

Association of Placental Laterality with Development of Preeclampsia and Fetomaternal Outcome

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Abstract

Background: Hypertension is one of the commonest medical complications of pregnancy as it contributes significantly to maternal as well as perinatal morbidity and mortality. The identification of this clinical entity and effective management play a significant role in the outcome of pregnancy, both for the mother as well as the baby.

Aims: This study was conducted to study. 1) Correlation of lateral placental implantation by ultrasound study and development of preeclampsia on color doppler study. 2) Predictive accuracy of placental laterality with the development of preeclampsia. 3) Relationship between placental laterality in preeclampsia and fetomaternal outcome on the basis of APGAR score and NICU admission.

Methods: The study was done among 59 preeclamptic pregnant patients who were admitted at and after 28 weeks of gestation in Obstetrics and Gynaecology department of GMCH over the period of one year.

Results: Majority of patients 29 (49.1%) were aged 21-25 yrs, and the incidence was highest among primigravida 45 (76%). Development of preeclampsia was highest in lateral placenta group. Overall prevalence of preeclampsia was found 2.47 times more with laterally located placenta compared with central ones. No correlation was found between development of preeclampsia and residence of the patient. Proteinuria (>1+) in lateral placenta group is higher (57.1%) than central placenta group which is significant with a p value of 0.009. On Color Doppler abnormal uterine artery notching or high RI (>0.58) led to predicting PE in majority of the patients. Preeclampsia, antepartum hemorrhage and term prelabor rupture of membranes were more common in lateral placenta. The incidence of FGR was also found to be higher in patients with lateral 5 (11.9%) and centrally 1 (5.8%) implanted placenta.

Conclusions: Lateral placenta along with uterine artery doppler abnormality at or after 28 weeks significantly increases the risk of preeclampsia. Appropriate obstetric intervention may be necessary to improve the pregnancy outcome and reduce preeclampsia related maternal as well as neonatal morbidity and mortality. A non-invasive ultrasound screening can be used to predict unfavorable pregnancy and neonatal outcomes.

Keywords: Preeclampsia, Color Doppler, Cesarean section, Placental implantation.

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Introduction

Hypertensive disorders include chronic hypertension, preeclampsia and gestational hypertension which complicate up to 10 percent of pregnancy. Worldwide incidence of preeclampsia is about 5%, although wide variations were reported. In India incidence of preeclampsia is 5-15%.¹ In hospital practice incidence in primigravida is 10% and in multigravida is 5%.[1] A new-onset hypertension during pregnancy termed as gestational hypertension is followed by signs and symptoms of preeclampsia in half of the patient while preeclampsia is identified in 4 to 5 percent of all pregnancies. [2]

American College of Obstetricians and Gynecologists (ACOG) classifies hypertensive diseases in pregnancy into: 1) Preeclampsia and eclampsia syndrome. 2) Chronic hypertension of any etiology. 3) Preeclampsia superimposed on chronic hypertension. 4) Gestational hypertension, in which definitive evidence for the preeclampsia syndrome does not develop and hypertension resolves by 12 weeks postpartum. [3]

Preeclampsia is defined as rise of blood pressure more than or equal to 140/90 mm Hg recorded on two occasions 6 hour 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 in non proteinuric women.

Localization of placenta on ultrasound has proved to be the safest, easiest and most accurate method for assessing placental location.[4] When the placenta is located centrally, the uteroplacental blood flow requirements are met by equal contribution from both the uterine arteries. However when the placenta is laterally located, the uteroplacental blood flow needs are met

primarily by ipsilateral uterine artery with some contribution from contralateral uterine artery via the collateral circulation. The degree of collateral circulation may not be the same in all the patients and a deficient contribution may facilitate the development of preeclampsia, fetal growth restriction or both.[5] Presence of unilateral placenta and abnormal uterine artery flow velocity waveforms is associated with development of preeclampsia.[6]

Aims and Objectives

This study was conducted to study 1) Correlation of lateral placental implantation by ultrasound study and development of preeclampsia on color doppler indices (pulsatility index/resistance index). 2) Predictive accuracy of placental laterality with the development of preeclampsia. 3) Relationship between placental laterality in preeclampsia and fetomaternal outcome on the basis of APGAR score and NICU admission.

Materials and Methods

It is an observational analytical study conducted at the Department of Obstetrics and Gynaecology Geetanjali Medical College and Hospital Udaipur for a period of one year.

Inclusion Criteria:

All the patients with preeclampsia who were admitted at GMCH in Obstetrics and Gynaecology department after 28 weeks of gestation.

Exclusion Criteria:

- H/O essential HTN
- Multiple pregnancy
- Renal disease
- Cardiac disorders
- Molar pregnancy
- H/O assisted reproductive techniques

Method of Data Collection:

The study was done among 59 preeclamptic pregnant patients who were admitted at and after 28 weeks of gestation. The demographic details such as age, weight, residence, socio-economic status and registration numbers were noted. General physical examination and details of obstetric examination was done. Routine investigations including blood group, CBC, PT/INR, RBS, TSH, HIV, HBsAg, VDRL, urea, creatinine, urine examination and special investigations LFT, RFT, APTT, LDH were also done. Obstetrical ultrasonography was performed in each case. Indices evaluated were number of foetus, presentation, central as well as lateral placental location, grading of placenta, AFI and congenital

anomaly. Lateral placenta is defined as when 75% or more of placental mass is located to one side of midline. Color Doppler study of various vessels like uterine artery, cerebral artery and ductus venosus was also studied. Indices calculated are Pulsatility index (PI) and Resistance index (RI) of Middle cerebral artery (MCA), Umbilical artery and Uterine artery.

Results:

Majority of the subjects in the study group were in the age group 21-25 years ie 29 (49.1%) followed by 26-30 years age group that is 14 (23.7 %) and among > 30 years there were 12 (20.3%). There were 4 (6.7%) cases who had been reported as teenage pregnancies.

Table No.1: Age wise distribution

S. No	Age (years)	No. of cases
1.	<20	4(6.7%)
2.	21-25	29(49.1%)
3.	26-30	14(23.7%)
4.	>30	12(20.3%)
Total		59(100%)

Maximum number of subjects were 34 (57.6%) from urban area and remaining 25 (42.3%) from rural area attending the antenatal clinic with preeclampsia. Majority of cases enrolled in the study were primiparous 45 (76.2%) followed by multiparous 14 (23.8%).

Table No. 2 : Parity wise Distribution

S. No.	Parity	No. of cases
1.	Primiparous	45(76.2%)
2.	Multiparous	14(23.8%)
Total		59(100%)

Majority of the subjects were in the range of 66-70 kg weight group that is 26 (44%) followed by 56-60 kg and > 70 kg comprising 11 (18.6%) each. 56-60 kg range group 9 (15.2%) and least <55 kg range consisting 2 (3.3%) cases.

Table 3: Proteinuria and Placental location

S. No.	Urinary Albumin	Placental Location				P Value
		Central (A)		Lateral (B)		
		No.	%	No.	%	
1.	Trace	1	5.8%	4	9.5%	0.009
2.	1+	13	76.4%	14	33.3%	
3.	>1+	3	17.6%	24	57.1%	
Total		17	100%	42	100%	

Majority of the subjects in group with lateral placenta were 24 (57.1%) had proteinuria (>1+). There seems to be a good relationship between urinary albumin level with placental location. Higher level

of urinary albumin corresponds with more lateral placental location where as low levels of urinary albumin associated with central placental location.

Table 4: Association of Severity of preeclampsia with location of placenta.

S. No.	Severity	Central		Lateral		Total	P Value
		No.	%	No.	%		
1.	Mild	14	33.3%	28	66.7%	42(100%)	0.228
2.	Severe	3	17.6%	14	82.4%	17(100%)	
Total		17		42		59(100%)	

The proportion of patients with severe preeclampsia was significantly higher that is 14 (82.4%) in laterally located placenta compared to those 3 (17.6%) with centrally located placenta group.

Table 5: Uterine Artery Doppler findings in Preeclampsia

S. No.	Uterine artery Doppler finding	Central	Lateral	Total
1.	RI <0.58 and early diastolic notch absent	3	5	8
2.	RI >0.58 Unilateral/ Bilateral notch	11	40	51
3.	Only Bilateral RI >0.58	4	15	19
4.	Unilateral/ Bilateral uterine artery notch	7	25	32
5.	Only Bilateral uterine artery notch	3	14	17

In 51 (86 %) women, a unilateral/bilateral RI > 0.58 was observed, and 19 women (32 %) had a bilateral RI >0.58. Notching of the uterine artery was also observed in 32(54% unilateral/bilateral) and in 17 (28%) bilaterally. In 8 (13%) women showed clinical signs of preeclampsia with RI < 0.58 and no early diastolic notch. The Doppler ultrasound findings of uterine arteries are shown in Table 7.

The incidence of adverse maternal events including Preterm labor, Premature rupture of membranes (PROM), Oligohydramnios, Antepartum hemorrhage and Eclampsia were observed significantly more in cases with lateral placenta compared to central ones as shown in Figure 1.

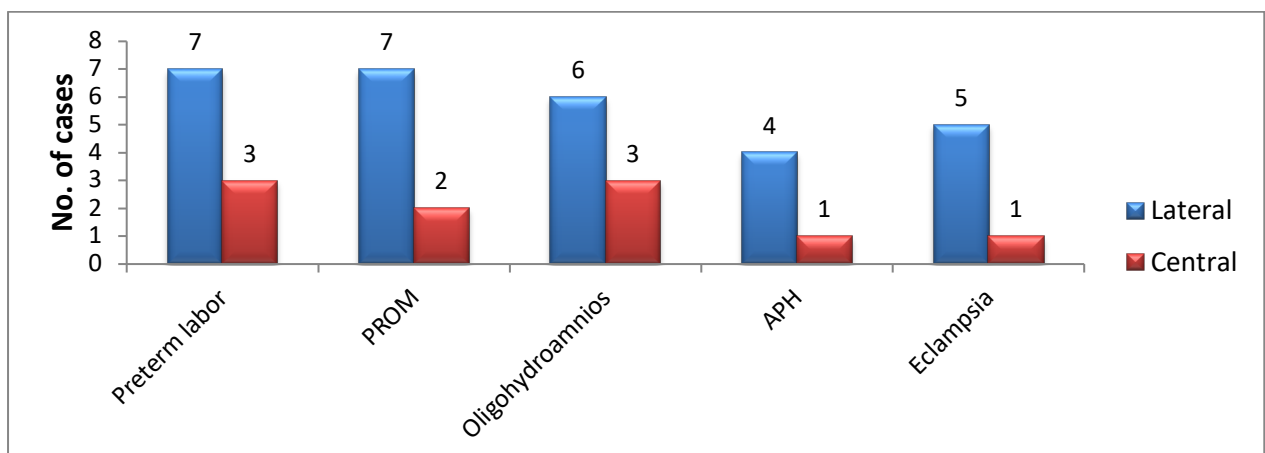


Figure 1: Maternal complications noted with relation of placenta

Table 8: Neonatal outcomes associated with placental location

Variables	Lateral	Central	Total
Fetal Growth Restriction	5 (8.4%)	1 (1.6%)	6(10.1%)
Preterm birth	7 (11.8%)	3 (5.1%)	10(16.9%)
IUFD/still birth	1 (1.6%)	0 (0%)	1(1.6%)
NICU admission required	6 (10.1%)	2 (3.3%)	8(13.4%)

Table 9: APGAR score and Mean baby weight associated with placental location

Variables	Lateral	Central	Total
Mean APGAR score at 1 min	8.01±1.05	8.23±1.4	8.12±1.03
Mean APGAR score at 5 min	8.45±1.02	8.65±0.91	8.55±0.97
Mean baby weight (kg)	2.38±0.62	2.60±0.34	2.49±0.50

In present study mean APGAR score at 1 min was 8.12±1.03, mean APGAR score at 5 min was 8.55±0.97 and mean baby weight (kg) was 2.49±0.50. Adverse neonatal events were FGR 6 (10.1%), preterm birth 14 (23.7%), IUFD/still birth 1 (1.6 %) and 8 neonates required NICU admission (13.5 %). Majority of adverse events were noted in pregnant women with lateral location of placenta.

Discussion

During the past 50 years, there has been a significant reduction in the rates of preeclampsia / eclampsia, maternal mortality and maternal morbidity in the developed countries. In contrast the rates, maternal complications, and maternal mortality remain high in the developing countries.[7]

In a laterally implanted placenta, the uterine artery that is nearer the placenta has less resistance than the artery that is opposite from it. When the placenta is laterally implanted, in majority of the cases, the uteroplacental blood flow needs are met primarily by one of the uterine arteries with some contribution from the other uterine artery via the collateral circulation.[8]

There are various methods to predict or to diagnose preeclampsia. Out of all, placental localisation in second trimester by ultrasound is very useful, easy and noninvasive method to diagnose

preeclampsia. Other easy and noninvasive method to predict is Doppler study of uterine arteries in second trimester.[9]

The present study observed that majority of the patients in the study population were in the age group of 21-25 years i.e. 49.1 % which is in consonance with the study done by Tania Kakkar et al.[8] who observed 53.3% of patients; Shivamurthy H.M. et al.10 showed 51% and Sandhya K. et al.[5] observed 60% patients. Frequency of the patients was highest i.e. 44% in the weight group of 66-70 kg, in a study by Tania Kakkar et al.[8] 50% of patients in the same weight group.

The present study concluded that majority of the patients i.e. 76.2% were primiparous and 23.8% were multiparous which is in accordance to study by John Studds et al. [11] In this study 57.1% of patients with proteinuria (>1+) had laterally implanted placenta which is in contrast to the study by Shivamurthy H.M. et al.[10] who concluded that 75% of patients had proteinuria (>1+) with central location of placenta. The present study observed that incidence of preeclampsia among primiparous is 76.2% which is in accordance to John Studds et al. [11]

Our study is very similar to the study by Tania Kakkar et al.[8] The present study concluded that the incidence of preeclampsia in patients with lateral location of placenta was 71.1%. Tania Kakkar et al.[8] study had incidence of

about 66.6% among the lateral placenta which is statistically significant ($p < 0.01$). The present study was also comparable with the study done by Sandhya K. et al.[5] who observed incidence of 66.6%, Bhalerao A.V. et al.[12] as 73.23% Pai Muralidhar et al.[13] as 74% and study done by Kofinas et al.[14] in which the incidence of preeclampsia was 75% in patients having lateral placenta.

The present study observed that proportion of the patients with severe preeclampsia was significantly higher that is 82.4 % in laterally located placenta compared to 17.6% among lateral ones which is in contrast to the study conducted by Deepak Nanthini et al.[15] who concluded that proportion of patient with mild preeclampsia was higher that is 94.6%.

Patil et al.[16] studied 200 pregnant women, abnormal neonatal outcomes like FGR (16%), preterm birth (31%), and intrauterine death/ still birth (3%) were more in lateral placentation, which is in consonance with present study. The number of central placenta having NICU admissions were (14.6%) and lateral placentas with NICU admissions were (29.30%). We also found an association between unilateral located placenta and low Apgar scores at 1, 5 minutes in comparison with centrally located placenta.

Faizi et al.[17] studied 620 pregnant women, preeclampsia (27.9%) and antepartum hemorrhage (19.7%) were more common in lateral placenta. These findings were statistically significant and similar to present study. The incidence of FGR was also found to be higher in patients with lateral (16.4%) and posteriorly (16%) implanted placenta.

Shahid et al.[18] used Doppler Ultrasound for predicting PE by determining the notching of the uterine artery and its RI. It was successful in terms of abnormal uterine artery notching or high RI (> 0.58) as it led to predicting PE in a majority of

the patients which is in consonance with our study.

Conclusion

In this study it was concluded that laterally located placenta at or after 28 weeks is associated with increased risk of development of preeclampsia and relatively increased rate of adverse fetomaternal outcome. Lateral placenta along with uterine artery doppler abnormality significantly increases the risk of preeclampsia as compared to the lateral placenta alone. Color doppler ultrasound as well as early diastolic notch in uterine vessel, RI of umbilical artery and PI of umbilical and middle cerebral arteries in their individual form may be considered as salient tools to determine hemodynamic repercussion caused by PE. Women with laterally positioned placenta are more likely to experience PIH, hence appropriate obstetric intervention may be necessary to improve the pregnancy outcome and reduce preeclampsia related maternal as well as neonatal morbidity and mortality. Ultrasound is very useful, cost effective and easy to perform non-invasive test. A significant association was noted between laterally implanted placenta and adverse fetomaternal outcome. A non-invasive ultrasound screening can be used to predict unfavorable pregnancy and neonatal outcomes.

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