

Can Placental Laterality Predict Development of Pre-Eclampsia in Low Risk Pregnancies? – Prospective Study in a Medical College Hospital

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Received: 25-09-2024 / Revised: 23-10-2024 / Accepted: 26-11-2024

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Conflict of interest: Nil

Abstract:

Background: Hypertensive disorders complicate 5-10% of pregnancy globally and 7-8% in India. In pre-eclampsia, there is inhibition of second wave of trophoblast migration into myometrial segment of uterine arteries which is pronounced in women with laterally located placenta. As it is one of the major cause of maternal mortality and morbidity, there is immense need for prediction of pre-eclampsia.

Methods: Pregnant women of gestational age 18-24 weeks with singleton pregnancies were selected and placental localization was classified as central or lateral. Follow up with routine antenatal visits for signs and symptoms of preeclampsia, routine examination of blood pressure, weight and investigations were done and results were tabulated, maternal outcome was noted.

Results: In this study, 138 women were studied. 60 study participants had central placenta of which 20 % (n-12) developed hypertensive disorder of pregnancy. 78 study participants had lateral placenta among which 29.5 % (n-23) developed hypertensive disorder of pregnancy. Women who had lateral placenta are 1.7 times likely to develop hypertensive disorder of pregnancy. Sensitivity of lateral placenta in predicting development of pre-eclampsia is 65.7% and specificity is 46.6%.

Conclusion: Prediction of preeclampsia is important in classifying women into high risk category so that surveillance can be intensified and accessibility to healthcare with birth planning can be done. Placental laterality, although easily done and economical has poor sensitivity and predictive value, hence as a standalone parameter has trivial value in prediction of pre-eclampsia. Though predictive tests incorporating maternal characters, biochemical, biophysical, markers and ultrasound Doppler velocimetry of uteroplacental blood flow are in the pipeline, more randomized control trials are needed to substantiate their larger application in the cohort of pregnant mothers.

Keywords: Placental Laterality, Preeclampsia, Prediction.

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Introduction

Hypertensive disorders complicate 5-10% of pregnancy globally and 7-8% in India [1]. It is the most common complication of pregnancy and one of the causes of maternal mortality among the triad with haemorrhage and sepsis. In normal pregnancies the spiral arterioles that supply the placental bed undergo trophoblast induced conversion to uteroplacental arterioles. In pre-eclampsia, there is inhibition of second wave of trophoblast migration into myometrial segment of uterine arteries [2,3].

Placenta is classified as central when it is equally distributed between the right and left side of uterus irrespective of anterior, posterior or fundal position. When 75% or more of the placental mass was to one side of the midline it was classified as unilateral – right or left placenta. When the placenta is centrally

located both uterine arteries demonstrate similar resistance. The uteroplacental blood flow needs are met by equal contribution from both uterine arteries. But when the placenta is laterally located the uteroplacental blood flow needs are to be met primarily by one of the uterine arteries with some contribution from the other through collaterals. This degree of collateral circulation may not be the same in all patients and deficient contribution may facilitate the development of pre-eclampsia, fetal growth restriction or both.

The significance of normal placentation for this cytotrophoblastic invasion is high and cytotrophoblast failed to adopt vascular adhesion phenotype in preeclampsia. If there were no functional anastomosis between right and left

uterine arteries, in cases with unilaterally located placentas, ipsilateral uterine artery systolic diastolic ratios change more than the contralateral ratios in hypertensive pregnancies. This may explain the reduced trophoblastic invasion in laterally situated placenta when the uteroplacental blood flow need is mainly met by one side uterine artery. The use of ultrasound as a tool for screening/prediction of preeclampsia is based on the fact that defective placentation results in incomplete transformation of spiral arteries. Placental villous and vascular histopathological lesions are four-to-seven times more common in pre-eclampsia than in pregnancies without pre-eclampsia and are associated with increased resistance to uterine artery blood flow [4].

Many tests have been tried to predict preeclampsia based on the pathogenesis. Biochemical markers are based on placental dysfunction, endothelial cell activation, coagulation activation, angiogenesis, and markers of inflammation. Biophysical tests such as roll over test depend on pathophysiological process in preeclampsia, but none of them are sufficiently reliable in clinical practice [5].

Aims/Objectives: To analyse the scope of "Placental laterality as a predictor for the development of pre-eclampsia between 18-24 weeks of gestation in low risk pregnancies.

Materials and Method

Pregnant women of gestational age 18-24 weeks with singleton pregnancies were selected after obtaining written and informed consent. The study was conducted in Department of Obstetrics and Gynaecology, KAPV Government Medical College Hospital to attached to MGMGH for a period of one year. No dietary alterations was recommended. Detailed history taking, complete general, systemic and obstetric examination was done. The location of placenta was determined at 18-24 weeks by using MINDRAY ultrasound scanner with a 3.5 MHz curvilinear probe. Placental localization was classified as central or lateral:

- Central – When placenta was equally distributed between the right and left sides of uterus. The central placenta could be anterior, posterior, or fundal (fig 1)
- Lateral – When 75% or more of the placental mass was to one side of the midline it was classified as unilateral –right or left placenta. (fig 2)

Follow up with routine antenatal visits for signs and symptoms of preeclampsia, routine examination of blood pressure, weight and investigations were done and results were tabulated and maternal outcome was noted.

Inclusion Criteria: Pregnant women of gestational age 18-24 weeks attending op at MGMGH.

Exclusion Criteria

- Chronic hypertension
- Diabetes mellitus
- Chronic renal disease
- Anemia
- Multiple pregnancy
- Autoimmune disorders like Systemic lupus erythematosus

Study Design: Prospective cohort study.

Statistical Analysis Plan: SPSS Software.

Results

In this study, 150 women were enrolled of which 12 mothers were lost for follow up, hence 138 women were studied. Among 138 study participants, 78% of women belong to age group 21-30 years. (Table 1) 88 % of study participants were literate (Table 2). 55 % of study participants belong to urban area (Table 3). 50.7 % of study participants were primigravida, 43.5 % were second and third gravida. (Table 4) 60 study participants had central placenta of which 20 % (n=12) developed hypertensive disorder of pregnancy. 78 study participants had lateral placenta among which 29.5 % (n=23) developed hypertensive disorder of pregnancy. (Table 5) Women who had lateral placenta are 1.7 times likely to develop hypertensive disorder of pregnancy. Sensitivity of lateral placenta in predicting development of HDP is 65.7% and specificity is 46.6%. Positive predictive value of lateral placenta in prediction of preeclampsia development is 29.5% and negative predictive value is 80%.

Among the study participants who developed hypertensive disorders of pregnancy, 22 mothers had gestational hypertension, 12 mothers developed preeclampsia and 1 mother had antepartum eclampsia and there was no mortality in these women.

Table 1: Distribution of Cases According To Age

Age In Years	Number Of Participants(N-138)	Percentage
18-20	22	15.9%
21-25	48	34.7%
26-30	60	43.7%
31-35	6	4.3%
>35	2	1.4%

Table 2: Distribution of Cases According To Literacy Status

Educational Status	Number Of Participants (N-138)	Percentage
Illiterate	16	11.6%
Primary School	18	13.1%
High School	46	33.3%
Graduate	54	39.1%
Professional	4	2.9%

Table 3: Distribution of Cases According To Residence

	Number Of Participants (N-138)	Percentage
Rural	62	44.9%
Urban	76	55.1%

Table 4: Distribution of Cases According To Obstetric Code

Obstetric Code	Number Of Participants (N-138)	Percentage
Primigravid	70	50.7%
G2	42	30.4%
G3	18	13.1 %
G4	5	3.6%
G5 And Above	3	2.2%

Table 5: Association between Placental Location and Development of Pre-Eclampsia

Placental Location	Developed Hypertensive Disorders Of Pregnancy (N-35)	Normotensive (N-103)
Central Placenta (N-60)	12	48
Lateral Placenta (N-78)	23	55

Odds Ratio-1.6727, P Value-0.103233

**Figure 1: Ultrasound image showing central location of placenta**



Figure 2: Ultrasound image showing lateral location of placenta

Discussion

In a prospective Study by Kakkar et al, 66.6% of women with laterally located placenta developed PIH as compared to 36.6% of females with centrally located placenta. So, the risk of developing PIH was five times greater for the females with laterally located placenta, compared to those with centrally located placenta. The overall risk of developing PIH with laterally located placenta was 5.09 (odds ratio) [6]. In a prospective study to find whether placental laterality as determined by ultrasound can be used as a predictor of the development of preeclampsia and to find its correlation with severity of preeclampsia and obstetric outcome women with lateral placental location have 1.77 times greater risk of development of preeclampsia than ones with central placental [7]. In the present study, women who had lateral placenta are 1.7 times likely to develop hypertensive disorder of pregnancy.

In a cross sectional study to evaluate the impact of placental position on maternal fetal outcome by Alakonda et al, there was a positive and significant association between the lateral location of placenta and severe pre-eclampsia [8]. Pregnancies complicated by pre-eclampsia were more commonly associated with lateral placentation in the second trimester. [9]

Preeclampsia was present in 39.4 % of women with central placenta and 83% of women with lateral placenta in a prospective case control study in which placental location was compared in hypertensive and normotensive pregnancies by Agarwal et al .Preeclampsia is almost six times more frequent in the presence of lateral placenta as compared to

central placenta [10]. In prospective study by Priyadharshini et al, 48.5% patients with lateral placenta and 46.9% with central placenta developed pre-eclampsia. There was a significant association between laterality of placenta and development of PIH [11] In a prospective observational study of 100 pregnant mothers, placental laterality had sensitivity of 81%, specificity of 85.3%, positive predictive value of 47.2%, and negative predictive value of 96.43% in prediction of preeclampsia. [12]

In a meta-analysis by Naik et al, (13)out of 16 studies showed statistically significant positive association between laterally placed placenta and pre-eclampsia. Odd's Ratio was 3.48 with 95% confidence interval from 3.03 to 3.99 which clearly indicates that there is a strong positive association. A high index of suspicion for risk of developing PIH to be kept in mothers with lateral location of placenta on antenatal ultrasound [13].

Conclusion

Prediction of preeclampsia is important in classifying women into high risk category so that surveillance can be intensified and accessibility to healthcare with birth planning can be done. Combination of tests which includes maternal characters, medical history (Gestosis score), mean arterial pressure measurement (MAP), uterine artery pulsatility index, ratio between angiogenic and antiangiogenic factors (sFlt1, sEndoglin, PLGF, PAPP-A) are being evaluated. Placental laterality, although easily done and economical has poor sensitivity and predictive value, hence as a standalone parameter has trivial value in prediction of pre-eclampsia.

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