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Original Research Article

Comparative evaluation of the gestosis score and uterine artery pulsatility index for predicting gestational hypertension: a prospective observational study

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ABSTRACT

Background: Hypertensive disorders of pregnancy (HDP) are a leading cause of maternal and perinatal morbidity, with gestational hypertension (GH) often posing diagnostic and prognostic challenges. Early identification of at-risk women is essential, particularly in resource-limited settings. The HDP-gestosis score and uterine artery pulsatility index (UtA-PI) have been proposed as potential screening tools for GH, but their predictive value requires further validation.
Methods: This prospective observational study was conducted at a tertiary care hospital in Jodhpur, India, including 140 pregnancies between 11 to 14 weeks of gestation. Baseline demographic, clinical, and obstetric details were recorded. Each participant underwent gestosis score calculation using a standardized application and bilateral uterine artery Doppler for UtA-PI measurement. Women were followed until delivery, and the development of GH, as defined by ACOG criteria, was documented.
Results: The mean gestosis score was significantly lower in women who subsequently developed GH compared to normotensive women (2.59±1.76 vs. 3.55±1.73; p=0.019), suggesting limited predictive consistency in this cohort. Mean UtA-PI was higher among women with GH (1.61±0.57 vs. 1.46±0.57), though this difference did not reach statistical significance (p=0.263).
Conclusions: Neither the gestosis score nor UtA-PI demonstrated robust standalone predictive performance for GH in this population. These findings highlight the need for contextual calibration of existing tools and suggest that multimodal approaches, combining clinical, biophysical, and biochemical parameters, may be more effective. Integration of validated scoring systems into routine antenatal surveillance could strengthen risk stratification, facilitate timely interventions, and improve maternal and perinatal outcomes.

Keywords: Gestational hypertension, Hypertensive disorders of pregnancy, Gestosis score, Uterine artery pulsatility index, UtA-PI, Antenatal screening

INTRODUCTION

Globally, hypertensive disorders of pregnancy (HDP) complicate approximately 5-10% of pregnancies, with an estimated 18 million affected women in 2019, representing a significant public health burden-particularly in low-resource settings. Mortality due to these conditions has declined but remains disproportionately high where antenatal detection is limited.[1] Among these, GH-defined as new-onset hypertension after 20 weeks of gestation in a previously normotensive woman without proteinuria or end-organ dysfunction-poses a particular challenge

because of its unpredictable progression to more severe conditions such as preeclampsia, eclampsia, and HELLP syndrome. Women with GH are at increased risk of intrauterine growth restriction, placental abruption, preterm delivery, and perinatal death, while long-term maternal risks include chronic hypertension and cardiovascular disease.[2] Despite improvements in antenatal care, early detection of women at risk remains suboptimal, particularly in low- and middle-income settings like India, where reported prevalence varies between 5% and 15% depending on region and healthcare.[3]

Several screening tools have been explored to improve early risk stratification. The gestosis score is a simple, history-based scoring system that incorporates maternal age, parity, comorbidities, and obstetric history to identify high-risk women. Recent Indian cohorts have reported promising performance, with sensitivity of 83-90% and specificity approaching 97-99% when a cutoff of ≥3 is used.[4,5] Its appeal lies in being low-cost, easy to implement, and independent of specialized technology-making it especially useful in resource-constrained settings. In contrast, the UtA-PI, derived from Doppler ultrasonography, reflects uteroplacental resistance and has been widely studied as a biophysical marker of impaired placentation. Elevated UtA-PI values, particularly when assessed in the first or early second trimester, have been shown to predict hypertensive disorders with moderate sensitivity (~60-75%) but higher specificity, especially when combined with mean arterial pressure and biochemical markers.[6,7]

Although both methods individually demonstrate predictive value, head-to-head comparisons are limited, particularly in the Indian subpopulation where practical considerations often dictate choice of screening strategy. The gestosis score reflects a risk-factor approach, while UtA-PI captures placental vascular physiology; each therefore offers insight into different aspects of disease pathogenesis. Given the significant maternal and neonatal burden of GH, and the need for context-appropriate screening tools, this study was undertaken to compare the diagnostic performance of the gestosis score and UtA-PI in predicting GH in a tertiary care setting in Jodhpur. The findings aim to generate locally relevant evidence that may guide antenatal screening protocols and improve outcomes.

METHODS

This was a prospective observational study conducted in the Department of Obstetrics and Gynaecology at SN Medical College and Associated Group of Hospitals, Jodhpur, after obtaining approval from the institutional ethics committee. Pregnant women attending the antenatal clinic between February 2025 and July 2025, were enrolled after providing informed written consent. Inclusion criteria were pregnancies between 11 to 14 weeks of gestation, confirmed by dating ultrasound. Women with multiple gestation, chronic hypertension, renal disease, diabetes mellitus, or other major systemic illnesses were excluded.

The sample size was estimated to be 131, rounded to 140, considering an expected sensitivity of the gestosis score of 83%.[5] The calculation was performed using the formula-

$$n = (Z(1-\alpha))^2 \times Sn(100-Sn)/P$$

With Z=1.96 for a 95% confidence level, prevalence (P) of preeclampsia assumed at 15%, and a relative allowable error of 20% of sensitivity (16.6%). A purposive, non-randomized sampling technique was adopted.

Data were collected using a pre-coded structured questionnaire comprising five sections: (i) socio-demographic details, (ii) gestosis score assessment, (iii) UtA-PI, (iv) thyroid profile and laboratory investigations, and (v) blood pressure monitoring with clinical follow-up. For each participant, detailed demographic and obstetric history was recorded, and the gestosis score was calculated using HDP- gestosis score mobile application, utilizing predefined risk factors, including age, parity, body mass index, family history of hypertension, and previous obstetric complications. A score of ≥3 was considered high risk for development of GH. On the same visit, UtA-PI values were measured using ultrasonography. The uterine artery was identified at the apparent crossover with the external iliac artery, and the mean PI was calculated from bilateral measurements. A mean PI >95th percentile for gestational age was taken as abnormal.

Participants were followed up throughout pregnancy with routine antenatal care until delivery. The primary outcome was the development of GH, defined as new-onset hypertension (≥140/90 mmHg) after 20 weeks of gestation in a previously normotensive woman, as per the American college of obstetricians and gynecologists (ACOG) criteria. Data were entered in a predesigned proforma and subsequently analyzed using SPSS software (version 26). Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of both gestosis score and uterine artery PI were calculated, and their predictive performance was compared using receiver operating characteristic (ROC) curve analysis. The survey tools and protocols were pilot-tested for face validity among ten eligible antenatal volunteers at study center, and appropriate modifications were incorporated based on their feedback.

RESULTS

Baseline characteristics of study population

Among 140 pregnant women enrolled, the largest proportion (38.6%) were aged >30 years, followed by 34.3% in the 25–30-year range and 27.1% aged <25 years. Regarding gravida distribution, primigravidae comprised

31.4% of participants, while multigravidae were nearly evenly distributed across gravida 2 (23.6%), gravida 3 (25.7%), and gravida 4 (19.3%). Parity distribution showed that nulliparous women represented the largest subset (32.1%), followed by parity-1 (25.0%), parity-3 (22.9%), and parity-2 (20.0%).

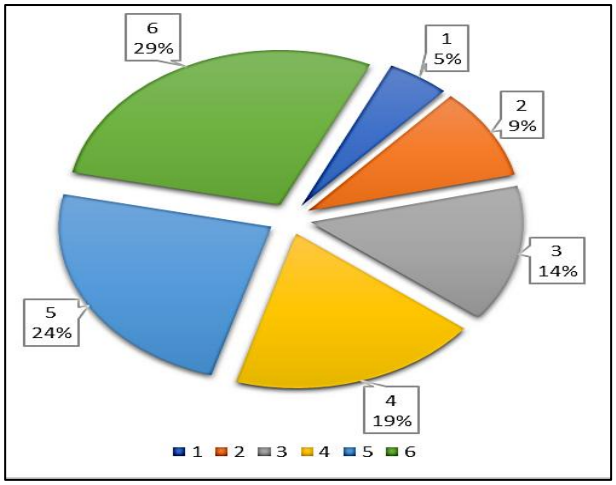

Figure 1: Distribution of gestosis scores among study participants, (n=140).

Gestosis score and comparison with various parameters

A family history of preeclampsia was reported by 21.4% of participants, while the majority (78.6%) had no such history. With respect to co-morbidities, nearly half of the cohort (47.1%) reported none, while the remainder presented with polycystic ovary syndrome (15.7%), hypothyroidism (14.3%), diabetes mellitus (13.6%), or chronic hypertension (9.3%). Overall, 52.9% had at least one medical disorder (Table 1).

Distribution of gestosis scores was relatively even across categories, with the highest proportion scoring 1 (21.4%), followed by 5 (17.1%), while scores of 2, 3, 4, and 6 each accounted for 14-16% of the sample (Figure 1).

Comparisons of maternal anthropometric and hemodynamic parameters between women with and without GH revealed no significant differences. Body mass index, gestational age at assessment, weight gain, systolic and diastolic pressures, and mean arterial pressure were all comparable ($p>0.25$) (Table 2).

Similarly, biochemical and hormonal parameters-including blood glucose, renal and liver function markers, lipid fractions, hemoglobin, and thyroid hormones-did not show statistically significant variation between the groups ($p=0.097$-0.981) (Table 3).

Comparison of gestosis score and UtA-PI

Notably, the mean gestosis score was significantly lower among women who developed GH compared to normotensive women (2.59 ± 1.76 vs 3.55 ± 1.73; $p=0.019$). In contrast, UtA-PI values were higher in hypertensive pregnancies (1.61 ± 0.57 vs 1.46 ± 0.57), though the difference was not statistically significant ($p=0.263$) (Table 4).

Table 1: Baseline characteristics of the study population, (n=140).

Variables	Category	N (%)
Age (in years)	<25	38 (27.1)
	25-30	48 (34.3)
	> 30	54 (38.6)
Gravida	1	44 (31.4)
	2	33 (23.6)
	3	36 (25.7)
	4	27 (19.3)
Parity	0	45 (32.1)
	1	35 (25.0)
	2	28 (20.0)
	3	32 (22.9)
Family history of preeclampsia	Yes	30 (21.4)
	No	110 (78.6)
Co-morbidities	Diabetes mellitus	19 (13.6)
	Hypertension	13 (9.3)
	Hypothyroidism	20 (14.3)
	Polycystic ovary syndrome (PCOS)	22 (15.7)
	None	66 (47.1)

Table 2: Comparison of anthropometric and hemodynamic parameters between normotensive and GH groups.

Variables	Normotensive (Mean±SD)	GH (Mean±SD)	P value
Anthropometric			
BMI (kg/m²)	26.81±8.19	28.65±6.72	0.255
Gestational age (weeks)	16.55±2.15	16.42±2.35	0.799
Weight gain (kg)	11.50±5.08	12.19±4.24	0.496
Hemodynamic			
SBP (mmHg)	130.50±19.10	131.87±16.32	0.725
DBP (mmHg)	81.45±11.19	79.87±11.41	0.548
MAP (mmHg)	85.64±8.03	85.38±9.54	0.892

Table 3: Biochemical and hormonal parameters in normotensive and GH groups.

Variables	Normotensive, (Mean±SD)	GH, (Mean±SD)	P value
Metabolic and renal			
RBS (mg/dl)	110.30±22.47	111.73±22.34	0.784
Urea (mg/dl)	31.60±9.72	31.10±7.83	0.791
Creatinine (mg/dl)	0.88±0.23	0.92± 0.21	0.417
Liver function tests			
Total protein (g/dl)	6.95±0.87	6.96±0.91	0.981
Albumin (g/dl)	4.53±0.59	4.43±0.63	0.458
SGOT (U/l)	27.60±10.22	25.47±11.78	0.383
SGPT (U/l)	27.87±10.07	24.98±10.79	0.222
ALP (U/l)	80.25±25.94	77.40±23.56	0.612
Lipid profile			
Total cholesterol (mg/dl)	200.79±30.43	196.09±29.08	0.495
Triglycerides (mg/dl)	132.01±43.26	130.80±36.08	0.890
HDL (mg/dl)	55.81±14.64	57.31±15.26	0.661
LDL (mg/dl)	114.46±26.67	112.04±25.40	0.687
Haematological and thyroid			
Hemoglobin (g/dl)	11.98±1.70	12.58±1.48	0.097
T3 (ng/dl)	140.73±32.18	139.51±33.69	0.871
T4 (ng/dl)	8.99±2.21	8.46±2.37	0.316
TSH (mIU/l)	3.14±1.72	3.23±1.75	0.823

Table 4: Comparison of gestosis score and UtA-PI between normotensive and GH groups.

Variables	GH, (Mean±SD)	Normotensive, (Mean±SD)	P value
Gestosis score	2.59±1.76	3.55±1.73	0.019*
UtA-PI	1.61±0.57	1.46±0.57	0.263

*Statistically significant.

DISCUSSION

In this cohort, women over 30 comprised the largest age group (38.6%), reinforcing advanced maternal age as a consistent risk factor for HDP. Multiple studies underscore this association: for instance, women over 35 have a 20-120% higher risk of preeclampsia-rising further with increasing age (RR 2.4 for >40 years, and RR 3.6 for >45 years).[8] Age-related vascular stiffening and endothelial dysfunction have been linked with impaired uteroplacental adaptation and preeclampsia, as shown in large epidemiological studies.[8,9]

In our study, the gestosis score and UtA-PI yielded contrasting predictive outcomes for GH, underlining the complexity of early risk stratification in pregnancy. Unexpectedly, the mean gestosis score was lower in the GH group compared to normotensive women (2.59 vs. 3.55; p=0.019). This observation deviates from multiple Indian cohort studies: Gupta et al reported sensitivity 83.1%, specificity 97.5%, accuracy 95.4% for scores ≥3 in predicting preeclampsia (PE).[5] Similarly, a study from North India reported sensitivity 76.3%, specificity 77.2%, and accuracy 76.7% for this tool.[10] More recently, Sharma et al found outstanding diagnostic performance at higher thresholds (Gestosis score >9), with AUC 0.968, sensitivity 90.2%, specificity 99.1%, and diagnostic accuracy 94.6%.[4] Our lower scores may reflect population-specific differences, variation in gestosis inputs, or the

particular dynamics of GH versus PE-suggesting a need for local recalibration before clinical adoption.

Our UtA-PI results echoed broader concerns about its standalone predictive power: despite being higher in the GH group (1.61 vs 1.46), the difference was not statistically significant (p=0.263). In contrast, a prospective at AIIMS Raipur (2021) found first-trimester UtA-PI significantly higher among hypertensive pregnancies (mean 2.00 vs 1.51; p=0.01), with sensitivity 68% and specificity 53% at a cut-off of 1.48 for predicting HDP (including PE and GH).[11] A review of uterine artery Doppler studies highlighted that UtA-PI >95th percentile offers low sensitivity (12–27%) but high specificity (~95%) for PE, suggesting limited utility in isolation, especially in low-risk populations.[12] Other settings have demonstrated variable performance: in low-resource environments, UtA-PI predicted PE with moderate accuracy (sensitivity 61.5-65%, specificity 63–66%), particularly when combining PI with notch presence.[13] Further, a recent nested cohort described a non-linear dose–response between UtA-PI and PE risk-risk rose sharply when PI exceeded 1.83-underscoring potential gestational threshold effects.[14]

Strength of our study include its prospective design and the direct comparison between gestosis score and UtA-PI in predicting GH within an Indian tertiary-care setting. However, limitations include a modest sample size, which may have underpowered detection of moderate differences. Additionally, GH (rather than PE) was the outcome-gestosis score and UtA-PI were initially validated primarily for PE, possibly undermining performance for GH prediction.

The divergent findings suggest the need for population-specific recalibration of the gestosis score-possibly adjusting cut-offs or weighting individual risk factors differently. As for UtA-PI, its predictive strength appears enhanced when integrated into multimodal algorithms (e.g., combined with MAP, PlGF/PAPP-A), which have shown improved performance in other settings (e.g., FMF algorithm).[15]

Future research should explore these tools in larger, multicenter cohorts, with robust subgroup analyses by early vs. late onset GH/PE, BMI, parity, and ART. Multi-marker risk models that blend clinical scores, Doppler metrics, and biomarkers may offer the best balance of feasibility and accuracy-critical for resource-limited settings.

CONCLUSION

In conclusion, this prospective observational study assessed the HDP-gestosis score and UtA-PI for early prediction of GH. While the gestosis score differed significantly between groups, its inverse association with outcomes limits applicability without contextual refinement, and UtA-PI showed no significant predictive value.

Overall, neither tool demonstrated strong independent utility for early detection in this cohort, suggesting continued refinement of these tools and their contextual adaptation remain essential for enhancing their clinical applicability and ensuring effective early prediction and management of HDP. Integration of validated scoring systems into routine antenatal surveillance has the potential to strengthen risk stratification, facilitate timely interventions, and ultimately improve maternal and perinatal outcomes.

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