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Original Research Article

Role of Placental Localization and Uterine Artery Doppler as Predictors for Preeclampsia

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Abstract: Preeclampsia is a pregnancy specific syndrome of reduced organ perfusion secondary to vasospasm and endothelial activation. Several tests have been proposed to predict development of preeclampsia such as cold pressor test, isometric hand grip exercise, urinary calcium and plasma fibronectin. Studies have been shown that there is significant association between lateral placenta with presence of preeclampsia and abnormal uterine artery resistance. Among the various predictors for preeclampsia, localization of the placenta by ultrasound at 18-24 weeks is a very cost effective and noninvasive method, and has a good positive predictive value. Of our study is to find out relation of placental laterality and uterine artery resistance in prediction of preeclampsia. This Prospective observational study comprises 500 antenatal cases of Singleton, primi gravida at 18 to 24 weeks with complete follow-up till delivery. After recording of Blood pressures, Location of the placenta was determined by ultra-sonography. Lateral placenta was considered, only when 75% or more of the placental mass located on either side of the uterine cavity. All patients with lateral placenta were evaluated by Pulse Doppler to find out the uterine artery resistance index .Uterine artery RI > 0.58 and persistence of pre diastolic notch in the dominant side, taken as significant. In study of 500 cases, 18% had lateral placenta, while remaining had central placenta on ultra sound examination. Incidence of preeclampsia was approx 38% in lateral placenta. Out of these lateral placenta patients 34% had raised uterine artery RI and among them 83.8% developed preeclampsia. Raised uterine artery resistance in relation to preeclampsia exhibited high sensitivity of 83%, specificity of 86.4%, and positive predictive value of 76.4% and negative predictive value of 91.3%. Ultra-sonography is a simple, easy and cost effective diagnostic tool to predict high risk antenatal cases. Our study suggests that incidence of preeclampsia is more in patients with lateral placenta and its sensitivity and specificity increases significantly, when it is combined with uterine artery Doppler study.

Keywords: Ultra sonography, Pre-eclampsia, PIH, Placental localization, Placental laterality, Central placenta, Color Doppler, Resistive Index

INTRODUCTION

PIH is the most common medical complication during pregnancy and a major cause for maternal and perinatal morbidity and mortality. Preeclampsia complicates around 3-8% of pregnancies world wide and 10-15% maternal mortality [1]. Despite recent advances in antenatal care no reliable screening test is available for prediction of preeclampsia. Preeclampsia is defined as rise of blood pressure 140/90 mmHg or more recorded on two occasions 6 hours apart and proteinuria 30 mg or more in two random urine samples after 20 weeks of gestation in a normotensive woman [2].

Preeclampsia is a pregnancy specific syndrome of reduced organ perfusion secondary to vasospasm and

endothelial activation [2]. Reduced placental perfusion is thought to result from failure of second wave of trophoblastic invasion to spiral arteries [3]. Doppler study of uterine arteries in the second trimester reveal that abnormal waveforms indicating defective uterine perfusion is primarily a consequence of placental implantation, when one uterine artery is the dominant supply of intervillous flow [4,5].

Several tests have been proposed to predict development of preeclampsia such as cold pressor test, isometric hand grip exercise, urinary calcium and plasma fibrinectin. Placental location has been found to correlate with presence of preeclampsia [6,7] and pregnancy outcome [8].Studies have been shown that there is significant association between lateral placenta and uterine artery resistance [4]. Among the various predictors for preeclampsia, localization of the placenta by ultrasound at 18-24 weeks is a very cost effective and noninvasive method, and has a good positive predictive value [9]. In the light of these observations, we designed a prospective study to find relation of placental laterality and uterine artery resistance and development of preeclampsia.

AIMS AND OBJECTIVES

- To predict the incidence of preeclampsia in relation to location of placenta
- To correlate the uterine artery Doppler in relation to lateral placenta
- To determine the relation between abnormal uterine artery Doppler for preeclampsia.
- To assess sensitivity, specificity, PPV and NPV of uterine artery resistive index in relation to preeclampsia and lateral placenta.

METHODS AND MATERIAL

This prospective observational study was carried out in Department of Radio diagnosis at Index Medical College and PG Institute Indore. This study was conducted from November 2015 to January 2017 with complete follow-up of the selected pregnancy till delivery. Prior informed consent was taken from all the pregnant women. Total 500 patients referred from antenatal clinic for routine obstetric ultrasound were included in our study at 18 to 24 weeks of gestation age.

Inclusion Criteria

Normotensive, Primigravida, Singleton pregnant women of 18 to 24 weeks.

Exclusion Criteria

Previous history of diabetes, hypertension, renal disease, collagen vascular disorders or history of smoking, Multipara and multiple gestations were excluded. Blood pressures were recorded by auscultatory method in all the selected patients. Ultrasound was done by Siemens' Acuson X 300 machine using convex probe of frequency ranging from 3-5 MHz. Location of the placenta was determined by real time ultra-sonography. Lateral placenta was considered, only when 75% or more of the placental mass located on either side of the uterine cavity, Rest was considered as central placenta [10].

All patients with lateral placenta were evaluated by Pulse Doppler to find out the uterine artery resistance index and persistence of pre diastolic notch of dominant uterine artery. Uterine artery resistance index of more than 0.58 and presence of pre diastolic notch in the dominant side is taken as significant. All subjects were followed till delivery for occurrence of preeclampsia as per ACOG (American College of Obstetrics and Gynecology) guidelines [2].

Statistical Methods

All data was analysed and statistical significance was determined by x2 test and value of $p<0.05$ is considered significant.

OBSERVATION AND RESULT

Out of the total 500 women, maximum number of patients is in 20-25 years age group. In our study, we have observed that incidence of preeclampsia is found to increases with increasing age of patient. Highest percentage of preeclampsia was found in age group of >30 years (Table 1).

Approximately18% (90) of cases showed lateral placenta and 82% (410) showed central placenta on ultrasound examination done at 18-24 weeks of gestation. Among them, 37.7% (34/90) patients developed preeclampsia in lateral placental location (Table 2).

Out of 90 patients 31(34.4%) had raised uterine artery resistance and out of them 26 (83.8%) developed preeclampsia in later weeks of pregnancy. Only 5 %(8.9%) patients of preeclampsia with lateral placenta had normal uterine artery resistance. Which is statistically significant ($p < .001$) (Table 3). Raised uterine artery resistance in relation to preeclampsia yielded sensitivity of 83%, specificity of 86.4%, positive predictive value of 76.4% and negative predictive value of 91.3 %(table 4).

Table-1: Distribution of patients' age and its correlation with preeclampsia.

Age group (In Years)	Patients with preeclampsia	Total (n=500)	Percentage
< 20	0	3	0
20 – 25	51	356	14.3%
26 - 29	21	124	16.9%
>30	8	17	47%

Table-2: Distribution of patients in relation to site of placenta and preeclampsia

Site of placenta	Preeclampsia present	Preeclampsia Absent	Total	Percentage
Central	46	364	410	11.2%
Lateral	34	56	90	37.7%

P value is less than 0.001 (significant)

Table-3: Distribution of lateral placenta in relation to occurrence of preeclampsia and changes in UA Color Doppler

	Uterine artery Color Doppler in lateral placental		Total
Preeclampsia	**Abnormal RI**	**Normal RI**	
Present	26 (76.4%)	8 (23.5%)	34
Absent	5 (8.9%)	51 (91.0%)	56

P value is less than 0.001 (significant)

Table-4: Significance of occurrence of Preeclampsia in relation to Uterine Artery RI in patient with lateral placenta

sensitivity	specificity	Positive predictive value	Negative predictive value
83.8%	86.4%	76.4%	91.3%

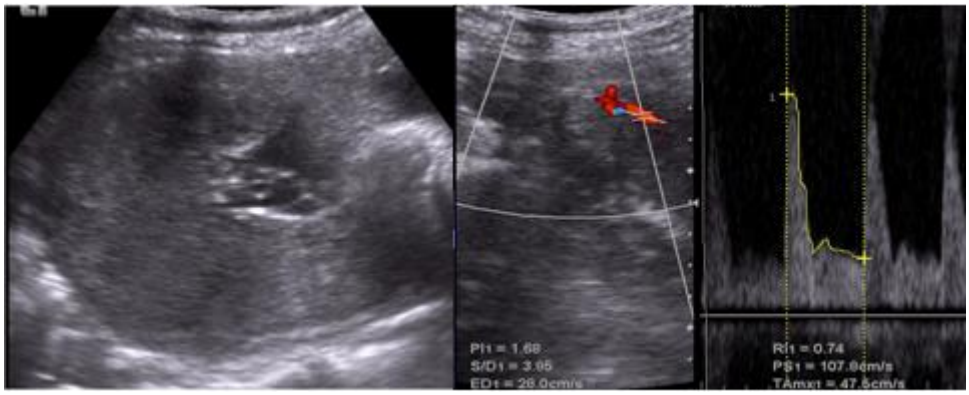

Fig-A&B: Right lateral placenta showing Raised RI with persistent pre diastolic notch in uterine artery in patient with PIH

DISCUSSION

In patients with central placenta both the uterine arteries show similar resistance because demand of blood flow met by equal contribution of both uterine arteries. In case of lateral placenta, the demand of blood flow is primarily provided by uterine artery of the same side with some contribution by opposite side by collateral circulation [11].The contribution of collateral circulation may not be adequate and deficient perfusion may facilitate preeclampsia [12]. In lateral placenta failure to invasion of cytotrophoblast in opposite side further contribute to preeclampsia [13].

Our study is comparable with Jani P.S *et al.*, who observed that out of 400 cases, 320 (80%) cases had central placenta, while 80 (20%) had lateral placenta. 0ut of the 80 patients with lateral placenta 28

(35%) developed preeclampsia and out of them 22 (78.5%) had abnormal uterine artery Doppler [14].

The incidence of pre eclamsia was found more in lateral placenta (38%) than in central placenta (11%) which is statistically significant ($p < 0.001$). Our study is comparable with study of Patel A *et al.*, they found out of 200 patients, incidence of preeclampsia was 2.5 fold higher than central placenta ($p<0.001$). Total 40 patients detected with lateral placenta out of them 32.5 % had raised uterine artery resistance and among these raised RI patients, 78.5% developed preeclampsia. Sensitivity and specificity of raised uterine artery resistance in relation to preeclampsia and lateral placenta was approximately 85% and 89% respectively. The results of this study are similar to our study [15].

Chinnappa M K *et al.* in their study included 200 cases at the time of anomaly scan. The study population had15% lateral placenta and 85% had central placenta. The incidence of preeclampsia in their study was 13%. In their study 15 developed preeclampsia out of 30 lateral placentation with chi square value of 42.71 and p value of 0.000. They found 61.5% patients with preeclampsia had abnormal Doppler with a chi –square value of 32.29. The incidence of abnormal Doppler in lateral placenta was 65% with chi square 98.04 [16].

The results of the study were also comparable to those of Muralidhar *et al.* [17]. In his study out of 426 women, 324(76%) had central placenta and 102 (24%) had lateral placenta. The relationship was found to be statistically significant $p < 0.0001$. In Studies of H valensies *et al* [18] Palma-Dias *et al.* [19] and Gómez O [20] *et al.* uterine artery with Color Doppler had shown significant association of preeclampsia with raised uterine artery resistance.

CONCLUSION

Ultrasonography is a simple, easy and cost effective diagnostic tool to predict high risk antenatal cases. Our study suggests that incidence of preeclampsia is more in patients with lateral placenta and its sensitivity and specificity increases significantly when it is combined with uterine artery Doppler study. Therefore, ultrasound at 18 to 24 weeks can be a useful diagnostic method to predict preeclampsia in patients with lateral placenta and thus raised uterine artery RI.

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