

SIGNIFICANCE OF UTERINE ARTERY DOPPLER IN PREDICTING PREECLAMPSIA AND IUGR: A DESCRIPTIVE STUDY

Pooja¹, Adiba Zehra², Himanshu Sharma³, Sunita Gulati⁴

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Corresponding Author:

Dr. Pooja,

Email: atishawasthi1@gmail.com

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^{1,2}. PG Resident, Department of Obstetrics & Gynaecology, Rama Medical College Hospital & Research Centre, Pilkhuwa, Hapur, Uttar Pradesh, India.

³PG Resident, Department of Radiology, Narayana Medical College & Hospital, Jamuhar Sasaram, Bihar, India.

⁴Professor and HOD, Department of Obstetrics & Gynaecology, Rama Medical College Hospital & Research Centre, Pilkhuwa, Hapur, Uttar Pradesh, India.

Abstract

Background: Preeclampsia is a very common complication observed during pregnancy which accounts for 14% of maternal mortality and morbidity and accounts for 10% of perinatal mortality. This study helps to evaluate the significance of first and mid trimester uterine artery doppler in both high risk and low risk women to predict preeclampsia and IUGR. **Materials and Methods:** The patients included in this study were recruited from Rama Medical College and Hospital, HAPUR, UP. This is a type of descriptive study where patients were selected based on inclusion and exclusion criteria. Uterine artery doppler screening was done at 12-14 weeks and 24-26 weeks. After that a follow up was done with these patients for further outcomes. Data obtained was subjected to statistical analysis and chi square test was done to understand the relationship between the underlying variables. **Result:** In the sample data set of 90 patients, 18 cases of preeclampsia and 25 cases of IUGR were reported. The presence of diastolic notch could predict 43% of cases that developed preeclampsia from as early as the first trimester. **Conclusion:** Presence of notch is a significantly better predictor of pre-eclampsia and IUGR than the PI index. Uterine artery Doppler screening meets all the requirements of a worthwhile screening program in prediction of preeclampsia and IUGR.

INTRODUCTION

Hypertensive disorders complicate 5 to 10% of all pregnancies and together they form one member of the deadly triad, along with hemorrhage and infection, which contribute greatly to maternal morbidity and mortality rates.^[1] Preeclampsia is a multisystem disorder and represents a major threat to fetus and mother when it emerges.^[2] It has been estimated that more than 14% of maternal deaths/year worldwide are due to eclampsia and preeclampsia, but in developed countries, it mainly affects fetus.^[3] The incidence of preterm birth due to preeclampsia is around 15%.^[4]

The trophoblast normally invades the decidual portion of the spiral arteries beginning by eighth week and this invasion is usually complete by the thirteenth week. After this time the second stage of spiral artery invasion starts in, whereby the myometrial portion of the spiral arteries are similarly invaded by the trophoblast. This is usually completed by 18 to 19 weeks but may be delayed up to 22 to 24 weeks. In an overwhelming majority of

preeclampsia, this transformation does not occur in the spiral artery bed leading to increased resistance to flow into the intervillous space. The method of choice to indirectly monitor the status of spiral artery bed is by uterine artery waveform.⁴ Increased uterine artery velocimetry determined by Doppler ultrasound in the first and second trimester should provide indirect evidence of this process and thus serve as a predictive test for preeclampsia.

Performing uterine artery doppler studies at 23- 26 weeks gestation instead of 19- 22 weeks gestation increases the predictive value for adverse pregnancy outcomes.^[5]

MATERIALS AND METHODS

Women attending obstetrics clinic at Rama Medical College, Hospital and Research Centre were recruited for this study based on following criteria.

Inclusion Criteria

- All women with singleton pregnancy attending routine antenatal care visit.

- All uncomplicated pregnancies in the first and second trimester.
- Patients who gave informed written consent.
- Family history of pre-eclampsia.
- History of pre-eclampsia in previous pregnancy.

Exclusion Criteria

- Patients who did not give consent.
- Multiple pregnancy.
- Patients with comorbidities like diabetes, mellites, chronic hypertension.

Observed data was subjected to chi square test to analyze the PI values and notching in first and second trimester and their correlation to pre-eclampsia and IUGR. A P value of < 0.05 was considered statistically significant.

RESULTS

In the first trimester, out of the 26 patients who had diastolic notching present in their screening, 11 of them had developed preeclampsia and the remaining 15 patients had no evidence of preeclampsia even though they had notching present in their screening. Out of 64 patients who had no notching, 7 cases of preeclampsia were observed. Out of 32 women who had PI values above cutoff, 8 cases were found to have preeclampsia and remaining 24 cases had no evidence of preeclampsia.

In the second trimester, out of the 21 patients who had diastolic notching present in their screening, 14 of them had developed preeclampsia and the remaining

7 patients had no evidence of preeclampsia even though they had notching present in their screening. Out of 69 patients who had no notching, 4 cases of preeclampsia were observed. Out of 28 women who had PI values above cutoff, 7 cases were found to have preeclampsia and remaining 21 cases had no evidence of preeclampsia.

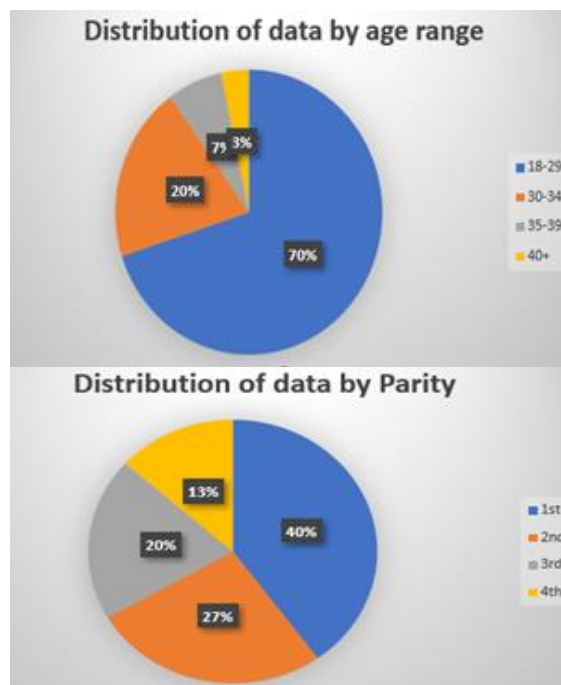


Figure 1: Observations of demographic data

Table 1: Association of diastolic notching with Preeclampsia and IUGR

		Total no. of cases	Association with Preeclampsia	Association with IUGR
Diastolic notch in 1st trimester	Present	26	11 (42.3%)	5 (19.23%)
	Absent	64	7 (10.94%)	20 (31.25%)
	P value		< 0.05	> 0.05
Diastolic notch in 2nd trimester	Present	21	14 (66.66)	6 (28.57%)
	Absent	69	4 (5.78%)	19 (27.54%)
	P value		< 0.05	> 0.05

Table 2: Association of PI values with Preeclampsia and IUGR

		Total no. of cases	Association with Preeclampsia	Association with IUGR
PI Values in 1st trimester	Above cutoff	32	8 (25%)	13 (40.63)
	Below cutoff	58	10 (17.24%)	12 (20.68%)
	P value		> 0.05	< 0.05
PI Values in 2nd trimester	Above cutoff	28	7 (25%)	11 (39.28%)
	Below cutoff	62	11 (17.74%)	14 (22.58%)
	P value		> 0.05	> 0.05

DISCUSSION

Preeclampsia is a very common complication observed during pregnancy which contributes significantly to maternal-fetal morbidity and mortality. Women patients can be identified using uterine artery doppler screening, if they are having obstetric complication which is associated to abnormal placentation because doppler screening is a useful method to assess the velocity of uterine artery blood flow. A high resistance to flow and or an early diastolic notch can be observed in an abnormal velocity waveform.

This descriptive study was done using data available from 90 pregnant women. Out of these 18 women had developed preeclampsia and 25 cases of IUGR were noted.

Maternal age: The extremes of the age group are more prone to preeclampsia. An increased risk is present in women below 20 years and above 35 years. In our study 13 patients who developed preeclampsia were between the ages of 18 and 34 years while 2 women patients were below 20 years of age, and 3 patients were above age of 35 years. Hence in our study, age did not play a major role as a risk factor for pre-eclampsia.

Parity: For women who are in their first pregnancy, preeclampsia is twice as common as compared to women who are in their second and more pregnancy. In our study, out of 18 patients who developed preeclampsia, 3 patients were primigravida hence indicating that gravidity was not a very strong contributing factor for the disease.

Blood pressure: Mean values of systolic and diastolic blood pressure were 129.15 \pm 14.63 mmHg and 81.86 \pm 11.84 mmHg respectively in the third trimester of pregnancy.

Birth weight: The birth weight was less than < 2500 g in 25 cases and out of these 9 cases had developed the preeclampsia. Hence low birth weight was significantly associated with preeclampsia.

Uterine artery doppler waveform analysis: Out of 18 patients who developed pre-eclampsia, 11 patients had abnormal doppler screening from as early as the first trimester. The study showed that presence of diastolic notching could predict 43% of cases that developed preeclampsia from as early as the first trimester. An even more significant fact is that abnormal uterine artery screening was able to predict the preeclampsia in those cases which had early manifestation of the disease and had the worst pregnancy outcomes.

PI Values: Uterine artery doppler indices were higher in women who developed preeclampsia as per a study done by Melchiorre (2008 135).^[6] In our study the 1st trimester PI values in patients who developed preeclampsia was not a strong predictor. However, in clinical practice a 1st trimester PI value of >1.5 is deemed as elevated and warrants monitoring (Nicolaou, 2011: Personal communication).^[7] In the group that developed preeclampsia, 1st trimester PI values ranged between 0.64 and 2.2 respectively. In the 2nd trimester most preeclamptic cases had PI value above the 50th percentile signifying that PI performed better as a predictor of preeclampsia in the 2nd trimester.

Swanepoel (2004:6) suggested that the presence of notch is a significantly better predictor of poor pregnancy outcome than the PI index.^[8]

In our study the presence of notch in the second trimester was the best predictor for the development of pre-eclampsia. Uterine artery Doppler analysis in the high-risk population has shown potential for predicting adverse pregnancy outcomes (Harrington et al, 2004: 50).^[9] The results of our study confirm the work done by Pilalis (2007: 533),^[10] and Harrington (2004:54),^[9] who both found that second trimester uterine artery Doppler screening has proven to be a sensitive and accurate tool for predicting preeclampsia and IUGR in high-risk populations.

Association Between Preeclampsia And IUGR: It has been proved beyond doubt, in previous studies and in the present study that preeclampsia is significantly associated with IUGR. Shear and colleagues (2005:1119),^[11] reported a relationship between preeclampsia and IUGR. Their study showed critical maternal complications more frequently in pre- eclamptic patients with associated IUGR. Our study also shows a significant association between preeclampsia and IUGR.

CONCLUSION

Preeclampsia accounts significantly for maternal and perinatal mortality. The presence of notch is a significantly better predictor of pre-eclampsia and IUGR than the PI index. In our study the presence of diastolic notch in the second trimester was the best predictor for the development of pre-eclampsia.

Uterine artery Doppler screening meets all the requirements of a worthwhile screening program in prediction of preeclampsia and IUGR. As this is a small-scale study due to constraints, the usefulness of uterine artery doppler screening must be evaluated using a large cohort.

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