Prediction Of Preeclampsia And Fetal Growth Retardation By Uterine Artery Doppler In 1st Trimester

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Abstract:

Background: *Preeclampsia is one of the major reasons for maternal and perinatal mortality and morbidity globally, particularly in developing countries. As there is no effective treatment, identification of women who are at risk of developing preeclampsia would be of great value. Persistence of high impedance to blood flow was found in uterine arteries of women with preeclampsia, which is another indirect evidence of abnormal placentation. It is therefore logical to focus on uterine artery Doppler as the screening test for women at risk of developing preeclampsia.*

Objective: *To assess the role of uterine artery Doppler during 1st trimester in the prediction of pre-eclampsia and fetal growth retardation.*

Materials and Methods: *This study was done in the Department of Radiodiagnosis at Konaseema Institute of Medical Sciences as per the eligibility criteria. The study was done from January 2023 to March 2024. Pregnant women aged above 19 years with 11 to 14 weeks of gestational period who provided informed consent were included.*

Results: *Most of the women were aged 21 to 30 years. 12% of women had a more pulsatile index (PI). 7% of women developed preeclampsia (PE) on follow-up till the last trimester. 5% of women delivered foetuses with growth retardation (FGR). 19% of the women had comorbidities. There is a significant association between PI and PE and PI and FGR. There is no neonatal mortality or maternal mortality.*

Conclusion: *Pulsatile index helps to detect future development of pre-eclampsia, so that appropriate actions can be taken to reduce neonatal and maternal morbidity and mortality.*

Key Words: *Uterine artery doppler, Preeclampsia, Fetal growth retardation, Maternal mortality, Perinatal mortality*

I. Introduction

Preeclampsia is one of the major reasons for maternal and perinatal mortality and morbidity globally, particularly in developing countries.[1,2] Although it is a heterogeneous disease, it results from impaired placentation. Pre-eclampsia and intrauterine growth restriction (IUGR) are characterized by abnormal formation of the placenta,[3] resulting in inadequate uteroplacental blood flow, leading to an idea of using Doppler ultrasonography to determine the velocity of uterine artery blood flow as ultrasound screening.[4] Low end-diastolic

velocities and an early diastolic notch are the typical features of waveforms of uterine artery blood flow among women who are not pregnant or are during their first trimester. The persistence of a diastolic notch after 24 weeks of gestation or the presence of abnormal flow velocity ratios were associated with inadequate trophoblast invasion.[5] Accurate prediction of pre-eclampsia and IUGR helps in the judicious allocation of resources for monitoring to improve maternal and perinatal outcomes.[6,7]

Preeclampsia and fetal growth restriction (FGR) were identified as causes of around 6% and 10% of perinatal deaths, respectively. Modern antenatal care is focused on a risk-based approach to monitoring adverse pregnancy outcomes like pre-eclampsia, FGR, placental abruption, and stillbirth. There is more research geared towards early identification of risks, allowing early commencement of management strategies to reduce risk of adverse outcomes, including facilitation of a proper level of pregnancy monitoring.[8]

Current literature suggests that preeclampsia needs interaction between placental abnormalities and genetically determined maternal factors that are modified by pregnancy-specific changes.[9,10] As there is no effective treatment, identification of women who are at risk of developing preeclampsia would be of great value. Persistence of high impedance to blood flow was found in uterine arteries of women with preeclampsia, which is another indirect evidence of abnormal placentation.[11] It is therefore logical to focus on uterine artery Doppler as a screening test of women at risk of developing preeclampsia.

II.   Methods

Study duration:
The current study was done at a tertiary care centre in India from January 2023 to March 2024.
Study Design: Prospective, Cohort study.
The study was prospective, as the patients were followed up forward.
Cohort study- As the study involved a cohort of pregnant women of 1st trimester.
Study Location: This study was done at a teaching hospital in the Department of Radiodiagnosis at KIMS, Amalapuram, Andhra Pradesh, India.
Sampling procedure: Cconvenience sampling
Sample size: 100
Sample size calculation:
Sample size calculation: As per the previous study, the prevalence of HTN disorders of pregnancy in India was 6.9%.[12]
Sample size $N=Z^2PQ/E^2$
Error =5%
Confidence intervals of 95%,
The minimum sample size came to be 99.
Hence included 100 patients.
Subjects & selection method: The study population was pregnant women in 1st trimester attending KIMS, Amalapuram
Inclusion criteria:
Pregnant women aged above 19 years.
Pregnant women with 11 to 14 weeks of gestational period.
Women who provided informed consent.
Patients who are willing for attending follow up visits.
Exclusion criteria:
Patients with severe cardiac, pulmonary, renal disorders that interrupt data collection.
Pregnant women with multiple gestation detected <14 weeks, fetal abnormalities detected <14 weeks.
Patients who are on treatment for hypertensive disorder.

Methodology:
After Involving patients as per the inclusion and exclusion criteria, data collection was done. A detailed history was taken from each patient. Thorough physical examination, vital signs and systemic examination were done. The data was subjected to statistical analysis and then a conclusion was drawn.

Parameters assessed:
● Age
● Gestational age
● Parity or gravida
● Comorbidities
● Neonatal outcomes
● Preterm deliveries

● Neonatal mortality
● Maternal mortality
● Development of Preeclampsia and fetal growth retardation
● Incidence of high pulsatile index
● Resistance index

Ethical considerations: Written Informed consent form were obtained from every patient who participated in the study. Institutional ethics committee approval were taken before conducting the study.

Stastistical Analysis:

The collected data were compiled, tabulated, presented in graphs and were statistically analyzed using EPI Info. Version 7.2.6 Means, SD, Frequencies and percentages were used

III. Results

The current study included 100 pregnant women.

Age: Most of the patients belonged to the age group 21 to 30 years (60%). The age of the patients ranged from 19 yrs. to 34 years with a mean age of 26.5 yrs.

| Age	No of women	Percent of women
Below 20 years	4	4%
21 to 30 years	60	60%
Above 30 years	36	36%
Total	100	100%

Table 1: AGE OF PATIENTS

Pulsatility index (PI): 12% of women had increased PI and 88% had normal doppler. Among 12 women, 7 women developed PE finally and babies of 5 women showed growth retardation.

PI	No of women	Percent of women
Normal	88	88%
High	12	12%
Total	100	100%

Table 2: Pulsatility index of women

Obstetric history:

Most of the women were gravida 1 (56%) followed by gravida 2 (30%), gravida 3 (14%).
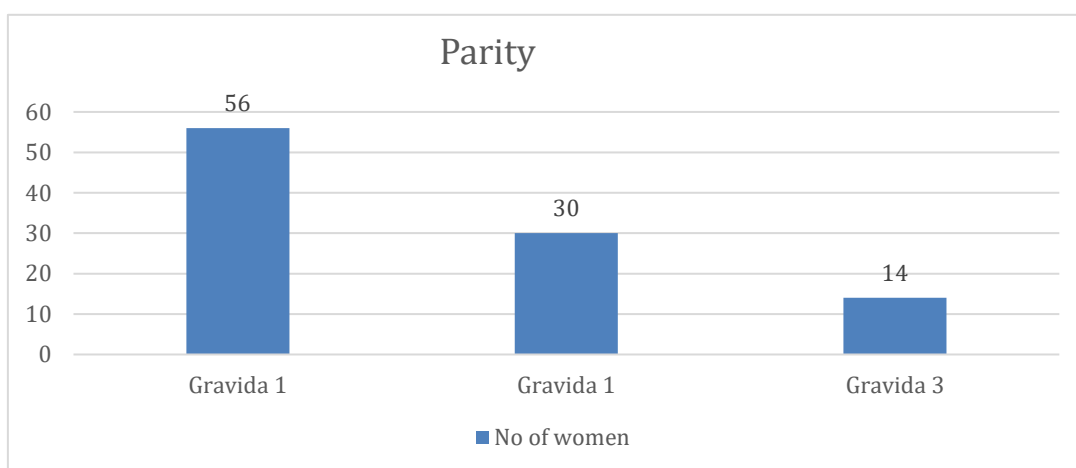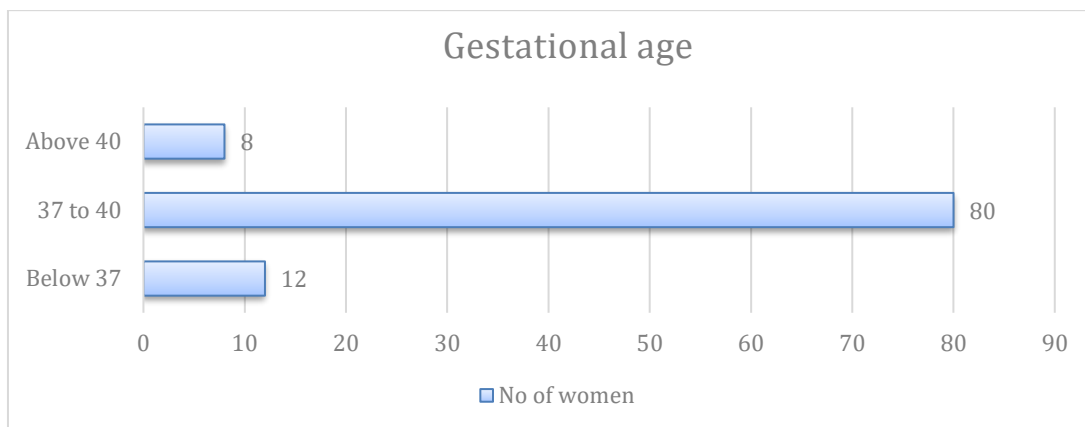

Graph 1: Obstetric history of women

BMI:

68% of women had normal BMI. Mean BMI was 24.3 kg/m2.

Gestational age:

Gestational age at delivery ranged between 30 weeks and 40 weeks. 80% of women delivered between 37 weeks to 39 weeks. Mean gestational age at delivery was 37.2 weeks.

Graph 2: Gestational age of pregnant women

Maternal Comorbidities: 19% of women had comorbidities, and the most common comorbidity was GDM, which was seen in 10% of women. 7% developed preeclampsia and 2% had hypothyroidism.
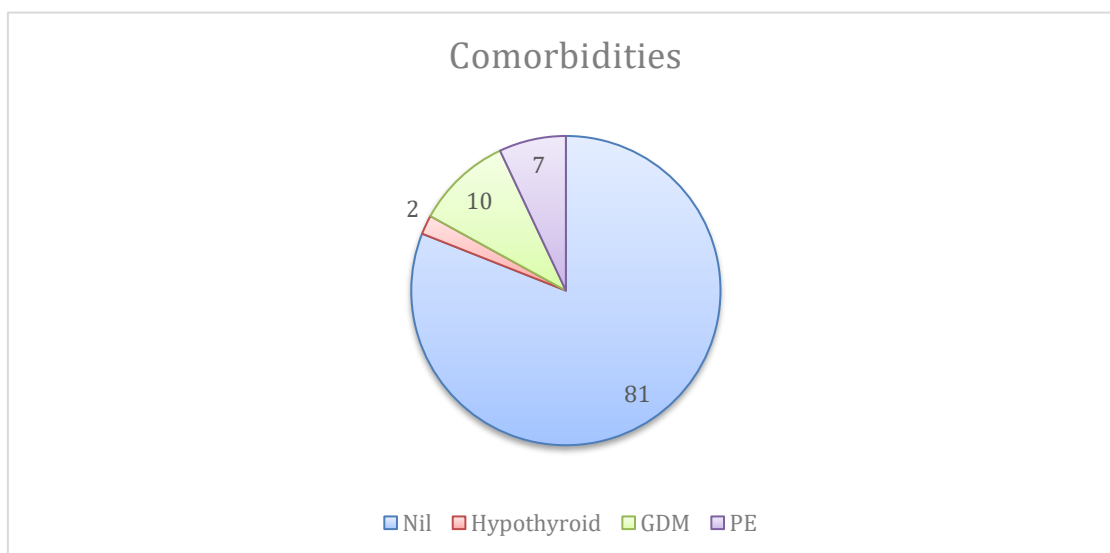
Graph 3: Maternal Comorbidities

Neonatal outcomes:

There were 4 preterm deliveries of them, 1 had fetal stillbirth. There is no neonatal mortality.

Neonatal outcomes	No of women	Percent of women
Normal	96	96%
Preterm deliveries	4	4%
Total	100	100%

Table 3: Neonatal outcomes

Association between PE and PI:

There is significant association between PE and PI as a greater number of women with PI of ≥95% had preeclampsia. (P=0.0001)

Parameters	PE(n)	Non-PE(n)	Total	P Value
Women with More PI	6	6	12	0.0001
Women with Normal PI	1	87	88	
Total	7	93	100	

Table 4: Association between PE and PI

Association between FGR and PI:

There is significant association between Fetal growth retardation and PI (P=0.0001)

Parameters	FGR(n)	Non FGR(n)	Total	P Value
Women with More PI	5	7	12	0.0001
Women with Normal PI	1	84	88	
Total	6	91	100	

Table 5: Association between FGR and PI

Association between Resistance index (RI) and SGA:
There is a significant association between maternal resistance index and delivery of small for gestational age (SGA) neonate PI (P=0.0001). Total 8 neonates are SGA in the current study. Total 11 mothers had more resistance index.

Parameters	SGA(n)	Non-SGA(n)	Total	P Value
Women with More RI	7	4	11	0.0001
Women with Normal RI	1	88	89	
Total	8	92	100	

Table 6: Association between Resistance index (RI) and SGA

Bilateral notching:
It was seen among 13 mothers and 11 among them delivered SGA neonates.

IV. Discussion

The current study included 100 pregnant women attending our tertiary care center for antenatal screening. Most of the women were aged 21 to 30 years. 12% of women had more pulsatile index (PI). 7% of women developed preeclampsia on follow up till last trimester. 5% of women delivered foetuses with growth retardation. 19% of the women had comorbidities. There is significant association between PI and PE and PI and FGR. There is no neonatal mortality or maternal mortality. 5 preterm deliveries were seen overall.

In the study of Surabhi Handa et al.[13] mean PI was 2.98. PE was seen among 41.6%, and FGR was seen among 25% of pregnant women with increased PI, while in the current study, 63.6% of patients with more PI developed PE and 36.6% of patients had fetal growth retardation.

In the study by Martin et al., pregnancies complicated by PE were found to be 2.1% and FGR 9.5%, [14] while in the current study, among 100 women, PE was developed finally among 7% and FGR was found among neonates of 4% of women.

1st-trimester uterine artery Resistance index was significantly more among women who delivered SGA neonate compared with mothers with normal outcome in the study of Melchiorre et al, [15] similar to the current study.

In the review done by Marianna et al. 30 articles were included. Uterine artery Doppler was found to detect less than 50% of PE cases and less than 40% of pregnancies affected by fetal growth retardation.

The sensitivity of predicting PE was 24% in the study by Gomez et al However, [16]these findings need more validation due to certain limitations of the study.

Limitations:
☐ Small sample size
☐ Single center study

V. Conclusion

The current study showed significant association between PI of ≥95% with PE and FGR among pregnant women. Hence, we conclude that 1st-trimester uterine artery Pulsatile index helps to detect future development of pre-eclampsia, so that appropriate actions can be taken to reduce neonatal & maternal morbidity and mortality. The study is self-sponsored. There were no conflicts of interest.

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