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Original Research Article

Lateral placenta as a predictor for development of preeclampsia

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ABSTRACT

Background: The placenta is an important structure that supports the pregnancy. The abnormality in the placental trophoblastic tissues is associated with the various complications during pregnancy. Preeclampsia, a hypertensive disorder of pregnancy results from the abnormality in the placental trophoblastic tissues and is the major cause of maternal mortality and morbidity. Several studies have found correlation between the placental location and development of preeclampsia. Among the various predictors of preeclampsia, the placental location by ultrasound at 18-24 weeks have been found to be cost effective, non invasive and associated with good predictive value.
The objective of the study was to assess the relationship between second trimester placental position by ultrasound and the subsequent development of preeclampsia.
Materials and Methods: A prospective observational study was conducted on 106 singleton pregnant women from November 2013 to October 2015, attending the antenatal clinic in Sikkim Manipal Institute of Medical Sciences, Gangtok. The location of placenta was determined by ultrasound at 18-24 week and patients were followed up till development of preeclampsia or delivery.
Results: Out of 106 patient studied, 69 patient had central placenta and 37 had lateral placenta. A total of 17 patient developed preeclampsia of which 12 had laterally implanted placenta. This finding was statistically significant with a p value of 0.001.
Conclusion: This study revealed an increased association of development of preeclampsia in patients with laterally located placenta which aids to preventive approach and optimum management of preeclampsia.

1. Introduction

Hypertensive disorders complicate 5-10% of all pregnancy. Of all hypertensive disorder, preeclampsia accounts for 4-5% cases in pregnancy.[1] Preeclampsia syndrome is gestational hypertension with proteinuria and is of variable severity affecting almost all the organs of the body.

One of the etiology for development of preeclampsia is placental implantation with abnormal trophoblastic invasion of uterine vessels. The presence of trophoblastic tissue is therefore important for the development of preeclampsia.[2] The uteroplacental vessel development occurs in two waves, first occurs before 12 weeeks and second wave between 12-16 weeks.[3] This forms the basis of Doppler changes in the uterine arteries in the form of diastolic notch indicating resistance and later development of preeclampsia.

Of many predictors of preeclampsia, the roll over test, isometric exercise test, angiotensin II infusion test, uterine Doppler velocimetry are the tests that assess the placental perfusion or vascular resistance. This test have lower predictive value, unreliable and expensive.

Many study have shown the relationship between placental location and development of preeclampsia.

The placenta is located normally in the upper part of uterus near fundus with blood supply from uterine artery

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from the both side. If located laterally the blood supply is usually from the dominant side and collateral from the opposite side.

In majority of patient who had laterally located placenta, the Doppler study of the uterine arteries in second trimester have shown abnormal waveforms[4]. This indicates that the blood supply especially if it is from dominant one uterine artery of one side results in defective uterine perfusion which is reflected as a Doppler changes. Many studies have found the presence of unilateral placenta and abnormal uterine artery flow velocity waveforms in association with development of preeclampsia. If it is true, the cost effective, simple and reliable predictor of preeclampsia in the form of laterally located placenta as determined by ultrasound would help in optimum management of preelampsia.

This study was carried out to find the relationship between laterally located placenta and subsequent development of preeclampsia.

2. Materials and Methods

A Prospective study was carried out on 106 pregnant women over a period of two years between November 2013 till October 2015 attending the antenatal clinic in Sikkim Manipal Institute of Medical Sciences, Gangtok, Sikkim. A singleton pregnant women attending antenatal clinic were randomly selected, between 18 weeks and 24 weeks. Women with Chronic hypertension, multiple pregnancies, uterine anomalies and not willing to participate in the study were excluded.

After taking an informed consent, 106 patients were enrolled. General, Systemic and Obstetrical examinations were done. Location of placenta was determined by ultrasound between 18-24 weeks of pregnancy by using an ultrasound machine equipped with 3.5 MHz transducer. The placenta was classified as central when placental mass was equally distributed between the right and left side of the uterus irrespective of anterior, posterior or fundal position. When more than 75% of placental mass was located on one side of the midline, it was classified as unilateral right or left placenta.

All pregnancies was followed up till the development of preeclampsia (as per American College of Obstetricians and Gynecologists guidelines) or till delivery.

Data collected was entered in Microsoft excel 2007 and then transferred to SPSS version 16 for analysis. Test of significance was done using Chi-square test and Fisher exact test. P-value of <0.05 was taken as significant.

3. Observation and Results

The present study was conducted in Sikkim Manipal Institute of Medical Sciences, Gangtok, Sikkim. A total of 106 randomly selected singleton pregnant women attending the antenatal clinic were included. The location of the placenta was determined by ultrasound at 18-24 weeks. The end point of the study was the development of hypertension or delivery.

Table 1: Distribution of cases based on age

Age in Years	Frequency	Percentage
Up to 20	6	5.7%
21 - 25	30	28.3%
26 - 30	42	39.6%
31 - 35	23	21.7%
36 - 40	5	4.7%
Total	106	100%

Table 1 shows that majority of the pregnant women were from the age group of 26-30 years.

Table 2: Distribution of cases by religion

Religion	Frequency	Percentage
Hindu	76	71.7%
Christian	4	3.8%
Muslim	1	0.9%
Buddhist	25	23.6%
Total	106	100%

Nearly 2/3 of the women were Hindu (71.7%), followed by Buddhists (23.6%) Christians (3.8%) and Muslims (0.9%).

Table 3: Distribution of cases by ethnicity

Ethnicity	Frequency	Percentage
Scheduled Tribe	31	29.2%
Scheduled Caste	5	4.7%
OBC	21	19.8%
General	49	46.2%
Total	106	100%

In this study most of the women belonged to general category (46.2%), followed by OBC (19.8%), Schedule tribe (29.2%), and lastly Schedule caste (4.7%).

Table 4: Distribution of cases on socioeconomic status

Socioeconomic status	Frequency	Percentage
Low	24	22.6%
Middle	59	55.7%
High	23	21.7%
Total	106	100%

From the above figures it can be seen that the majority of women belonged to the middle class (55.7%), followed by lower class (22.6%) and High class (21.7%).

Most of the women attending our institution were found to be hailing from urban areas (61.3%), and (38.7%) hailed from rural areas.

Most of the women had educational qualification of higher secondary (38.7%) and illiterate constituted 3.8% of

Table 5: Distribution of cases by area of residence

Area of Residence	Frequency	Percentage
Urban	65	61.3%
Rural	41	38.7%

Table 6: Distribution of cases on educational qualification

Educational Qualification	Frequency	Percentage
Illiterate	4	3.8%
Up to SSLC	32	30.2%
Higher Secondary	41	38.7%
Graduate and above	29	27.4%

Table 7: Distribution of cases on parity

Parity	Frequency	Percentage
Nullipara	64	60.4%
Primipara	30	28.3%
Multipara	12	11.3%

women.

Nullipara constituted the majority (60.4%), followed by primipara (28.3%) and multipara (11.3).

Table 8: Distribution of cases on placental location

Placental Location	Frequency	Percentage
Central	69	65.1%
Lateral	37	34.9%

It was observed that that location of placenta was central in a majority of cases (65.1%) whereas lateral location was found in 34.9% of women.

Table 9: Distribution of cases by development of preeclampsia

Development of Preeclampsia	Frequency	Percentage
No	89	84.0%
Yes	17	16.0%

Among the women 16% of them developed preeclampsia whereas the majority (84%) of them did not develop the condition.

Table 10: Distribution of cases by mode of delivery

Mode of Delivery	Frequency	Percentage
Normal	35	33.0%
LSCS	71	67.0%

The mode of delivery in the majority of women was a caesarean section (67.0%), and the rest of the women delivered through vaginal route (33.0%)

The birth weight of most of the babies was more than 2.5 kg (82.1%), and babies weighing less than 2.5 kg were 17.9%.

Table 11: Distribution of cases by birth weight

Birth Weight	Frequency	Percentage
$<$ 2.5 KG	19	17.9%
$>$ 2.5 KG	87	82.1%

Table 12: Distribution ofcases by development of abruption placentae

Abruptio Placentae	Frequency	Percentage
No	105	99.1%
Yes	1	0.9%
Total	106	100%

Abruptio placentae developed in 0.9% of cases.

Table 13: Distribution ofcases by development of gestational diabetes mellitus

Gestational Diabetes Mellitus	Frequency	Percentage
No	102	96.2%
Yes	4	3.8%

Gestational diabetes mellitus was seen in 3.8% of cases as shown inTable 13.

Table 14: Distribution ofcases by H/O intrauterine demise

H/O of Intra Uterine Demise	Frequency	Percentage
No	104	98.1%
Yes	2	1.9%

About 1.9% of women had history of intra uterine fetal demise in past pregnancies.

Table 15: Distribution ofcases by history of preeclampsia

History of Preeclampsia	Frequency	Percentage
No	104	98.1%
Yes	2	1.9%

History of preeclampsia in previous pregnancy was seen in 1.9% of cases.

4. Discussion

Preeclampsia is one of the commonest complication during pregnancy that is responsible for the significant cases of maternal and neonatal morbidity and mortality. The major burden of cases is from developing countries that results mainly from lack of prenatal care, lack of access to hospital care, lack of resources, and inappropriate diagnosis and management of patients with preeclampsia. The predictor of preeclampsia would have significantly reduced the disease burden if there was ideal one.

Table 16: Relationship between development of preeclampsia and gestational diabetes mellitus

Gestational Diabetes Mellitus	Development of Preeclampsia		Total	p - value
	No	Yes		
No	88 (86.3%)	14 (13.7%)	102	
Yes	1 (25.0%)	3 (75.0%)	4	0.013
Total	89 (84.0%)	17 (16.0%)	106	

75% of women with gestational diabetes mellitus developed preeclampsia which was found to be statistically significant.

Table 17: Relationship between development of preeclampsia and history of intra uterine demise

History of Intra Uterine Demise	Development of Preeclampsia		Total	p - value
	No	Yes		
No	89 (85.6%)	15 (14.4%)	104	
Yes	0 (0.0%)	2 (100.0%)	2	0.024
Total	89 (84.0%)	17 (16.0%)	106	

Among the women who had a past history of intrauterine demise, development of preeclampsia was found to be statistically significant with a p value of 0.024.

Table 18: Relationship between development of preeclampsia and history of preeclampsia

History of Preeclampsia	Development of Preeclampsia		Total	p - value
	No	Yes		
No	89 (85.6%)	15 (14.4%)	104	
Yes	0 (0.0%)	2 (100.0%)	2	0.024
Total	89 (84.0%)	17 (16.0%)	106	

History of preeclampsia in the previous pregnancy was also found to be statistically significant with a p value of 0.024.

Table 19: Relationship between placental location and mode of delivery

Mode of Delivery	Placental Location		Total	p - value
	Central	Lateral		
Normal	24 (68.6%)	11 (31.4%)	35	
LSCS	45 (63.4%)	26 (36.6%)	71	0.598
Total	69 (65.1%)	37 (34.9%)	106	

No significant relation was found between placental location and the mode of delivery.

Table 20: Relationship between placental location and development of preeclampsia

Development of Preeclampsia	Placental Location		Total	p - value
	Central	Lateral		
No	64 (71.9%)	25 (28.1%)	89	
Yes	5 (29.4%)	12 (70.6%)	17	0.001
Total	69 (65.1%)	37 (34.9%)	106	

Out of 106 women 37 women were found to have lateral location of placenta (34.9%). Preeclampsia developed in 17 of these 106 women, out of which 12 were found to have lateral placenta (70%). This finding was found to be statistically significant with a p value of 0.001.

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

This cross sectional study included 106 pregnant women attending antenatal clinic of Department of Obstetrics and Gynaecology, Sikkim Manipal Institute of Medical Sciences, Sikkim, Gangtok. The ultrasound was done for all these patients between 18-24 week for placental location. Patients were followed till development of preeclampsia or till delivery.

In our study there was no statistical significant difference among the women with different location of placenta with respect to age, gestational age, and the number of times she conceived. Majority of the women were from the age group of 26-30 (39.6%).

In the present study, majority of patients were Hindu 71.7%, followed by 23.6% Buddhist, Christians by 3.8% and 1% Muslim. This was comparable to the population distribution of Sikkim which has 60% of Hindus, 33% Buddhist, 5% Christians, 1% Muslims and less than one percent other religion.

In the present study most of women hailed from middle class (55.7%), followed by low (22.6%), lastly high class (21.7%). It was also observed that majority (38.7%), of these women were educated up to higher secondary

Table 21:

Study	Sample size	Ultrasound timing	IUGR/SGA	Preeclampsia
Kofinas et al, 1989[4]	300 total 153 normal	24-40	IUGR 2.7 times more likely in cases with lateral placenta	PIH 2.8 times more likely with lateral placenta
Liberati et al,1997[5]	732 total 481 lateral 251 central	22-24	No significant association between IUGR and lateral placenta	No significant association between PIH and lateral placenta
Kalanithi et al, 2007[6]	272 total 67 IUGR 205 non IUGR	16-20	IUGR babies 3.8 times more likely to have lateral placenta	-
Magann et al, 2007[7]	3386 total,2914 fundal, 328 lateral	14-40	No significant association	No significant association
Gonser M et al, 1996[8]	148 total, 33 central 115 lateral	24-36	---	3.1 times increased risk of preeclampsia in lateral placenta
Kakkar T et al, 2013[9]	150 total, 84 lateral, 66 central	18-24	----	5.09 times increased risk of preeclampsia in lateral placenta
My study	106 total	18-24	IUGR babies more associated with lateral placenta	6.1 times increased risk

followed by SSLC with 30.2%. Graduation and higher level of education was seen in 27.4% women whereas 3.8% were found to be illiterate.

4.1. Placental location

In our study, we found 34.9% of women to have lateral location whereas 65.1% of women had central location of placenta. This finding was similar to studies done by Pai MV et al.[10] where 24% of women had lateral placenta and 76% had central placental location. Studies conducted by Bhalerao AV et al.[11] also found 26.1% women had lateral location of placenta compared to 73.8% women who had central location of placenta. Similarly, study by Jani PS et al.[12] have showed 20% of women had lateral placenta and 80% of women had lateral placenta.

Out of 37(34.9%) cases of laterally located placenta, 12 developed preeclampsia (70.6%) which was more than that had developed among centrally located placenta (29.4%). This finding was statistically significant ($p<0.001$) hence inferring that development of preeclampsia is associated more with the laterally located placenta. This result is consistent with the studies by Tania K et al.,[9] Bhalerao AV et al[11] and Muralidhar VP et al.,[13] in which 66.6% of laterally situated placenta developed preeclampsia in the study by Tania K et al.[9] and 73.23% of lateral situated placenta developed preeclampsia in study by Bhalerao AV et al[11] and Muralidhar VP et al[13] respectively.

Odds ratio in this study was 6.1 i.e., there is 6.1 times higher chances of development of preeclampsia among laterally located placenta than centrally located placenta. This finding is consistent with study by Tania K et al[9] and Seadati N et al[14] where the odds ratios were 5.09 and 5.6 respectively. This is also comparable with the study by Bhalerao AV et al.,[11] Kofinas AD et al[4]and Gonser M et al.[8] where the odds ratio was 2.7, 2.8 and 3.1 respectively. Some of the studies as by Magann EF et al.[7] showed no association between placental position and development of preeclampsia.

4.2. Mode of delivery

In the present study, 33% women underwent normal vaginal delivery whereas 67% underwent LSCS. Of the 37 women with lateral placenta 31.4% underwent vaginal delivery whereas 36.6% underwent caesarean section. This finding was found to be insignificant with p value of 0.598. In a study by Bhalerao AV et al.[11] the caesarean rate was 26.78% and vaginal deliveries were 73.21%. 16.41% of women undergoing caesarean section had centrally located placenta and 10.36% had laterally located placenta which was also statistically insignificant. The higher percentage of caesarean in the present study may be due to the higher number of elective caesarean section on patient's request.

In this study the number of babies born with birth weight less than 2.5 kg was 19(17.9%), whereas those born with birth weight more than 2.5 kg was 87(82.1%). Of those with birth weight was less than 2.5 kgs, 57.9% had lateral placentas whereas only 29.9% women with laterally located placenta had babies with birth weight more than 2.5 kg. This finding was found to be statistically significant with p value of 0.020. This finding was similar to studies done by Kofinas et al.,[4] which showed a 2.7 times increased risk of IUGR in women with laterally located placenta as compared to centrally located placenta. Similarly studies conducted by Kalanithi LEG.[6]sshowed a 3.8 increased risk of IUGR

in women with laterally located placenta as compared to centrally located placenta. In contrast studies by Liberati et al.,[5] Magann EF et al[7] found no significant association between placental location and birth weight.

5. Conclusion

The study was carried out to find the relationship between placental position in second trimester and subsequent development of preeclampsia.

This study revealed that the patient with laterally located placenta had more number of preeclampsia later in pregnancy than centrally located placenta.

Furthermore the association was seen between IUGR and placental location, with more cases seen with laterally located placenta.

In spite of much research, there is no practical, acceptable and reliable method that predicts development of preeclampsia. Placental location by ultrasound at 18-24 weeks of gestation appears to be promising approach to categorize women as a high risk cases for the development of preeclampsia especially in developing countries with limited resources thereby decreasing the morbidity and mortality.

6. Source of Funding

None.

7. Conflict of Interest

None.

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