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Screening for Preeclampsia by Uterine Artery Doppler at 11-14 weeks of Gestation

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ABSTRACT

Background: The possibility of prediction of preeclampsia (PE) in first trimester of pregnancy is a new concept in recent years. **Methods:** A prospective cohort study was done on 150 antenatal women at 11- 14 weeks of gestation. Uterine Artery Doppler was done and Pulsatility Index (PI) and Resistance Index (RI) were measured and women followed up for development of PE. **Results:** Out of the 150 women enrolled, 19 women (12.67%) developed preeclampsia. **Conclusion:** Uterine Artery Doppler Pulsatility Index (PI) was found to be good non-invasive screening method (sensitivity-86.67%, specificity-95.56% at cut off of 1.9) for prediction of preeclampsia.

Keywords: Preeclampsia; Uterine Artery Doppler; Pulsatility Index (PI); Resistance Index (RI).

1

INTRODUCTION

Most pregnancies are normal biological process resulting in healthy maternal and fetal outcome. Those that are not normal, however, can result in maternal and/or perinatal mortality or substantial morbidity.[1] Monitoring the growth and wellbeing of the foetus is a major purpose of antenatal care. A key aim of antenatal care is to identify and manage the proportion of pregnancies at risk for developing complications. Pre-eclampsia remains an important cause of maternal and perinatal mortality and morbidity. Pre-eclampsia is a heterogenous disorder with variable maternal and fetal manifestations and complicates 3%-8% of pregnancies worldwide.

Overall 10-15% of maternal deaths are associated with preeclampsia and eclampsia.[2] This figure is higher in developing countries.

Identification of women at risk for preeclampsia is of major importance for antenatal care. Women identified as high risk can be scheduled for more intensive antenatal surveillance and prophylactic interventions.

Current strategies for risk assessment are based on the obstetric and medical history and clinical examination. Unfortunately, evidence regarding the actual risk associated with individual factors is unreliable.[3-5]

A screening strategy based on maternal history and other risk factors was proposed in United Kingdom by National Institute of Clinical Excellence (NICE).

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The results classified more than 60% of pregnant women as high-risk and predicted less than 30% of those destined to develop preeclampsia, with a false-positive rate of 10%.[6]

Screening by maternal history alone detects a third of women who will develop preeclampsia but is ineffective in nulliparous women, who are at particular risk of this complication.

Measurement in early pregnancy of a variety of biological, biochemical and biophysical markers implicated in the pathophysiology of preeclampsia has been proposed to predict its development. Multiple biochemical markers have been studied individually and in combination as potential markersfor adverse pregnancy outcomes. These testing strategies have poor sensitivity and poor predictive value for preeclampsia.[7] Currently there are roll over test, serum uric acid, fibronectin, coagulation activation, cytokines, placental peptides, fetal DNA levels. None of them are reliable and cost effective. The sonography and colour Doppler flow studies have provided a tool where the physiology of the fetomaternal unit can be assessed.[8]

MATERIALS & METHODS

A prospective study was conducted on 150 pregnant women between 11-14 weeks of gestation in the department of Obstetrics and Gynaecology at Government Medical College and Rajindra Hospital, Patiala attending antenatal clinic or emergency in collaboration with department of Radio-diagnosis Government Medical College and Rajindra Hospital, Patiala.

Inclusion Criteria

- Singelton pregnancy
- Gestation period between 11-14 weeks

Exclusion Criteria

- Multiple pregnancy
- Congenital fetal anomalies
- Women with pre-existing hypertension, renal disease, diabetes mellitus or known autoimmune disease previous with history of PIH and/or BOH.

After recording the detailed history and examination, these women were subjected to transabdominal uterine artery doppler using Philips HD 11XE machine and uterine artery Resistance index and Pulsatility Index were noted bilaterally and then mean resistance index(RI) and Pulsatility Index (PI) of uterine arteries were calculated.

The women were followed up to see the subsequent development of preeclampsia and FGR.

RESULTS

Out of 150 women studied, 92 (61.33%) had uncomplicated pregnancy whereas 58 women (38.66%) developed some complication during pregnancy PE, FGR or both. 19 women (12.67%) developed preeclampsia, out of which early onset PE was observed in 7 (4.67%) cases and late onset PE occurred in 12 (8%). FGR was observed in 45 (30%), FGR with and without PE was seen in 6(4%) and 39 (26%) women respectively.

Table 1:

	Number	% of total
Preeclampsia	19	12.67%
Early onset PE	7	4.67%
Late onset PE	12	8%
FGR	45	30%
FGR with PE	6	4%
FGR without PE	39	26%
Total	58	38.66%

The mean BMI of women with complications was 22.72kg/m2 and those without complications was 21.81 kg/m2 (p=0.22). No statistically significant increase in complications was found in primigravida (p=0.382). Family history of hypertension and diabetes did not statistically affect development of complications in pregnancy (p=0.568).

[Table 2] shows the mean UA RI and mean UA PI in women with preeclampsia in relation to women without preeclampsia. The mean PI of the women who developed preeclampsia was 1.99± 0.44 and that of women who did not develop preeclampsia was 1.07 ± 0.33 (p 0.001) which is statistically significant. The mean UA RI of women who developed preeclampsia was 0.76±0.18 and women who did not develop preeclampsia was 0.50±0.17 (p 0.001) which is statistically significant.

The sensitivity and specificity of mean PI at 11-14 weeks of pregnancy for predicting preeclampsia was 86.67 % and 95.56% at cut off of 1.9.The sensitivity and specificity of mean RI at 11-14 weeks of pregnancy for predicting preeclampsia was 65% and 95.38% at cut off of (0.76) Thus mean uterine artery PI and RI were found to be good non invasive investigation to predict preeclampsia.

Table 2:

	Women with PE	Women without PE	Level of significance
Mean UA RI	0.76±0.18	0.50±0.17	P=0.001
Mean UA PI	1.99±0.44	1.07±0.33	P=0.001

DISCUSSION

There was no difference in age or BMI of women with or without PE. It could be because women with known high risk factors like history of preeclampsia, pre-existing diabetes, multiple pregnancy, nulliparity, a raised BMI before pregnancy or at booking, maternal age >40, renal disease and hypertension antiphospholipid antibodies were excluded from the study.

A recent meta-analysis by Velauthar et al, reviewed the accuracy of uterine artery Doppler analysis in the first trimester in the prediction of IUGR and preeclampsia.[9]

Eighteen studies involving 55, 974 women were evaluated, with fifteen of these studies enrolling women with low risk pregnancies. Uterine artery RI or PI ≥90th centile and the presence of notching (unilateral/bilateral) were used to define abnormal flow velocity waveforms.

An abnormal uterine artery PI in the first trimester was predictive of preeclampsia and early-onset preeclampsia with sensitivities of 26.4% and 47.8%, respectively. Fetal growth restriction was predicted at 15.4%. In present study, uterine artery PI at 11-14 weeks of pregnancy was found to be the best parameter for screening of women at risk of developing preeclampsia as it had a high sensitivity (86.67%) and specificity (95.56%) for identifying the high risk group at a cut of 1.9.

Dascau et al conducted Uterine Artery Doppler in pregnant women during 11-13+6 days of gestation[10] the mean RI and PI were 0.79 and 1.63 which are comparable to present study where RI and PI are 0.76 and 1.9. Masihi et al conducted a study on 300 singleton pregnant women at 11-13 weeks of gestation[11] where uterine artery PI , with cut off of 2.1 the sensitivity and specificity for predicting PE was 100% and 83.7% which are comparable to present study with sensitivity and specificity at cut off of 1.9 as 86.67% and 95.56%.

It can be concluded that, first trimester uterine artery PI can be used as a good predictor for preeclampsia.

Lower uterine artery Doppler indices were found in normal pregnancies and patients with raised Doppler indices had more chance of developing preeclampsia when compared with those of low Doppler indices. It is thus concluded that Doppler ultrasonography is a good non-invasive investigation to assess changes in

uteroplacental haemodynamics and predict development of preeclampsia and initiate early preventive steps and treatment.

CONCLUSION

Uterine Artery Doppler Pulsatility Index (PI) was found to be good non-invasive screening method (sensitivity-86.67%, specificity-95.56% at cut off of 1.9)for prediction of preeclampsia.

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