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To Study of Diagnostic Accuracy of The History Based HDP Gestosis Score In Pre-Eclampsia Patients

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Abstract

Background: Pre-eclampsia stands out among the hypertensive disorders for its impact on maternal and neonatal health. It is one of the leading causes of maternal and perinatal mortality and morbidity worldwide.

Aim: To study of diagnostic accuracy of the history based HDP Gestosis score.

Materials and Methods: This is a Retrospective Case Control Study conducted at the Department of obstetrics & gynecology of Dr. Baba Saheb Ambedkar Medical College & Hospital, Sector-6, Rohini, New Delhi for a duration of 1 year. Women admitted in post-natal ward of Dr BSA hospital diagnosed with and without preeclampsia satisfying the inclusion and exclusion criteria categorized in 2 groups case (group A) and control (group B). Case was defined as a woman delivered within the preceding two days and diagnosed by the obstetrician as being preeclamptic as per ISSHP4 definition. Control was a normotensive woman delivering within the preceding two days. Study subjects on aspirin during pregnancy, delivery before 24 weeks of gestation & Unconscious subject (unable to provide information) were excluded. Their ANC records and previous medical records were analyzed.

Results: Risk of pre-eclampsia was lower in age group 21-30 years and 31-40 years with odds ratio of 0.019(0.003 to 0.104) and 0.119(0.021 to 0.684) respectively. Median (25th-75th percentile) of gestosis score in group A was 18.5(14.75-23) which was significantly higher as compared to group B (2(1-2)). (p value <.0001). Women with high gestosis score had significantly high risk of pre-eclampsia with odds ratio of 11.521(1.363 to 1.698).

Conclusion: Women with high gestosis score had significantly high risk of pre-eclampsia with odds ratio of 11.521(1.363 to 1.698). Gestosis score is a significant predictor of pre-eclampsia with a Sensitivity of 90.18%, Specificity of 99.11% and Diagnostic accuracy of 94.64%.

Keywords: Gestosis score; Pre-eclampsia; Hypertensive disorder; Maternal death; Gestational hypertension

Introduction

Hypertensive disorders of pregnancy are an important cause of maternal and perinatal morbidity and mortality in developing countries like India. Pre-eclampsia stands out among the hypertensive disorders for its impact on maternal and neonatal health. It is one of the leading causes of maternal and perinatal mortality and morbidity worldwide. Incidence of pre-eclampsia was found to be 10.3% (*NER* 2013) [1]. The incidence of eclampsia is 1.9%. These numbers of PE are higher as compared to the developed countries of North America and Europe, where it is estimated to be about 5–7 cases per 10,000 deliveries [2].

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Hypertensive disorders of pregnancy are the second only to hemorrhage as a cause of maternal mortality and are responsible for 14% of maternal *deaths* [3]. According to the International Society for the Study of Hypertension in Pregnancy (ISSHP), Preeclampsia is gestational hypertension accompanied by one or more of the following new-onset conditions at or after 20 weeks gestation [4].

1. Proteinuria
2. Other maternal organ dysfunction, including:
   a) Acute kidney injury (creatinine 1 mg/dL) or elevated transaminases (e.g. ALT or AST > 40 IU/L) with or without right upper quadrant or epigastric abdominal pain.
   b) Neurological complications (examples include eclampsia, altered mental status, blindness, stroke, clonus, severe headaches, persistent visual scotomata).
   c) Hematological complications (platelet count below 150,000/μL, DIC, hemolysis)
3. Uteroplacental dysfunction (such as fetal growth restriction, abnormal umbilical artery Doppler wave form analysis, or stillbirth)

Research to specifically identify risk factors for the occurrence of pre-eclampsia among pregnant women in developing countries is of paramount importance. Although the incidence of pre-eclampsia and associated mortality and morbidity continue to be higher in India as compared to developed world, there is limited research on the predictors.

There is a growing interest in the first trimester predictions of pre-eclampsia so that early medical attention can be provided for optimal effects. Variety of predictors are being developed at present. However, it is worthy of note that the Fetal Medicine Foundation (FMF) [5,6] first trimester prediction model has undergone successful internal and external validation. The FMF triple test has detection rates of 90% and 75% for the prediction of early and preterm preeclampsia, respectively [7]. However, in resource constraint set ups in developing nations, FMF [5,6] prediction model is of limited value as it requires Doppler study and biochemical markers. A simple risk model HDP GESTOSIS SCORE has been proposed by FOGSI8 wherein score 1, 2 and 3 are allotted to each of the clinical risk factors as per its severity in development of pre-eclampsia. When total score is >/3, pregnant women should be marked as "At risk for pre-eclampsia". Only a few studies [9,10] have validated the HDP Gestosis score as a predictor of preeclampsia. In present study, diagnostic accuracy of the history based HDP Gestosis score developed by FOGSI [8] has been assessed in our population.

Material and Methods

This is a Retrospective Case Control Study conducted at the Department of obstetrics & gynecology of Dr. Baba Saheb Ambedkar Medical College & Hospital, Sector-6, Rohini, New Delhi for a duration of 1 year.

Women admitted in post-natal ward of Dr BSA hospital diagnosed with and without preeclampsia satisfying the inclusion and exclusion criteria categorized in 2 groups case (group A) and control (group B). Case was defined as a woman delivered within the preceding two days and diagnosed by the obstetrician as being preeclamptic as per ISSHP4 definition. Control was a normotensive woman delivering within the preceding two days. Study subjects on aspirin

Table 1: HDP Gestosis Score Risk Assessment

S No	RISK FACTOR	SCORE
1	Age older than 35 years	1
2	Age younger than 19 years	1
3	Maternal Anemia	1
4	Obesity (BMI >30)	1
5	Primigravida	1
6	Short duration of sperm exposure (cohabitation)	1
7	Woman born as small for gestational age	1
8	Family history of cardiovascular disease	1
9	Polycystic ovary syndrome	1
10	Inter pregnancy interval more than 7 years	1
11	Conceived with Assisted Reproductive (IVF/ ICSI) Treatment	1
12	MAP>85 mm of Hg	1
13	Chronic vascular disease (Dyslipidemia)	1
14	Excessive weight gain during pregnancy	1
15	Maternal hypothyroidism	2
16	Family history of pre-eclampsia	2
17	Gestational diabetes mellitus	2
18	Obesity (BMI > 35 kg/M2)	2
19	Multifetal pregnancy	2
20	Hypertensive disease during previous pregnancy	2
21	Pregestational diabetes mellitus	3
22	Chronic hypertension	3
23	Mental disorders	3
24	Inherited / Acquired Thrombophilia	3
25	Maternal chronic kidney disease	3
26	Autoimmune disease (SLE / APLAS / RA)	3
27	Pregnancy with Assisted Reproductive (OD or Surrogacy) Treatment	3

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during pregnancy, delivery before 24 weeks of gestation & Unconscious subject (unable to provide information) were excluded. Their ANC records and previous medical records were analyzed.

HDP GESTOSIS SCORE [8] has been developed by FOGSI-GESTOSIS-ICOG 2019.This score takes into account all of the pregnant woman's existing and emerging risk factors. Each clinical risk factor is assigned a score of 1, 2, or 3 based on its severity in the development of preeclampsia (table 1). A total score is obtained from time to time through careful history and assessment of the woman. When the total score is =/> 3, the pregnant woman should be labelled as 'At Risk for Preeclampsia'.

The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM

Table 2: Association of demographic characteristics with group A and B.

Demographic characteristics	Group A(n=112)	Group B(n=112)	Total	P value	Odds ratio(95% CI)
Age(years)					
18-20	29 (25.89%)	1 (0.89%)	30 (13.39%)	<.0001†	1
21-30	33 (29.46%)	90 (80.36%)	123 (54.91%)		0.019(0.003 to 0.104)
31-40	50 (44.64%)	21 (18.75%)	71 (31.70%)		0.119(0.021 to 0.684)
Mean ± SD	29.34 ± 7.49	28.26 ± 2.61	28.8 ± 5.63	0.062‡	1.035(0.987 to 1.085)
Median(25th-75th percentile)	30(20-36)	28(27-30)	29(26-32)		
Range	18-40	18-35	18-40		
Education of wife					
Illiterate	25 (22.32%)	0 (0%)	25 (11.16%)	<.0001*	1
Primary school	17 (15.18%)	52 (46.43%)	69 (30.80%)		0.007(0.000 to 0.119)
Secondary school	65 (58.04%)	58 (51.79%)	123 (54.91%)		0.022(0.001 to 0.390)
Graduate/post graduate	5 (4.46%)	2 (1.79%)	7 (3.13%)		0.043(0.002 to 1.137)
Education of husband					
Illiterate	10 (8.93%)	0 (0%)	10 (4.46%)	<.0001†	1
Primary school	10 (8.93%)	0 (0%)	10 (4.46%)		1(0.015 to 68.057)
Secondary school	79 (70.54%)	101 (90.18%)	180 (80.36%)		0.037(0.002 to 0.743)
Graduate/post graduate	13 (11.61%)	11 (9.82%)	24 (10.71%)		0.056(0.003 to 1.221)
Occupation of wife					
Home maker	106 (94.64%)	110 (98.21%)	216 (96.43%)	0.213*	1
Job	3 (2.68%)	2 (1.79%)	5 (2.23%)		2.091(0.321 to 13.605)
Labour	3 (2.68%)	0 (0%)	3 (1.34%)		31.109(0.055 to 17496.255)
Occupation of husband					
Driver	2 (1.79%)	0 (0%)	2 (0.89%)	0.386*	1
Labour	51 (45.54%)	56 (50%)	107 (47.77%)		0.038(0 to 38.157)
Private job	59 (52.68%)	56 (50%)	115 (51.34%)		0.048(0 to 47.87)
Income(/month)					
Mean ± SD	9938.39 ± 5312.42	16428.57 ± 3502.16	13183.48 ± 5543.51	<.0001‡	0.99(0.998 to 0.999)
Median(25th-75th percentile)	10000(5000-14000)	17000(15000-19000)	15000(10000-18000)		
Range	1000-21000	5000-22000	1000-22000		
Area of residence					
Rural	56 (50%)	59 (52.68%)	115 (51.34%)	0.688†	1
Urban	56 (50%)	53 (47.32%)	109(48.66%)		1.113(0.659 to 1.880)
Socioeconomic class					
Lower middle	51 (45.54%)	51 (45.54%)	102 (45.54%)	0.16†	1
Upper lower	42 (37.50%)	51 (45.54%)	93 (41.52%)		0.82(0.467 to 1.441)
Lower	19 (16.96%)	10 (8.93%)	29 (12.95%)		1.89(0.801 to 4.456)

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manufacturer, Chicago, USA, version 25.0. For statistical significance, p value of less than 0.05 was considered statistically significant.

Results

112 women delivered within the preceding two days and diagnosed by the obstetrician as being preeclamptic as per ISSHP4 definition were included as cases {Group A} and 112 women delivered within the preceding two days and was not diagnosed with pre-eclampsia were included as controls {Group B}. Clinico-demographic risk factors were assessed and results are described in Table 2.

Proportion of women of age group:- 31-40 years was significantly higher in group A as compared to group B. (31-40 years:- 44.64% vs 18.75% respectively). Proportion of women of age group:- 21-30 years was significantly lower in group A as compared to group B. (21-30:- 29.46% vs 80.36% respectively). (p value <0.0001) After taking 18-20 years as reference, risk of pre-eclampsia was lower in age group 21-30 years and 31-40 years with odds ratio of 0.019(0.003 to 0.104) and 0.119(0.021 to 0.684) respectively.

Association of Maternal baseline characteristics with group A and group B have been described in Table 3.

Proportion of women born as SGA was significantly higher in group A as compared to group B. (58.93% vs 12.50% respectively). (p value <0.0001) Proportion of women born as SGA had significantly high risk of pre-eclampsia with odds ratio of 9.715(4.97 to 18.989).

Distribution of physical activity was comparable with group A and B. (Light:- 37.50% vs 46.43% respectively, Moderate:- 44.64% vs 42.86% respectively, Heavy:- 17.86% vs 10.71% respectively) (p value=0.212).

Table 3: Association of maternal baseline characteristics with group A and group B.

Maternal baseline characteristics	Group A(n=112)	Group B(n=112)	Total	P value	Odds ratio(95% CI)
Women born as SGA	66 (58.93%)	14 (12.50%)	80 (35.71%)	<.0001†	9.715(4.97 to 18.989)
Conceive with ART or not	39 (34.82%)	18 (16.07%)	57 (25.45%)	0.001†	2.749(1.456 to 5.19)
Physical activity					
Light	42 (37.50%)	52 (46.43%)	94 (41.96%)	0.212†	1
Moderate	50 (44.64%)	48 (42.86%)	98 (43.75%)		1.294(0.733 to 2.282)
Heavy	20 (17.86%)	12 (10.71%)	32 (14.29%)		2.062(0.906 to 4.697)
Body mass index(kg/m²)					
<18.5 kg/m² {Underweight}	4 (3.57%)	3 (2.68%)	7 (3.13%)	<.0001*	4.056(0.796 to 20.672)
18.5 to 22.99 kg/m² {Normal BMI}	12 (10.71%)	38 (33.93%)	50 (22.32%)		1
23 to 24.99 kg/m² {Overweight}	14 (12.50%)	36 (32.14%)	50 (22.32%)		1.205(0.494 to 2.939)
>=25 kg/m² {Obese}	82 (73.21%)	35 (31.25%)	117 (52.23%)		7.23(3.394 to 15.4)
Mean ± SD	27.37 ± 4.58	23.45 ± 2.63	25.41 ± 4.21	<.0001‡	1.336(1.22 to 1.463)
Median(25th-75th percentile)	28(24.75-30)	23(22-25)	25(22.225-28.25)		
Range	14.2-40.5	18-31	14.2-40.5		
Multi fetal pregnancy	45 (40.18%)	12 (10.71%)	57 (25.45%)	<.0001†	5.416(2.681 to 10.942)
Gestational weight gain(kg)					
Mean ± SD	14.99 ± 3.25	11.24 ± 0.91	13.12 ± 3.03	<.0001‡	2.67(2.021 to 3.527)
Median (25th-75th percentile)	15(13-17)	11(10.75-12)	12(11-15)		
Range	May-30	Sep-14	May-30		
Smoking habit	37 (33.04%)	32 (28.57%)	69 (30.80%)	0.469†	1.233(0.698 to 2.177)
Food habit					
Non vegetarian	86 (76.79%)	32 (28.57%)	118 (52.68%)	<.0001†	1
Vegetarian	26 (23.21%)	80 (71.43%)	106 (47.32%)		8.082(4.441 to 14.708)

‡ Mann Whitney test, * Fisher's exact test, † Chi square test

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Proportion of women with body mass index (kg/m²):- <18.5 kg/m² {Underweight}, >=25 kg/m² {Obese} was significantly higher in group A as compared to group B. (<18.5 kg/m² {Underweight}:- 3.57% vs 2.68% respectively, >=25 kg/m² {Obese}:- 73.21% vs 31.25% respectively). Proportion of women with body mass index (kg/m²):- 18.5 to 22.99 kg/m² {Normal BMI} was significantly lower in group A as compared to group B. (18.5 to 22.99 kg/m² {Normal BMI}:- 10.71% vs 33.93% respectively). (p value <0.0001) After taking normal BMI as reference, risk of pre-eclampsia was higher in <18.5 kg/m² {Underweight}, 23 to 24.99 kg/m² {Overweight} and >=25 kg/m² {Obese} with odds ratio of 4.056(0.796 to 20.672), 1.205(0.494 to 2.939), 7.23(3.394 to 15.4) respectively.

Table 4: Association of gestosis score with group A and B.

Gestosis score	Group A(n=112)	Group B(n=112)	Total	P value	Odds ratio(95% CI)
Mean ± SD	18.23 ± 7.04	2.17 ± 2.1	10.2 ± 9.58	<.0001‡	1.521(1.363 to 1.698)
Median(25th-75th percentile)	18.5(14.75-23)	2(1-2)	4.5(2-18.25)		
Range	Feb-32	0-12	0-32		

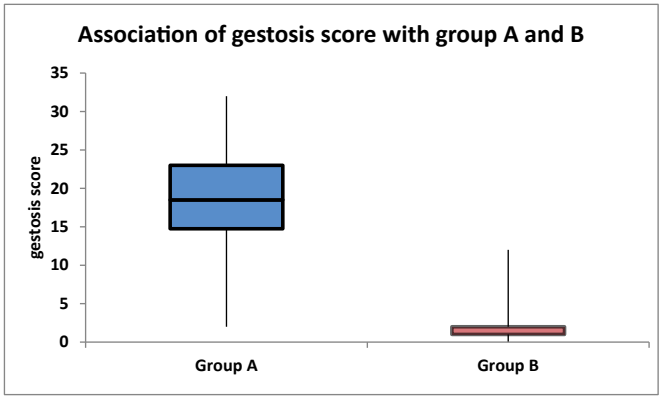

Figure 1: Association of gestosis score with group A and B.(non-parametric variable, Box-whisker plot).

Distribution of smoking habit was comparable with group A and B. (No:- 66.96% vs 71.43% respectively, Yes:- 33.04% vs 28.57% respectively) (p value=0.469).

Association of HDP GESTOSIS SCORE with the groups A and B has been described in Table 4.

Table 5: Receiver operating characteristic curve of Gestosis score for predicting pre-eclampsia.

Variables	Gestosis score
Area under the ROC curve (AUC)	0.968
Standard Error	0.0105
95% Confidence interval	0.936 to 0.987
P value	<0.0001
Cut off	>9
Sensitivity(95% CI)	90.18%(83.1 - 95.0%)
Specificity(95% CI)	99.11%(95.1 - 100.0%)
PPV(95% CI)	99%(94.7 - 100.0%)
NPV(95% CI)	91%(84.4 - 95.4%)
Diagnostic accuracy	94.64%

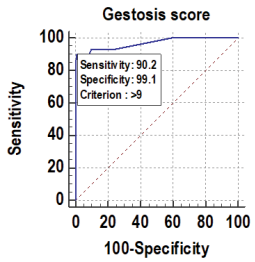

Figure 2: Receiver operating characteristic curve of Gestosis score for predicting pre-eclampsia.

Median(25th-75th percentile) of gestosis score in group A was 18.5(14.75-23) which was significantly higher as compared to group B (2(1-2)). (p value <.0001)Women with high gestosis score had significantly high risk of pre-eclampsia with odds ratio of 11.521(1.363 to 1.698) as shown in figure 1.

Interpretation of the area under the ROC curve showed that the performance of gestosis score (AUC 0.968; 95% CI: 0.936 to 0.987) was outstanding. Gestosis score was the significant predictor of pre-eclampsia at cut off point of >9 with area under curve of 0.968 for correctly predicting pre-eclampsia. Among the women who had pre-eclampsia, 90.18% of women had gestosis score >9. If gestosis score >9, then there was 99.00% probability of pre-eclampsia and if Gestosis score<=9, then 91.00% chances of no pre-

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Table 6: Multivariate step wise forward logistic regression to find out independent significant risk factors of pre-eclampsia.

Variables	Beta coefficient	Standard error	P value	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Perceived stress scale	0.247	0.067	0	1.281	1.123	1.46
History of hypertension disorder in previous pregnancy	3.918	0.895	<0.0001	50.294	8.696	290.87
GDM	2.052	0.896	0.022	7.784	1.345	45.062
Family history of pre eclampsia	1.655	0.933	0.076	5.233	0.84	32.591
Maternal hypothyroid	1.343	0.773	0.082	3.831	0.842	17.439
Autoimmune disease	1.732	1.054	0.1	5.651	0.716	44.63
Food habit						
Vegetarian				1		
Non vegetarian	1.971	0.73128	0.007	7.178	30.095	1.712

eclampsia. Among women who did not have pre-eclampsia, 99.11% of women had Gestosis score<=9 as shown in table 5 & Figure 2.

On performing multivariate regression, perceived stress scale, history of hypertension disorder in previous pregnancy, GDM, family history of pre-eclampsia, maternal hypothyroid, autoimmune disease, food habit: non vegetarian were significant independent risk factors of pre-eclampsia after adjusting for confounding factors. With the increase in perceived stress scale, history of hypertension disorder in previous pregnancy, GDM, family history of pre eclampsia, maternal hypothyroid, autoimmune disease, risk of pre-eclampsia significantly increases with adjusted odds ratio of 1.281(1.123 to 1.46), 50.294(8.696 to 290.87), 7.784(1.345 to 45.062), 5.233(0.84 to 32.591), 3.831(0.842 to 17.439), 5.651(0.716 to 44.63) respectively. Women with food habit: non vegetarian had significantly high risk of pre-eclampsia with adjusted odds ratio of 7.178(30.095 to 1.712) as shown in table 6.

Discussion

In the present study, after taking 18-20 years as reference, risk of pre-eclampsia was lower in age group 21-30 years and 31-40 years with odds ratio of 0.019(0.003 to 0.104) and 0.119(0.021 to 0.684) and 31-40 yr was significantly higher in group A as compared to Group B (44.64% vs 18.75%) which was similar to previous study done by Kumar [11] et al wherein the risk of preeclampsia was found to be four times higher in age less than 20yr. This might be due to inadequate antenatal care given to teenage pregnant girl Increased risk of preeclampsia in women with age more than 30 may be explained by the increased villous reaction.

The study done by Shamsi [12] et al in Pakistan observed no significant differences between cases and controls regarding the maternal age. However, Hou [13] et al found that age was positively correlated with the risk of hypertensive disorders of pregnancy, the relative risk was 1.356.

Women born as SGA (estimated fetal weight less than 10th centile) were significantly higher in group A as compared to group B. (58.93% vs 12.50% respectively) (p value <0.0001). our finding was supported by study conducted by Klebanoff [14] et al(AOR=1.8 95%CI 1.1-2.8) and Innes [15] et al in a case control study in New York city (p-0.025) stated that these findings are consistent with hypothesis that susceptibility to hypertension and related insulin resistance conditions may be programmed in utero,fetal growth may be important in etiology of PIH.

We found that the risk of preeclampsia was very high among women who conceived with ART as the women who conceived with ART were significantly higher in group A (34.82%) as compared to group B (16.07%) (p value=0.001). Similar significance was found in the study conducted by Omani-Samani [16] et al (p <0.001).

In our study Median (25th-75th percentile) of body mass index(kg/m²) in group A was 28(24.75-30) which was significantly higher as compared to group B 23(22-25) (p value <.0001). Study conducted by Luo [17] et al and Mishra [9] et al concluded that obesity was a high-risk factor for preeclampsia. In our study, group A women with more gestational weight gain (15 kg vs 12 kg) had significantly high risk of pre-eclampsia with odds ratio of 2.67(2.021 to 3.527).our finding supported by previous similar study done by Jaboi [18] et al(p-0.001)and Shao [19] etal (p-<0.0001).

Distribution of smoking habit was comparable with group A and B. (No:- 66.96% vs 71.43% respectively, Yes:- 33.04% vs 28.57% respectively) (p value=0.469).our finding supported by previous similar study conduct by Shamsi [12] etal (p-0.42)and Reyes [20] etal (p-0.274)as there is no significant difference among cases and control with regard to smoking habit as risk factor.

Gestosis score in group A was 18.5(14.75-23) which was significantly higher as compared to group B (2(1-2)). (p value <.0001)Women with high gestosis score had significantly high risk of pre-eclampsia with odds ratio of 11.521(1.363 to 1.698).our finding was supported by similar previous study

done by Mishra [9] et al where difference between mean scores was statistically significant with p value-<0.001and our study secondary objective was assessment of diagnostic accuracy of gestosis score found to be significant (diagnostic accuracy 94.64%) which was supported by similar previous study conducted by Gupta [10] etal for HDP8 gestosis score diagnostic accuracy 95.35%.

Conclusion

The present study has been undertaken to find the association between clinical and demographic risk factors and development of preeclampsia, as well as to assess diagnostic accuracy of HDP GESTOSIS SCORE in sample size of 224 women of which 112 women delivered within the preceding two days and diagnosed by the obstetrician as being preeclamptic as per ISSHP definition were included as cases {Group A} and 112 women delivered within the preceding two days and was not diagnosed with pre-eclampsia were included as controls {Group B}.

Women with high gestosis score had significantly high risk of pre-eclampsia with odds ratio of 11.521(1.363 to 1.698). Gestosis score is a significant predictor of pre-eclampsia with a Sensitivity of 90.18%, Specificity of 99.11% and Diagnostic accuracy of 94.64%. However, it is an exhaustive list of twenty-five risk factors and misses some crucial ones like dietary habits and mental stress found to be significantly associated with risk of preeclampsia.

Limitations

1. It was a Retrospective study and the sample size taken in the study was comparatively small.
2. Demographic limitation of women as our study conducted in government hospital and study population almost belong to lower middle and lower class.
3. It was single center hospital-based study and it cannot be generalized to whole population.
4. Risk scoring system developed using factors with strong independent association needs independent external validation.

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