

Placental laterality: As a predictor for the development of Pre- eclampsia

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Abstract:-

Objective: To find whether placental laterality as determined by ultrasound can be used as predictor for the development of pre-eclampsia.

Methods: This prospective study was conducted in the Department of Obstetrics and Gynecology, R.N.T. Medical College, Udaipur from 2014 to 2015. 100 pregnant women attending antenatal clinic both OPD and IPD at 20–24 weeks of gestation without any high risk factor were subjected to ultrasound examination, and placental location was determined. These cases were followed for the development of signs and symptoms of pre-eclampsia.

Result: Out of the total 100 women, 50 had laterally located placenta and of them, 33 (66 %) developed pre-eclampsia, while the remaining 50 had centrally located placenta and of them, 18 (36 %) developed pre-eclampsia. So, the overall risk of developing pre-eclampsia with laterally located placenta was 3.451 (Odds Ratio) and 95% Confidence Interval (1.52 to 7.85). The difference was found to be statistically significant, p value (0.01) by chi-square test.

Conclusion: Ultrasonography is simple, non-invasive, easy to perform, cost effective, diagnostic method to identify high-risk cases. From the above study, we concluded that females with laterally located placenta determined by USG at 20–24 weeks of gestation have five times greater risk of developing preeclampsia. By identifying such patients appropriate treatment can be initiated and the patients are regularly followed up.

Keywords: Placental laterality, Pre-eclampsia, Central placenta, Predictor

I. Introduction

Hypertensive disorders remain the most common medical complications during pregnancy and form one of the deadly triad along with hemorrhage and infections. These disorders indeed, remain among the most significant and intriguing unsolved problem in obstetrics. Pre-eclampsia is a disease of trophoblastic tissue. Pre-eclampsia is a multi-system disorder of pregnancy, which is characterized by new onset hypertension (systolic and diastolic blood pressure of ≥ 140 and 90 mm Hg, respectively, using Korotkoff V sound for diastolic blood pressure recorded on two occasions 6 hour apart with proteinuria (0.3 grams 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 in non proteinuric women.

Preeclampsia occurs only in the presence of placenta[1]. Several tests have been proposed to identify women at risk of developing preeclampsia. Some of these tests such as the cold pressor test, the isometric hand grip exercise, and the roll over test depend on the presence of some pathophysiological changes that occur in preeclampsia. Other tests such as the measurement of urinary calcium or plasma fibronectin are based on the presence of biochemical alterations peculiar to this disease. Placental location has been found to correlate with fetal position and presentation [2,3], length of gestation[4], course of labor[5], presence of pre-eclampsia[6,7], and pregnancy outcome[8].

Among the various predictors for pre-eclampsia, the placental location by ultrasound at 18–24 weeks is very cost effective, non-invasive, and has a good positive predictive value[9]. There is a significant association between placental location and uterine artery resistance and adverse outcomes such as pre-eclampsia and IUGR. In the women with centrally located placenta, both uterine arteries demonstrate similar resistance. When the placenta is laterally located, the uterine artery close to the placenta has lower resistance than the one opposite from it. In laterally located placenta, the utero placental blood flow needs are to be met primarily by one of the uterine arteries with some contribution by the other uterine artery via collateral circulation [10,11]. The degree of collateral contribution may not be the same in all women, and deficient contribution facilitates the development of pre-eclampsia, IUGR, or both.

II. Materials and Methods

The present study is a hospital based prospective study. This study was carried out in the Department of Obstetrics and Gynecology, R.N.T. Medical College, Udaipur from the period of October 2014 to 2015. The study was started after proper approval from Institutional Ethical Committee of RNT Medical College, Udaipur

Inclusion Criteria

All pregnant women attending the antenatal clinic, both outpatient and ward admissions, at 20–24 weeks of gestation without any high risk factors were included in this study.

Exclusion Criteria

Pregnant women were excluded from the study if they were having chronic hypertension or essential hypertension, Elderly Primi gravida, □ Twin gestation, □ Uterine anomalies, □ Previous caesarean section, □ Previous history of preeclampsia or eclampsia, □ Diabetes, □ Renal disease, Thyrotoxicosis, Connective tissue disorder, □ Recurrent Pregnancy Loss, □ History of smoking / alcohol / drug addiction.

All the cases were subjected to detailed history, general physical, and systemic as well as obstetrical examination at the time of their antenatal visit and at the time of admission. The location of placenta was determined by ultrasound at 20–24 weeks in all the selected women and followed subsequently for the development of pre-eclampsia. Blood Pressure was measured in sitting posture from right arm by mercury sphygmomanometer for which phase Korotkoff V sound was taken to determine the diastolic component. Urine Albumin determination was done by Urinary Dipstick method in which all samples were Midstream Urine and were collected in a clean sterile container. Dipstick was held horizontally for 60 seconds before reading the result. Pedal edema of the subjects was determined by applying pressure with thumb over medial malleolus of lower limb is either present or absent, and if present either pitting or non pitting.

The placenta was classified as central when it was 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. All women were followed throughout the pregnancy for the development of the signs and symptoms of pre-eclampsia.

Pre-eclampsia was diagnosed on the basis of the American Congress of Obstetricians and Gynecologists criteria for pre-eclampsia. The patients were treated according to the severity of the disease. Mild cases were advised bed rest and prescribed sedatives and told to come for regular follow-ups, while moderate to severe cases were given anti-hypertensive (labetalol) in addition to the above treatment. Those who showed no response were hospitalized and managed accordingly. In severe cases with persistent hypertension, pregnancy was terminated.

III. Results

- Out of the total 100 women, 54 women were in the age group 21 to 25 years, of which 68% had lateral location of placenta (Table 1). Fifty cases had laterally located placenta, while 50 cases had centrally located placenta on ultrasound examination done at 20–24 weeks of gestation.

Distribution of cases according to age and placental location (Table 1)

Age in years	Placental location	
	Central n(%)	Lateral n(%)
<20	3(6%)	5(10%)
21-25	20(40%)	34(68%)
26-30	14(28%)	6(12%)
>30	13(26%)	5(10%)
Total	50	50

- Majority of the women i.e 50 were in the weight group 66–70 kg (Table 2). Distribution on the basis of weight gain (Table 2).

Weight of subjects in kg	Frequency
<55	5
56-60	10
61-65	32
66-70	50
>70	3
Total	100

➤ Out of the 50 women with laterally located placenta, 33 (66 %) developed Pre-eclampsia, while 18 women (36%) out of the remaining 50 women with centrally located placenta developed Pre-eclampsia (Table 3). So, the risk of developing Pre-eclampsia was five times greater in the females with laterally located placenta as compared to those with centrally located placenta. The overall risk of developing PIH with laterally located placenta was *was* 3.451 (Odds Ratio) and 95% Confidence Interval (1.52 to 7.85). The difference was found to be statistically significant, p value (0.01) by chi-square test.

Association of placental location with pre-eclampsia (Table 3).

Placental Location	Normotensive		Pre-eclampsia		Total
	No.	%	No.	%	
Central	32	64	18	36	50
Lateral	17	34	33	66	50

➤ Out of the total 100 cases, 25 developed mild Pre-eclampsia. Out of these 25 cases, 12 had centrally located placenta and 13 had laterally located placenta (Table 4). Twenty six women developed severe Preeclampsia and out of these 6 had centrally located placenta and 20 had laterally located placenta. No case of eclampsia was reported (Table 4)

Association of Severity of pre-eclampsia with location of placenta (Table 4).

Severity	Central		Lateral		Total
	No.	%	No.	%	
Mild	12	23	13	52	25
Severe	6	48	20	76.9	26

➤ Majority of the cases of severe preeclampsia were 40% who were having proteinuria (>1+) had lateral location of placenta. There seems to be a good relationship between urinary albumin level with placental location. Higher level of urinary albumin indication more lateral placental location where as low levels of urinary albumin associated with central placental location. (Table 5)

Association of proteinuria and placental location (Table 5)

Urinary Albumin (Proteinuria)	Normotensive		Pre-eclampsia	
	No.	%	No.	%
Nil	32	64	17	34
Trace	4	8	7	14
1+	8	16	6	12
>1+	6	12	20	40

IV. Discussion

Pre-eclampsia is a complex clinical syndrome involving multiple organ systems and still remains the principal cause of maternal and perinatal mortality and morbidity [12]. It has been shown that in humans, both uterine arteries have a significant number of branches and each supply the corresponding side of the uterus. Although anastomoses between the two uterine arteries exist, there is no proof that these are functional. When the placenta is laterally located, the uterine artery close to the placenta has lower resistance than the one opposite from it. In patients with centrally located placenta, both uterine arteries demonstrate similar resistance [10,11,13]. When the placenta is centrally located, the uteroplacental blood flow needs are met by equal contribution from both uterine arteries. However, when the placenta is laterally located, in the majority of the patients, the uteroplacental blood flow needs are to be met primarily by one of the uterine arteries, with some contribution by the other uterine arteries, with some contribution by the other uterine artery via collateral circulation. This degree of collateral circulation, however, may not be the same in all patients and deficient contribution may facilitate the development of pre-eclampsia, IUGR or both [14].

The existence of major vascular anastomoses in some patients may explain the normal uterine flow velocity waveform and absence of pre-eclampsia and IUGR despite the presence of a unilateral placenta. In normal pregnancies, the spiral arterioles that supply the placental bed undergo trophoblast induced conversion

to uteroplacental arterioles. The significance of normal placentation for this cytotrophoblastic invasion is high and the cytotrophoblasts fail to adopt a vascular adhesion phenotype in pre-eclampsia[15]. In preeclampsia conversion of the spiral arterioles is incomplete[16]. It involves only the subplacental venules. If there were no functional anastomoses between right and left uterine arteries, in cases with unilaterally located placentas, one would expect the ipsilateral uterine artery systolic/ diastolic ratios to 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 are mainly met by one side uterine artery.

In the present study, out of 100 women, 50 females had laterally located placenta and 50 had centrally located placenta. Out of the 100 women with laterally located placenta, 33 (66 %) developed Pre-eclampsia as compared to 50 females with centrally located placenta where 18 (36 %) developed Pre-eclampsia. So, the risk of developing Pre-eclampsia was five times greater for the females with laterally located placenta as compared to those with centrally located placenta. The overall risk of developing Pre-eclampsia with laterally located placenta was 3.451 (Odds Ratio) and 95% Confidence Interval (1.52 to 7.85). The difference was found to be statistically significant, p value (0.01) by chi-square test This result is in accordance with Kofinas et al[17]. who concluded that in women with unilateral placenta, the incidence of pre-eclampsia was 2.8-fold greater than those with centrally located placenta. The results of the present study were also comparable to those of Muralidhar et al[18]. In his study, a total of 426 unselected singleton pregnant women were included. Out of 426 women, 324 had centrally located placenta and 102 had unilateral placenta. A total of 71 women developed pre-eclampsia of which 52 (74 %) had unilaterally located placenta. The relationship was found to be statistically significant $p < 0.0001$.

Despite extensive clinical trials, up to date, no therapeutic approaches are available for either treatment or prevention of pre-eclampsia. Anti-hypertensive drugs, corticosteroids for lung maturation or magnesium sulfate to prevent from eclampsia (RCOG Guideline No. 10(A) are to prevent the worsening of the symptoms and can thus temporize over the short term to allow for safe delivery with a more mature fetus. The only cure of pre-eclampsia is delivery of placenta and baby. Risk of recurrent pre-eclampsia is between 5 to 70 percent. women who had severe features of pre-eclampsia and were delivered before 30 weeks gestation having the highest risk up to 70 percent in future pregnancies. Women with pre-eclampsia without severe features have only 5 percent chance of developing pre-eclampsia.

V. Conclusion

Ultrasonography is simple, non-invasive, easy to perform, cost effective, diagnostic method to identify high risk cases. From the above study, it is concluded that laterally located placenta on ultrasound done at 20 to 24 weeks is associated with increased risk of development of pre-eclampsia. Females with laterally located placenta have a five times greater risk of developing PIH, so these pregnancies may require careful obstetric management to achieve a more favorable outcome and decrease the maternal and perinatal morbidity and mortality associated with pre-eclampsia.

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Conflict of interest

The authors declare no conflict of interest.

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