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PREDICTION OF PRE-ECLAMPSIA BY UTERINE ARTERY DOPPLER AT 11 TO 13.6 WEEKS OF GESTATION

Obstetrics & Gynaecology

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ABSTRACT

Background: Pre-eclampsia is a pregnancy related complication affecting about 2% to 8% of all the pregnancies. The most promising screening test for predicting pre-eclampsia is uterine artery doppler velocimetry. Uterine artery doppler can interrogate the uteroplacental circulation and can screen impaired placentation by detecting the alterations in blood flow. Abnormal (raised) uterine artery doppler was defined when mean PI >95% and for the first trimester 95th percentile value is 2.6. Newer biochemical predictors- PAPP-A, Inhibin A, Activin A, Placental protein13, Angiogenic factors can help in screening pre-eclampsia These screening tests could lead to increased surveillance and identify women at risk and help to take interventions which improve the outcome **Method:** A prospective observational study was conducted in a tertiary care hospital where 89 patients between the gestational age 11 to 13+6 weeks were selected and subjected to first trimester uterine artery doppler assessment and observed till delivery to know whether these patients developed pre-eclampsia. **Result and Conclusion:** In our study, out of all the patients who had pre-eclampsia, 92.31% had raised uterine artery PI. When other outcomes like FGR, low birth weight and need of NICU admissions were studied, it was found out that abnormal uterine artery PI was significantly associated with it. Uterine artery doppler in the first trimester done along with NT scan has found to be a good predictor of pre-eclampsia with good sensitivity and specificity. Thus early detection at low cost is of utmost importance. Also, it has a good predictive value for FGR.

KEYWORDS

Uterine artery doppler, pre-eclampsia, FGR

INTRODUCTION

Pre-eclampsia is a pregnancy related complication affecting about 2% to 8% of all the pregnancies [1].

It is defined as a multisystem progressive disorder characterized by the new onset of hypertension and proteinuria or the new onset of hypertension plus significant end organ dysfunction with or without proteinuria, typically presenting after 20 weeks of gestation [2][3].

The most promising screening test for predicting pre-eclampsia is uterine artery doppler velocimetry. Impaired trophoblastic invasion of maternal spiral arteries and their conversion from narrow muscular vessels to non-muscular vessels results is thought to be the underlying mechanism.

Uterine artery doppler can interrogate the uteroplacental circulation and can screen impaired placentation by detecting the alterations in blood flow .The velocimetry of uterine arteries shows hemodynamics of maternal side, a part of materno-fetal placental unit.

Abnormal (raised) uterine artery doppler was defined when mean PI was > 95% and for the first trimester, 95th percentile value is 2.6 [4]. Newer biochemical predictors like PAPP-A, inhibin A, activin A, placental protein13 and angiogenic factors can help in screening pre-eclampsia.

These screening tests could lead to increased surveillance and identify women at risk thereby helping us to take interventions which improve the outcome. Prophylactic antiplatelet therapy with aspirin is advised to women with risk factors and to those who are screen positive for pre-eclampsia [5].

Thus, this study was done to predict pre-eclampsia by uterine artery doppler at 11 to 13+6 weeks of gestational age

MATERIAL AND METHODS

A prospective observational study was conducted at a tertiary care center to test the hypothesis that, raised uterine artery pulsatility index is a high risk factor for developing pre-eclampsia. Random sampling method was applied for recruiting 89 patients between 11 to 13+6 weeks of gestation who attended the antenatal clinic at MGM Medical College and Hospital, Chh. Sambhaji Nagar (MH).

Inclusion criteria

- All pregnant women coming for ANC checkup in between 11 to 13+6 weeks willing to give consent

Exclusion criteria:

- Women with multifetal gestation,
- Patients in terminal stage of chronic diseases and
- Patients with congenital anomaly of fetus

An informed consent was taken from all the women who were willing to participate. After enrolling demographic data, obstetric data and current pregnancy details were taken .A trans-abdominal ultrasound was used for doppler assessment of uterine circulation for uterine artery and mean PI was obtained. USG with obstetric doppler was done in the third trimester to monitor fetal growth parameters. The women were then followed up until the delivery to observe that whether there was development of fetal complications like fetal growth restriction, low birth weight, need of NICU admission. The data obtained were coded and entered into Microsoft excel worksheet and tests of significance were applied. The results were taken to be statistically significant when p value was < 0.05.

RESULTS

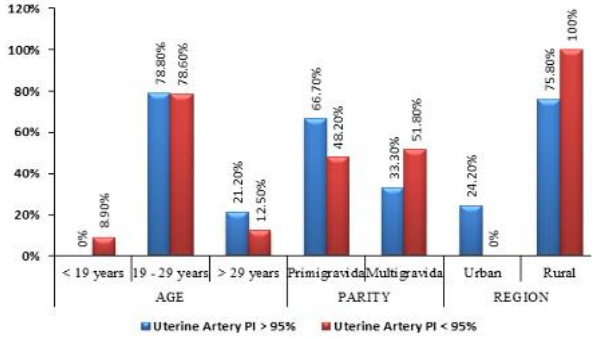

Figure No. 1: Distribution of demographic and obstetric data

Most of the patients in both categories belonged to the age group of 19 to 29 years. 66.7 % of patients with raised PI were primigravida and 75.4% of cases with raised PI belonged to urban region.

Table No. 1: Association between uterine artery PI and pre-eclampsia.

Pre-eclampsia (n = 89)	Uterine Artery PI > 95%	Uterine Artery PI > 95%	Total (n = 89)	p-value
Present	12 (92.31%)	01(07.70 %)	13	**0.0005 Significant**
Absent	21(27.63 %)	55(72.37 %)	76	
Total	33	56	89	

(* Note: Percentages are calculated row wise)

In our study, out of all the patients who had pre-eclampsia, 92.31% had raised uterine artery PI, and; out of all the women who did not have pre-eclampsia, 72.37 % had normal uterine PI. This suggests that the use of uterine artery doppler as a predictor for pre-eclampsia is important and is of value.

Table No. 2: Association between uterine artery PI and fetal growth restriction.

Fetal Growth Restriction (n = 89)	Uterine Artery PI > 95%	Uterine Artery PI > 95%	Total (n = 89)	p-value
Present	15 (51.72 %)	14 (48.28 %)	29	**0.047Significant**
Absent	18 (30.00 %)	42 (70.00 %)	60	
Total	33	56	89	

(* Note: Percentages are calculated row wise)

In our study, out of all the patients who did not develop FGR, 70 % had normal uterine artery PI and out of all the patients who developed FGR, comparatively more number of patients had abnormal uterine artery PI suggesting that raised uterine artery PI could also be used as a predictor of FGR.

Table No. 3: Association between uterine artery PI and birth weight.

Birth weight (n = 89)	Uterine Artery PI > 95%	Uterine Artery PI > 95%	Total (n = 89)	p-value
< 2.5 kgs	15 (57.69 %)	11 (42.31 %)	26	**0.010 Significant**
> 2.5 kgs	18 (28.57 %)	45 (71.43 %)	63	
Total	33	56	89	

(* Note: Percentages are calculated row wise)

In our study, out of all the patients who delivered low birth weight babies, 57.69 % had raised uterine artery PI, and; out of all the women who delivered normal weighing babies, 71.43 % had normal uterine PI. This suggests positive co-relation between normal uterine artery PI and normal weight babies.

Table No. 4: Association between uterine artery PI and NICU admission.

NICU Admission (n = 89)	Uterine Artery PI > 95%	Uterine Artery PI > 95%	Total (n = 89)	p-value
Present	17 (58.62 %)	12 (41.38 %)	29	**0.003 Significant**
Absent	16 (26.67 %)	44 (73.33 %)	60	
Total	33	56	89	

(* Note: Percentages are calculated row wise)

In our study, out of all the patients whose baby required NICU admission, 58.62 % had raised uterine artery PI, and; out of all the patients whose baby did not require NICU admission, 73.33 % had normal uterine PI. This shows significant association between raised uterine artery PI and NICU admission.

DISCUSSION

The aim of our study was to predict the possibility of developing pre-eclampsia according to uterine artery doppler pulsatility index. This study was a prospective observational study where total of 89 cases were enrolled of which 33 cases had uterine artery PI more than 95th percentile and 56 cases had uterine artery pulsatility index less than 95th percentile. All cases were followed up to the delivery to assess whether uterine artery doppler pulsatility index which is measured at 11 to 13+6 weeks helps in predicting pre-eclampsia and has any predictive value with respect to fetal growth restriction, baby weight and NICU admissions.

Chitra Andrew et al (2015) reported in her study that 78% of the women with uterine artery PI more than 95th percentile were in the age group between 25-30 years. [6] A similar study by Jyoti Bindal et al (2016) reported that 52% of the women were in the age group between 21 -30 years. [7] In a study performed by Goynumer et al (2009), they observed that parity did not affect uterine artery PI value but the mean pulsatility index in nulliparous women (mean PI-2.1) was significantly higher than multiparous women (mean PI-1.9). [8]

In our study, 92.31% of the women who developed pre-eclampsia had abnormal uterine artery doppler. It concluded that raised PI value is significantly associated with pre-eclampsia. M Bharati et al in the year 2013 tried to study the role of uterine artery PI where 88.2% of the cases with uterine artery PI more than 95th centile developed pre-eclampsia. The sensitivity of the study was 79% ,specificity was 95.5% with a positive predictive value of 88.2% and negative predictive value of 98.9%. [9] In another similar study, which was done by Su lynn khong et al(2015), the sensitivity of the study to predict pre-eclampsia was 26.4% and the specificity was 47.8%.[10]

In our study, out of all the patients who developed fetal growth restriction, 51.72% women had raised uterine artery PI which was statistically significant value. A study similar to our study was done by Surbhi Handa et al (2019) where 25% of the cases with uterine artery PI value more than 95th percentile developed fetal growth restriction as a complication. [11]

In our study, out of all the patients who delivered low birth weight babies, 57.69 % had raised uterine artery PI, and; out of all the women who delivered normal weighing babies, 71.43 % had normal uterine PI. Our study showed a positive co relation between normal PI and normal birth weight. Andres Sarmiento et al 2013 observed significant correlation between uterine artery PI and birth weight (p=0.013) was observed. [12] Anshu Dhar et al 2017 examined 200 pregnancies to determine the correlation of uterine artery PI with fetal outcome and observed that the birth weight in higher mean PI group (2.33+/-0.48kgs) was less than in pregnancies with uterine artery PI < 95th centile (2.86 +/-0.48kgs) [13]

In our study, out of all the patients whose baby required NICU admission, 58.62 % had raised uterine artery PI, and; out of all the patients whose baby did not require NICU admission, 73.33 % had normal uterine PI. This shows significant association between raised uterine artery PI and NICU admission. Veronique Schiffer et al 2018 conducted a retrospective pilot study to evaluate the co relation between abnormal uterine artery doppler pulsatility index and neonatal outcome .cases with uterine artery PI value 95% had higher rates of NICU admission (p=0.001). [14]

CONCLUSION

Pre-eclampsia is a life threatening disorder of pregnancy.
Uterine artery doppler in the first trimester done along with NT scan has found to be a good predictor of pre-eclampsia with good sensitivity and specificity. Thus early detection at low cost is of utmost importance.

This study also showed a positive association between PI > 95% with the development of pre-eclampsia and FGR.

It is an effective non-invasive screening test for the development of PE in pregnancies at risk, in health systems with limited means of evaluating other biomarkers. It is convenient and cost effective to use uterine artery doppler as a routine screening test. Also, early screening will help in individualized antenatal surveillance to reduce adverse maternal and fetal complication.

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