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Placental Laterality and Uterine Artery Resistance for Prediction of Preeclampsia

KEYWORDS: Placenta, uterine artery doppler, Preeclampsia

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ABSTRACT *Present Study is aimed to find out correlation of preeclampsia with lateral placenta and uterine artery resistance index .In this study we included 200 non high risk primigravida, all underwent ultrasonography at 18 to 22 weeks of pregnancy and site of placenta determined whether central or lateral. All patients having lateral placenta underwent colour Doppler and changes in uterine artery resistance index were noted. All patients were followed till delivery and occurrence of preeclampsia noted. We found out that 14 out of 40 patient having lateral placenta developed preeclampsia (p<0.001). And out of all 40 patients having lateral placenta who underwent colour Doppler, 13 patients had raised uterine artery resistance index (p<0.001). We conclude that lateral placenta can be used as a predictor marker for preeclampsia and if all patients with lateral placenta undergo colour Doppler, we can predict preeclampsia more accurately.*

Introduction:
Despite recent advances in antenatal care, hypertensive disorders of pregnancy remain a major cause of maternal and fetal morbidity and mortality. Early screening for preeclampsia allows vigilant antenatal surveillance and appropriate timing for delivery.

Preeclampsia is rise of blood pressure more than or equal to 140/90 mmHg recorded on two occasions 6 hours apart with Proteinuria (0.3 gms or more protein in 24 hour collected urine sample with 1+ or greater on urine dipstick test) after 20 weeks of gestation involving multiple organ systems.

Exact aetiology of preeclampsia is unknown. The poorly perfused placenta may be the origin of factors which gain access to maternal vasculature and cause endothelial cell dysfunction. Reduced placental perfusion in preeclampsia is thought to result from failure of the trophoblasts to invade maternal spiral arteries.1 So If impaired placentation is the fundamental cause of preeclampsia, can it`s manifestation be used as a screening test by simple non-invasive ultrasonography?

It has been shown that there is significant association between lateral placenta and uterine artery resistance2. It is possible that lateral placenta may disturb uterine artery blood flow distribution and invasion of trophoblasts in to spiral artery3. This study was designed to find relation of placental laterality and uterine artery resistance and development of preeclampsia.

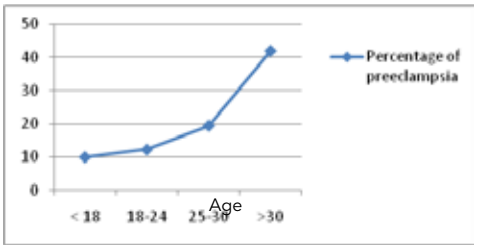
Material and Method:
This prospective observational study was conducted at Bharati hospital and research centre, a tertiary care teaching institute in Pune from September 2010 to September 2012. A total 200 non high risk primigravida with singleton pregnancy were included, all patients with diabetes, Hypertension, Renal disease, and history of smoking were excluded. Mid trimester blood pressure was noted in all 200 patients. In all these patients, location of placenta was determined by ultrasonography at 18 to 22 weeks of gestation. When more than 75% or more of the placental mass was on one side of uterus it was classified as lateral placenta, rest other were classified as central placenta.4 Patients who had lateral placenta were subjected for colour Doppler study for determining uterine artery resistance index. All 200 patients were followed till delivery for occurrence of preeclampsia as per ACOG guidelines. All data was analysed and statistical significance was determined by x2 test and value of p<0.05 is considered significant.

Observations and Result:
Data of 200 patients was analysed. There was no relation of age, BMI, or socioeconomic status for placental laterality. Out of these 200 patients 80% had shown Central placenta and 20% had Lateral placenta.

Incidence of preeclampsia in selected cohort was found to be 16%.

Incidence of preeclampsia is found to increase with increasing age .In our study 42% patients over 30 years (Figure 1) developed preeclampsia.

Figure 1:



Patients with laterally situated placenta had 2.5 fold higher incidence of preeclampsia than centrally located placenta (p<0.001 Table 1).

Table 1: Distribution of patient with respect to site of placenta and preeclampsia.

Site of placenta	PE Absent	Present	Total	p-value
Central	18	142	160	< 0.001
Lateral	14	24	40	

*-By using Chi-square test p-value > 0

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All 40 patient who had lateral placenta, 13 patient had raised uterine artery resistance and out of those 13 patients 11 developed preeclampsia and 27 had no change in uterine artery resistance out of those 27 only 3 had preeclampsia($p<0.001$,sensitivity, specificity Table 2).

Table 2: Distribution of patients with respect to raised uterine artery resistance and occurrence of preeclampsia in patients with laterally situated placenta.

PE	Raised uterine artery resistance		Total(n)	p-value*
	Yes	No		
Present	11 (78.57%)	3 (21.43%)	14	< 0.001
Absent	2 (7.69%)	24 (92.31%)	26	

*-By using Fisher's exact test p-value < 0.05

Table 3: Significance of occurrence of preeclampsia in raised uterine artery resistance in patients with laterally situated placenta.

Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
84.62%	88.89%	78.57%	92.31%

Discussion and conclusion:

Extensive biochemical and clinical studies in preeclampsia had been carried out in the past but none had convincing results with good sensitivity and specificity.5 This study provides evidence of association between placental laterality and preeclampsia. It also appears that majority of patients having lateral placenta have abnormal uterine artery flow velocity waveforms.

Preeclampsia is strongly related to poor placental development and function.2 Quantitative analysis of trophoblast invasion in preeclampsia had shown restricted invasion of the trophoblastic cells in preeclampsia..6,7 Studies of uterine artery with colour Doppler had shown significant association of preeclampsia with raised uterine artery resistance.,8,9,10. It has been shown that both uterine arteries have significant number of branches and each supply corresponding side of uterus. There is anastomosis in-between but it is not functional. Hence when placenta is situated laterally, in the majority of cases the utero placental blood flow needs are met with primarily by uterine artery of same side with some contribution from opposite side by collateral circulation.11 The degree of collateral circulation is not same in all individuals and deficient contribution may facilitate preeclampsia and IUGR.12 In laterally situated placenta cytotrophoblasts may fail to adapt vascular invasion in opposite side and eventually contribute to preeclampsia.3 Pai Murlidhar V. et al has shown that in humans both uterine arteries have significant role in blood supply to the developing placenta, when both arteries contribute equally, they show similar resistance; In case of laterally located placenta , the uterine artery closer to the placenta has lower resistance than the one opposite to it.12

The pathophysiologic characteristics of preeclampsia are complex and the cause remains unknown. One of the fundamental causes is disturbed uteroplacental blood flow. However, whether it is the cause or effect of preeclampsia is yet to be discovered. Our data suggests that chance of preeclampsia is more in patients with lateral placenta but its sensitivity and specificity increases significantly when it is combined with uterine artery Velocimetric waveform study, and we can predict preeclampsia in patient who is having lateral placenta and raised uterine artery resistance.

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