PLGF [13] (or PAPP-A when PLGF is not available). Gestosis score differs from this in avoiding the USG or biomarkers and making the scoring easy at the grassroot level by inculcating the maternal history and baseline tests.

The study holds strength in validating a scoring system that can be routinely applied in the obstetric practice. The study results must be interpreted under limitations of being a single centre study with no association of feto-maternal outcomes with gestosis score.

Conclusion

In conclusion, gestosis score seems to be a novel early marker with diagnostic accuracy of 72.8% for prediction of the development of PE allowing for a prompt management for the patients, thereby allowing to curb the adverse consequences.

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