

Placental Laterality– A Simple yet Reliable Predictor of Pre-Eclampsia an Ultrasonic Prospective Study

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Abstract:

Introduction: Screening, important in preventive medicine, preeclampsia affects 5-8% of pregnant women, it is the most frequent medical complication in pregnancy and the most important cause of maternal and perinatal morbidity and mortality. In the past two decades ultrasonography has proved to be the safest, easiest, and most accurate method for assessing placental location. Some of non-invasive studies in second trimester of pregnancy revealed defective uterine perfusion in laterally implanted placenta.

Aims and objectives: To evaluate relationship between placental location and occurrence of preeclampsia. To study the incidence of preeclampsia in patients with centrally located placenta and in those with laterally implanted placenta. To find out whether placental laterality as determined by ultrasound can be used as a predictor of development of preeclampsia.

Methods: This prospective study was conducted on pregnant women attending the antenatal OP in Govt. Rajaji Hospital, Madurai from November 2015 to April 2016. 250 pregnant women attending antenatal OP both OPD and IPD at 18-24 weeks of gestation without any high risk factor were subjected to USG examination and placental location was determined. These cases were followed for the development of signs and symptoms of preeclampsia.

Results: Out of total 250 women, 123 had laterally located placenta and of them 98 (79.6%) developed preeclampsia. While the remaining 127 had centrally located placenta of them 22(17.3%) developed preeclampsia. So the overall risk of developing preeclampsia with laterally located placenta was found to be statistically significant. P value is <0.001.

Conclusion: From the above study, we concluded that females with laterally located placenta determined by USG at 18-24 weeks of gestation have greater risk of developing preeclampsia.

Key words: Placental laterality, preeclampsia, central placenta

I. Introduction

Preeclampsia affects 5-8% of pregnant women, it is the most frequent medical complication in pregnancy and the most important cause of maternal and perinatal morbidity and mortality. In the past two decades ultrasonography has proved to be the safest, easiest, and most accurate method for assessing placental location.

There is a significant association between placental location and uterine artery resistance and adverse outcome such as preeclampsia & 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 uteroplacental 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. The degree of collateral contribution may not be the same in all women, and deficient contribution facilitates the development of preeclampsia, IUGR or both. The significance of normal placentation for cytotrophoblastic invasion is high and the cytotrophoblasts fail to adopt a vascular adhesion phenotype in preeclampsia. This may explain the reduced trophoblastic invasion in laterally situated placenta when the uteroplacental blood flow needs are mainly met by one side uterine artery.

Among the various predictors for preeclampsia, the placental location by USG at 18-24 wks is very cost effective, noninvasive, and has a good positive predictive value.

Study proposal: Placental laterality by ultrasound – a simple yet reliable predictor of preeclampsia.

II. Aims And Objectives

1. To evaluate relationship between placental location and occurrence of PIH.
2. To study the incidence of PIH in patients with centrally located placenta and in those with laterally implanted placenta.

- To find out whether placental laterality as determined by ultrasound can be used as a predictor of development of preeclampsia.

III. Materials and Methods

Participants: The main sources of data for the study are patients attending antenatal OP in the Department of Obstetrics and Gynaecology in Govt. Rajaji Hospital.

Inclusion Criteria: All pregnant women attending the antenatal OP both out patient and ward admissions at 18-24 wks of gestation without any high risk factors.

Exclusion criteria:

Pregnant women were excluded from the study if they were having

- Chronic hypertension / Essential hypertension
- Diabetes mellitus
- Thyrotoxicosis
- Renal disease
- Severe anemia
- Connective tissue disorder
- APLA positive patients
- RH incompatibility
- Twin pregnancy
- Postive VDRL Test

IV. Method of Study

All patients were subjected to detailed history, general examination, systemic examination, obstetrical examination at the time of antenatal visit and at the time of admissions.

The location of placenta was determined by ultrasound at 18-24 wks and followed subsequently for the development of preeclampsia.

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 preeclampsia.

V. Results and Analysis

In this prospective study there were a two hundred and fifty singleton pregnant patients of whom 120 developed preeclampsia.

Total No. of cases : 120

I. Relation between Parity and development of Preeclampsia:

Parity	Primi gravaidaes	Second gravaidaes	Multigravaidaes (3 or >3)
No.of cases	80	24	16
Percentage	(66.7%)	(20.0%)	(13.3%)
Chi square value is 42.04 - p value is <0.001 significant			

Among 120 patients, 80 (66.7%) patients were primi gravaidaes, 24 (20%) patients were second gravaidaes and 16 (13.3%) patients were multi gravaidaes.

Primi gravaidaes are significantly higher when compare to other two gravaidaes in pre-eclampsia patients. P value is <0.001 significant.

II. Relation between placental location and development of Preeclampsia.

Placenta	Central placenta	Lateral placenta
No.of cases	22	98
Percentage	(18.3%)	(81.7%)

Among 120 patients developing preeclampsia, 98 (81.7%) patients had laterally located placenta and only 22 (18.3%) patients had centrally located placenta.

Among preeclampsia patients, laterally placenta was significantly higher than central placenta. it is statistically significant p value = <0.001.

Relation between Parity and placental location:

Parity	Primigravidae (80)		Second gravidae(24)		Multigravidae(16)	
Placenta	Central placenta	Lateral placenta	Central placenta	Lateral placenta	Central placenta	Lateral placenta
No. of cases	14	66	6	18	2	14
Percentage	(18.7%)	(81.3%)	(25.0%)	(75.0%)	(12.5%)	(87.5%)

Among 80 primi gravidae, 66 (81.3%) had laterally located placenta, 14 (18.7%) patients had centrally located placenta.

Among 24 second gravidae, 18 (75%) had laterally located placenta, 6 (25%) patients had centrally located placenta.

Among 16 multi gravidae, 14 (87.5%) had laterally located placenta, 2 (12.5%) patients had centrally located placenta.

Relation between location of placenta and severity of Preeclampsia.

Non severe Preeclampsia 52 (43.3%)		Severe Preeclampsia 61 (50.8%)		AP Eclampsia 4 (3.3%)		HELLP syndrome 3 (2.5%)	
Central placenta	Lateral placenta	Central placenta	Lateral placenta	Central placenta	Lateral placenta	Central placenta	Lateral placenta
16	36	5	56	1	3	0	3
(30.7%)	(69.3%)	(8.2%)	(91.8%)	(25%)	(75%)		(100%)

Among 120 patients developed preeclampsia, 52 of them developed non severe preeclampsia, 61 developed severe preeclampsia, 4 patients had AP eclampsia and 3 developed HELLP syndrome.

Among these 52 patients developed non severe preeclampsia 36 (69.3%) patients had laterally located placenta only 16 patients 30.7% had centrally located placenta.

In patients developed severe preeclampsia, among 61. 56 (91.8%) patients had laterally implanted placenta and only 5 (8.2%) had centrally located placenta.

Among 120 patients, 4 patients developed AP eclampsia, among them 3 of them (75%) had laterally located placenta and only 1 patient (25%) had centrally located placenta.

Among 120 patients, 3 patients developed HELLP syndrome, all the three had laterally located placenta.

Complication in relation to Preeclampsia & IUGR: (n=120)

IUGR 20 (16.7%)		IUFD 7(5.8%)		Abruptio placenta 5 (4.2%)		Oligohydramnios 20(16.7%)	
Central placenta	Lateral Placenta	Central placenta	Lateral Placenta	Central placenta	Lateral Placenta	Central placenta	Lateral Placenta
5	15	2	5	0	5	3	17
(21.4%)	(78.6%)	(28.6%)	(71.4%)		(100%)	(15%)	(85%)

Among 120 patients developed preeclampsia, 20 patients had IUGR baby. Among these, 15 (78.6%) patients had laterally located placenta and only 5 patients (21.4%) had centrally located placenta.

Among 120 patients developed preeclampsia, there is 7 intrauterine fetal death. Among these, 5 (71.4%) patients had laterally located placenta and only 2 patients (28.6%) had centrally located placenta.

Among 120 patients developed preeclampsia, 5 patients had Abruptio placenta and all the five had laterally located placenta.

Among 120 patients developed preeclampsia, 20 patients had oligohydramnios. Among these, 17 (85%) patients had laterally located placenta and only 3 patients (15%) had centrally located placenta.

Analysis of mode of delivery:

Mode of delivery	Vaginal delivery 52 (43.3%)		Lower segment cesarean section 68 (56.7%)	
Placenta	Central placenta	Lateral placenta	Central placenta	Lateral placenta
No. of cases	13	39	9	59
Percentage	(25.0%)	(75.0%)	(13.2%)	(86.8%)

Among 120 patients developed preeclampsia, 52 had vaginal delivery and 68 patients end up in caesarean section. Among these 68 patients, 59 patients (86.8%) had laterally located placenta.

Relation between neonatal outcome based in Apgar scores: (n= 88)

Good Apgar score 50 (56.8%)		Mild birth Asphyxia 30 (34.1%)		Moderate birth Asphyxia 8 (9.1%)	
Central placenta	Lateral placenta	Central placenta	Lateral placenta	Central placenta	Lateral placenta
8 (16%)	42 (84%)	10 (33.3%)	20 (66.7%)	2 (25%)	6 (75%)

Among 120 patients 50 babies had good apgar score (8-10), 30 babies had mild birth asphyxia (34.1%) and 8 (9.1%) babies had moderate birth asphyxia.

Among 50 babies had good apgar score, 42 patients (84%) had laterally located placenta and 8 patients (16%) had centrally located placenta.

Among 30 babies who had mild birth asphyxia (6-8), 20 patients (66.7%) had laterally located placenta and only 10 patients (33.3%) had centrally located placenta.

Among 8 babies who had moderate birth asphyxia(4-6), 6 patients (75%) had laterally located placenta and only 2 patients (25%) had centrally located placenta.

Due to severe preeclampsia, AP eclampsia and HELLP syndrome, iatrogenically induced preterm deliveries 20, IUD – 7, and 5 abruptions end up in preterm delivery.

Total No. of control patients: 130 (without complications)

I. Relation of Parity:

Parity	Primi gravidae	Second gravidae	Multi gravidae
No.of cases	62	44	24
Percentage	(47.7%)	(33.8%)	(18.5%)

Among 130 patients, 62 (47.7%) patients were primi gravidae, 44 (33.8%) were second gravidae and 24 (18.5%) were multi gravidae.

Relationship of the placental location:

Placenta	Central placenta	Lateral placenta
No.of cases	105	25
Percentage	80.8	19.2

Among 130 patients, 105 (80.8%) were centrally implanted placenta and 25(19.2%) were laterally implanted placenta.

VI. Discussion

1. Pre eclampsia is a complex clinical syndrome involving multiple organ systems and still remains the principal cause of maternal and perinatal mortality and morbidity. The search for an ideal predictive test and preventive measure remain challenging.
2. In 1989, Kofinas⁶ et al from north Carolina studied 300 pregnant women, of whom 153 women had no maternal complications while 147 had PIH / IUGR, to evaluate the association between placental location and development of PIH or IUGR. They found that in the presence of PIH, or IUGR, upto 75% of patients had laterally located placenta and 25% had central placenta. Whereas in absence of these two conditions, 51% patients had laterally located placenta, 49% central placenta (P<0.02). They found that in patients with lateral placenta, the incidence of PIH and IUGR was 2.8 fold and 2.7 fold greater respectively than in patients with central placenta.
3. A similar study with 426 singleton pregnant women was carried out in Manipal at Kusturba Medical College by Dr. Pai Muralidhar². V, and Pillai Jyothi. Out of the total 426 patients, 71 developed preeclampsia, of those 52 (74%) had unilaterally located placenta whereas only 19 had centrally located placenta. That result was in accordance with the study of Kofinas et al who state that of their preeclamptic women, 75% had unilateral placental location. The above study showed that women with unilateral placental location had a 2.7 fold increase over centrally located placenta in the incidence of preeclampsia. That was similar to 2.8 fold risk of preeclampsia with unilaterally located placenta reported by Kofinas et al.
4. The study conducted in Manipur in 2012-14. Out of 475 women 263(55.4%) had laterally located placenta and of them 45(17.1%) developed preeclampsia while the remaining 212(44.6%) had centrally located placenta and of them 13(6.1%) developed preeclampsia.
5. In present study, out of the total 250 singleton pregnant women, 120 developed preeclampsia, of these 98 (81.7%) had unilaterally located placenta whereas only 22 (18.3%) had centrally located placenta.

Placental position and development of preeclampsia (n=250)

Placental position	Development of Preeclampsia	
	Yes (n=120)	No (n=130)
Central position (n=127)	22 (18.3%)	105 (82.7%)
Lateral position ((n=123)	98 (81.7%)	25 (14.6%)

Chi square test - 36.6

P < 0.001

In Our study placental laterality as determined by ultrasound at 18-24 weeks as a screening test for development of preeclampsia has the sensitivity of 82.67%, specificity of 79.67%, Positive predictive value of 35.54% and negative predictive value of 88.05%.

This study provides evidence of the existence of a significant association between placental laterality and presence of PIH, IUGR or both. It also appears that the placenta is located laterally in a majority of patients of PIH & IUGR.

6. Relation between placental position and development of PIH in various studies:

	Kofinas Study	Manipal Study	Hyderabad study	Manipur study	Present study
Central placenta	25%	26%	30%	13	18%
Lateral placenta	75%	74%	70%	87	82%

7. The path physiological characteristics of PIH, are complex and the cause remains unknown. One of the fundamental disturbances in patients with this condition is decreased utero placental blood flow. However, whether this is the cause or result is yet to be discussed. Our data indicate that the presence of lateral placenta is strongly associated with PIH.

8. In present study shows that the location of placenta in primigravidae, second gravidae and multi gravidae may predict the development of PIH, IUGR and its complications to a considerable extent and may be used as simple, non expensive, easily accessible and reproducible screening test for the prediction of PIH and IUGR.

Further studies are necessary to evaluate the sensitivity of placental laterality is a predictor of the development of PIH.

9. As yet there is no practical, acceptable and reliable screening test for preeclampsia that has been thoroughly tried and tested. In our study placental laterality has a sensitivity of 78.57% which though low is much better than most other tests (Table above). Besides, it has a very good specificity of 81.39% and negative productive value of 95.89%. Its positive predictive value is low but so is the case with must other tests. It is a very useful cost effective and easy to perform non-invasive test.

10. Present study correlates well with the study conducted by Manipur study by Preety Agarwal, and study conducted by Dr. Kofinas.

Among 120 patients, 80 (66.7%) patients were primi gravidae, 24 (20%) patients were second gravidae and 16 (13.3%) patients were multi gravidae.

Primi gravidae are significantly higher when compare to other two gravidae in pre-eclampsia patients. P value is <0.001 significant.

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Among 120 patients developed preeclampsia, there is 5 intrauterine fetal death. Among these, 5 (71.4%) patients had laterally located placenta and only 2 patients (28.6%) had centrally located placenta.

Among 120 patients developed preeclampsia, 5 patients had Abruptio placenta and all the five had laterally located placenta.

Among 120 patients developed preeclampsia, 20 patients had oligohydramnios. Among these, 17 (85%) patients had laterally located placenta and only 3 patients (15%) had centrally located placenta.

VII. Conclusion

From the above study, it is concluded that laterally located placenta on ultrasound at 18-24 wks is associated with increased risk of development of preeclampsia. So these pregnancies may require careful obstetric management to achieve a more favourable outcome and decrease the maternal and perinatal morbidity and mortality associated with preeclampsia.

One of the major advantage of this study is it is not extra test. From the routine anomaly scan the location of placenta can be used as a predictor.

- Another reason for early identification is to determine whether prophylactic therapy would prevent or significantly decrease abnormal conditions.
- Early prediction of preeclampsia prevents dreadful maternal complications thereby reduces maternal mortality and morbidity.

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