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Original Research Article

Lateral Placental Location as a Predictor of Pre-Eclampsia Development: A Prospective Study

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Conflict of interest: Nil

Abstract:

Objective: The purpose of this study is to investigate the relationship between a placenta that is laterally placed on ultrasonography and the onset of pre-eclampsia in maternal patients.

Methods: A prospective longitudinal study was conducted at Hoskote tertiary center from August 2023 to August 2024. A total of 215 pregnant women between 18 and 24 weeks of gestation, who met the inclusion criteria, were recruited. Placental location was determined via ultrasound, and participants were followed up regularly until delivery. Data on the development and severity of pre-eclampsia, maternal complications, neonatal outcomes, and NICU admissions were collected and analyzed.

Results: Out of 215 women, 27 (12.56%) developed pre-eclampsia, with a significantly higher proportion (70.38%) having a placenta (lateral) compared to a placenta (central) (29.62%) ($p = 0.0014$). Severity of pre-eclampsia was greater in the placenta (lateral) group, with 42.11% of severe cases compared to 25% in the placenta (central) group ($p = 0.0056$). Maternal complications such as eclampsia, IUGR, HELLP syndrome, and PPH were more frequent in pre-eclamptic women with placenta (lateral). Neonatal outcomes showed lower APGAR scores at the 1st minute and higher NICU admissions for pre-eclamptic women with placenta (lateral) ($p = 0.0003$ and $p = 0.0008$, respectively).

Conclusions: Placental (lateral) location is significantly associated with the development and severity of pre-eclampsia. This association underscores the potential of using placental location as an early screening tool for predicting pre-eclampsia, enabling timely intervention and management to improve maternal and neonatal outcomes.

Keywords: Lateral Placental Location, Pre-eclampsia, Ultrasound Prediction, Maternal Complications, Neonatal Outcomes.

Introduction

A hypertensive complication of pregnancy, pre-eclampsia occurs in two to eight percent of pregnancies around the world. As a result, it is a significant contributor to the morbidity and mortality rates of both mothers and their unborn children. Eclampsia can arise with the development of seizures and other complications such as HELLP syndrome. Pre-eclampsia is defined as hypertension and proteinuria throughout the course of 20 weeks of pregnancy. It is a condition that poses a threat to both the mother and the baby. [1,2]

The etiology of pre-eclampsia is not understood but is considered to be related to placental dysfunction and development. During the initial development of the pregnancy, the placenta enters the maternal endometrium and the formation of blood flow is important for development of the fetus. [3,4] In the cases of pre-eclampsia this process is impaired, leading to poor blood flow through the placenta towards the fetus, hypoxia and the subsequent appearance of factors that cause damage to the endothelium in the maternal body. This endothelial dysfunction is observed in pre-eclampsia and it explains the hypertension and multiple organ involvement in the disease. [5] Preeclampsia is a condition that can be prevented by modifying certain risk factors, such as the mother's age being overweight, pre-existing hypertension, diabetes, and a previous history of preeclampsia. [6] The potential of specific biomarkers and ultrasound abnormalities in the pregnancy (early stages) to predict pre-eclampsia has been tested and examined. In addition, aberrant uterine artery Doppler flow patterns are seen, as well as higher levels of sFlt-1 and PlGF. [7,8]

An emerging area of interest is whether placental site, as identified by ultrasound, can be used for prediction. The placenta can implant in various locations within the uterus, including anterior (front), posterior (back), fundal (top), and lateral (side). The rationale behind this hypothesis is that placenta (lateral) tion might be indicative of suboptimal implantation and placental development, which are central to the pathogenesis of pre-eclampsia. [9,10]

Research on placental location and its implications for pregnancy outcomes has been ongoing for several decades. Earlier studies focused primarily on the impact of low-lying placenta or placenta previa on pregnancy outcomes. [11,12]

The potential mechanisms linking placenta (lateral)l location to pre-eclampsia are multifaceted. One theory posits that the uterine blood flow is less optimal in the lateral regions of the uterus compared to the central region. [13] This could result in inadequate placental perfusion and subsequent hypoxia, which are known contributors to the development of pre-eclampsia. Additionally, placenta (lateral)l location may reflect underlying issues with trophoblast invasion and spiral artery remodeling, processes that are crucial for establishing a robust placental blood supply. [14,15]

Additionally, the position of the placenta may have an effect on the degree of maternal-fetal exchange as well as the production of anti-angiogenic factors such sFlt-1. These factors are known to contribute to endothelial dysfunction and the pre-eclampsia development among pregnant women. Having an unequal perfusion and elevated oxidative stress could be the result of the asymmetrical distribution of placental mass in lateral areas, which would further enhance the likelihood of developing pre-eclampsia. [16]

Several prospective and retrospective studies have endeavored to prove the correlation between the placenta (lateral)tion and pre-eclampsia. Despite these findings, the clinical implementation of using placental location as a predictive measure for pre-eclampsia remains limited. One of the challenges is the variability in ultrasound techniques and interpretations, which can affect the accuracy of placental location determination. [16,17] The rationale for this study is to explore placenta (lateral)l location as pre-eclampsia early predictor. By identifying this correlation, healthcare providers can implement early interventions, improving maternal and fetal outcomes. This research aims to enhance screening methods for pre-eclampsia, ultimately reducing its incidence and associated complications.

Methodology

Study Design: A prospective longitudinal study.

Study Setting: The study was conducted at the Hoskote tertiary center, a well-equipped facility that provides comprehensive antenatal care. This setting enabled the researchers to access a diverse population of pregnant women and utilize advanced ultrasound technology to accurately determine placental location.

Study Participants: Sample targeted the pregnant women with gestational age of 18-24 weeks, attending routine antenatal clinic at Hoskote tertiary health facility. The eligibility criteria were pregnant women at the first trimester of pregnancy with normal blood pressure, English speaking, pregnant with a singleton pregnancy and willing to attend follow-up and deliver at the participating hospital.

Study Sampling: Purposive sampling was used to select participants who met the inclusion and exclusion criteria. By taking this approach, the research was able to concentrate on a particular group of pregnant women who were at risk of experiencing pre-eclampsia, which served to strengthen the validity of the findings.

Study Sample Size: The study included a sample size of 200 pregnant women. A statistically significant correlation between placenta (lateral)l position and the onset of pre-eclampsia was found to be able to be detected with this sample size, which was assessed to be adequate.

Study Procedure: This study included only those antenatal patients who were between 18 and 24 weeks of gestation who voluntarily consented to participate and whose blood pressure was normal in the first trimester. Health related demographics, medical history and obstetric assessment were documented. Blood pressure was taken while seated with the right arm at the heart level having used the sphygmomanometer. The PNA localization was assessed by the ultrasound examination, which was carried out by an experienced sonologist during 18–24 weeks of pregnancy. Following enrolment, participants were monitored on a regular basis on a monthly basis until 28 weeks, then on a bi-weekly basis until 36 weeks, and then on a weekly basis, or if they met certain criteria, such as exhibiting danger symptoms until delivery or reaching a gestational age of 40 weeks.

Study Data Collection: Data were collected through structured case record forms, documenting detailed history, clinical examinations, and ultrasound findings. Blood pressure readings and other clinical parameters were recorded during each antenatal visit. This systematic data collection ensured comprehensive and accurate tracking of each participant's pregnancy progression and the onset of pre-eclampsia.

Study Data Analysis: This analysis aimed to determine the relative risk and potential predictive value of placenta (lateral)l location for pre-eclampsia, providing valuable insights into its utility as a screening tool.

Ethical Consideration: All participants provided their written voluntary consent before participating in the experiment to increase the level of ethical compliance of the study and uphold the rights of the participants. These ethics safeguarded the study and respecting the respondent's autonomy and right to privacy.

Result and Analysis

Table 1: Distribution of women according to location of placenta

Placental location	Normotensive (188)	Preeclampsia (27)	Total (215)	P value
Central	95 (50.54%)	8 (29.62%)	103 (47.91%)	**0.0014**
Lateral	93 (49.46%)	19 (70.38%)	112 (52.09%)	

Table 1 shows that 70.38% of the patients with placenta (lateral) developed preeclampsia when compared with 29.62% of the patients with placenta (central) and this difference was found to be statistically significant (p = 0.0014).

Table 2: Association of placental location with severity of preeclampsia

Severity of preeclampsia	Placenta (central)	Placenta (lateral)	Total (27)
Mild	6 (75%)	11 (57.89%)	17 (62.96%)
Severe	2 (25%)	8 (42.11%)	10 (37.04%)
Fishers exact= 12.31, p = **0.0056**			

Table 2 shows that the severity of pre-eclampsia was higher among patients with placenta (lateral) than placenta (central) and this difference was found to be significant (p = 0.0056). Table 3 shows that maternal complications were more frequent in pre-eclamptic females with a placenta (lateral) compared to those with a placenta (central). Specifically, conditions such as eclampsia, HELLP syndrome, and PPH were observed more in the placenta (lateral) group, highlighting a higher risk of severe complications associated with placenta (lateral)tion in pre-eclamptic pregnancies.

Table 3: Distribution of maternal complications in relation to the position of the placenta

Complication	Normotensive (188)		Preeclampsia (27)		Total
	Placenta (central) 95	Placenta (lateral) 93	Placenta (central) 8	Placenta (lateral)19	
None	87 (91.57%)	84 (90.33%)	4 (50%)	9 (47.39%)	
Accidental hemorrhage	2 (2.10%)	-	-	1 (5.26%)	3
Eclampsia	-	-	-	2 (10.52%)	2
IUGR	4 (4.23%)	6 (6.45%)	2 (25%)	2 (10.52%)	14
HELLP	0	0	1 (12.5%)	2 (10.52%)	3
PPH	2 (2.10%)	3 (3.22%)	1 (12.5%)	3 (15.79%)	9

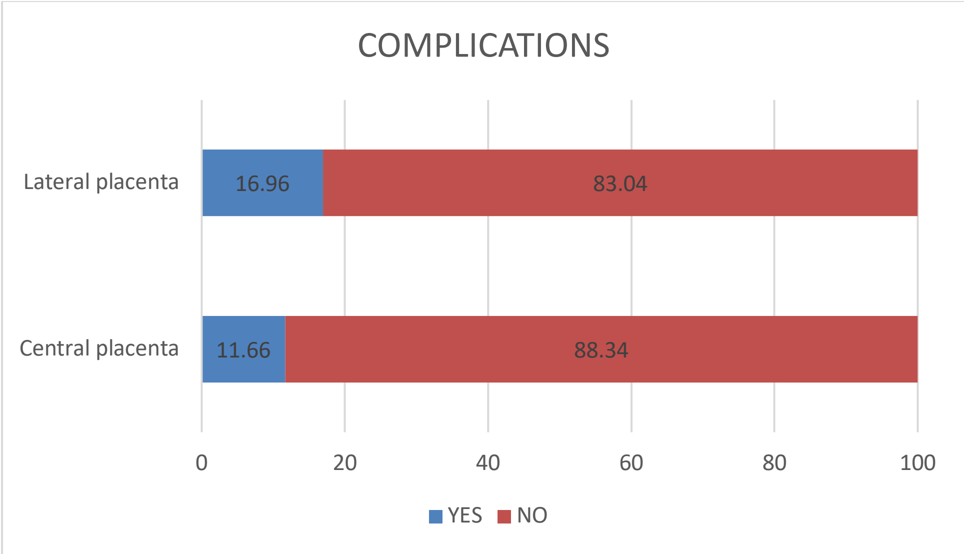

Figure 1: Complications

The data in Table 4 indicates that babies born to pre-eclamptic mothers with a placenta (lateral) had significantly lower APGAR scores at the 1st minute compared to those with a placenta (central), with 36.84% having scores below 7 (p = 0.0003). However, by the 5th minute, all babies had APGAR scores above 7, suggesting that initial distress may improve with time.

Table 4: Distribution of APGAR scores

APGAR scores	Normotensive (188)		Preeclampsia (27)		P value
	Placenta (central) 95	Placenta (lateral) 93	Placenta (central) 8	Placenta (lateral)19	
1ST MINUTE					
<7	2 (2.1%)	5 (5.38%)	2 (25%)	7 (36.84%)	**0.0003**
>7	93 (97.9%)	88 (94.62%)	6 (75%)	12 (63.16%)	
5TH MINUTE					
<7	-	-	-	-	-
>7	95 (100%)	93 (100%)	8 (100%)	9 (100%)	

Table 5 shows that NICU admissions were significantly higher among babies born to pre-eclamptic mothers with a placenta (lateral) (47.37%) compared to those with a placenta (central) (37.5%) (p = 0.0008). This suggests that placenta (lateral)tion in pre-eclamptic pregnancies is associated with a greater need for intensive neonatal care.

Table 5: Distribution of babies admitted to NICU in two study groups

NICU admission	Normotensive (188)		Preeclampsia (27)		P value
	Placenta (central) 95	Placenta (lateral) 93	Placenta (central) 8	Placenta (lateral)19	
YES	6 (6.32%)	7 (7.53%)	3 (37.5%)	9 (47.37%)	**0.0008**
NO	89 (93.68%)	86 (92.47%)	5 (62.5%)	10 (52.63%)	

Discussion

This research was conducted with the view of determining the relationship between right placenta (lateral)tion and pre-eclampsia. In this prospective observational study, conducted at a tertiary care center, placental localization was correlated with incidences and severity of pre-eclampsia, maternal complications, APGAR scores, and NICU admissions. These results are critical for advancing our understanding of the predictive value of placental location for pre-eclampsia and enhancing prenatal care strategies.

It was noted in the current study that out of the 215 prenatal patients that were recruited, 27 (12.56%) had pre-eclampsia. Furthermore, a substantially larger proportion (70.38%) of these cases had a laterally positioned placenta relative to a predominantly positioned placenta (29.62%). This finding is consistent with the findings of prior research that suggested a connection between pre-eclampsia and the position of the placenta in the lateral region. For instance, a study by Kakkar et al. [7], among 150 women, 84 (56%) presented with laterally positioned placentas, while 66 (44%) exhibited centrally positioned placentas.

In a study involving 84 women with laterally positioned placentas, 56 (66.6%) experienced pregnancy-induced hypertension (PIH). In contrast, only 24 (36.6%) of the 66 women with centrally positioned placentas developed PIH. In a retrospective study by Keshavarz E et al. [17], researchers revealed that a lateral position of the placenta correlated with pre-eclampsia in 47.6% (20 out of 42) of instances, whereas other placements were linked to pre-eclampsia in 30% (101 out of 337) of cases. [17] In another study by Pai MV and Pillai J, [18] a significant link (P < 0.0001) was found between the presence of a unilaterally positioned placenta at 20-24 weeks in 71 women who were diagnosed with pre-eclampsia. The current study's findings reinforce the hypothesis that placenta (lateral)tion may be indicative of suboptimal placental implantation and perfusion, leading to increased risks of hypertensive disorders during pregnancy. The increased severity in cases of placenta (lateral)tion could be attributed to the potential for more pronounced abnormal trophoblastic invasion and placental perfusion, leading to greater systemic endothelial dysfunction, which is a hallmark of severe pre-eclampsia.

Further evidence of the influence of placental position on the outcomes of pregnancies was provided by the maternal complications distribution. Among the normotensive group, complications such as accidental hemorrhage, intrauterine growth restriction (IUGR), and postpartum hemorrhage (PPH) were relatively low and comparable between those with central and placenta (lateral). However, in the pre-eclampsia group, complications were notably higher among those with placenta (lateral). These findings are consistent with studies such as those by Porto L. [19], (2015). The current study's data underscore the need for heightened surveillance and management strategies in pregnancies with laterally located placentas to mitigate these risks.

APGAR scores, a critical indicator of neonatal health immediately after birth, were significantly lower at the 1st minute in pre-eclamptic patients (36.84%) with placenta (lateral) in comparison with (25%) placenta (central). This value (p = 0.0003) underscores the immediate impact of placenta (lateral)tion on neonatal outcomes. By the 5th minute, however, all APGAR scores improved to >7, indicating that initial distress might be transient. These results align with those reported by Ayaz A et al. [20] (2009), who found that adverse neonatal outcomes were more common in pregnancies with abnormal placental positioning, suggesting a direct impact of placental health on neonatal well-being.

The study also found a higher rate of NICU admissions among babies born to pre-eclamptic mothers with placenta (lateral) (47.37%) compared to those with placenta (central) (37.5%), with a statistically significant difference (p = 0.0008).

This finding highlights the long-term neonatal implications of placenta (lateral)tion and pre-eclampsia, emphasizing the need for preparedness and resources in neonatal care units to support these high-risk births. Previous research by Kalambe MA et al. [21] (2024) corroborates this finding, suggesting that abnormal placentation is a predictor of adverse perinatal outcomes, necessitating enhanced neonatal monitoring and intervention, In this study, among the women who had preeclampsia, 13 newborns (27.66%) were admitted to NICU, 1 baby (1.20%) was hospitalised from the normotensive women. All of these points to a greater rate of neonatal intensive care unit admissions for infants who were born to mothers who had preeclampsia.

The results of this study have important implications for clinical practice. Identifying placenta (lateral)l location via routine ultrasound can serve as an early tool for screening and predicting the risk of pre-eclampsia. This could enable healthcare providers to implement closer monitoring and early intervention strategies for high-risk pregnancies. Enhanced surveillance protocols, including frequent blood pressure monitoring and early diagnostic testing for pre-eclampsia, could be particularly beneficial for women identified with placenta (lateral)tion.

Furthermore, the association of placenta (lateral)tion with increased maternal and neonatal complications underscores the need for comprehensive prenatal care plans that address these risks. Interventions such as tailored antenatal care, timely delivery planning, and preparedness for potential neonatal intensive care needs could improve outcomes for both mothers and babies.

The sample size, though adequate, could be expanded in future studies to validate these findings across different populations and settings. To better understand the underlying mechanisms that link placenta (lateral)tion to pre-eclampsia, future research should concentrate on this topic. After gaining an understanding of the pathophysiological mechanisms that are at play, one might be able to get insights into prospective treatment targets and preventative tactics. Longitudinal studies that follow the outcomes of both the mother and the foetus beyond the immediate postpartum period have the potential to shed light on the long-term repercussions of placenta (lateral)tion and pre-eclampsia.

Conclusion

The findings provide the possibility of employing the location of the placenta as a predictive marker for pre-eclampsia, which would make it easier to identify and treat high-risk pregnancies at an earlier stage. In order to enhance outcomes, comprehensive prenatal care measures are required, since the increased maternal and newborn problems that are linked with placenta (lateral)tion highlight the necessity of such strategies.

References

1. American College of Obstetricians and Gynecologists. (2020). Hypertension in pregnancy. ACOG Practice Bulletin No. 222.
2. Kaku R, Shivaraju P, Vimala K, Lingegowda K. Lateral location of placenta on ultrasound as a predictive test for preeclampsia. Int J Reprod Contracept Obstet Gynecol. 2017; 6:930-933.
3. Kumari A, Kirubamani N. Placenta (lateral)tion in ultrasonography and prediction of preeclampsia. Glob J Res Anal. 2022.
4. Puyo-Quintila M, Pili-Lopez M. VP50.23: Second trimester ultrasound-guided placental laterality as predictor of pre-eclampsia: a systematic review and meta-analysis. Ultrasound Obstet Gynecol. 2020;56.
5. Joshi SA, Shah M. Placenta (lateral)l Location as a Predictor of Preeclampsia Development: A Prospective Study. J South Asian Fed Obstet Gynaecol. 2021.
6. Priyadarshini A, Upreti P, Nautiyal R, Goyal M. Placental location and development of preeclampsia: a longitudinal study. Int J Reprod Contracept Obstet Gynecol. 2019.
7. Kakkar T, Singh V, Razdan R, Digra S, Gupta A, Kakkar M. Placental laterality as a predictor for development of preeclampsia. J Obstet Gynaecol India. 2013; 63:22-25.
8. R. C, Sundaram A, Shenbagam G. Prospective cohort study in relation of placental location and risk of developing preeclampsia in a tertiary care hospital. Int J Reprod Contracept Obstet Gynecol. 2022.
9. Kore S, Khot R, Supe P, Kanavia D, Thunga C, Nandanwar Y. Prediction of pre-eclampsia: role of placental laterality by ultrasonography. Int J Reprod Contracept Obstet Gynecol. 2016; 5:1433-1437.
10. Ahuja P, Saxena U. Role of placental laterality as a predictive tool for preeclampsia. Int J Contemp Surg. 2020.
11. Gonser M, Tillack N, Pfeiffer K, Mielke G. Placental location and incidence of pre-eclampsia. Ultraschall Med. 1996; 17(5):236-8.
12. Hya K, Madhavi G, Ramathi M. Placental laterality as a predictor of preeclampsia. Am J Phytomed Clin Ther. 2015; 3:231-236.
13. Sharma S, Shashibala, Manisha K, Goel M, Devi P. Second trimester placental location as a predictor of adverse maternal outcome. Indian J Appl Res. 2016; 317-320.
14. Jani P, Patel U, Gandhi MR, Thakor NC, Kakani CR. Placental laterality and uterine artery resistance as predictor of preeclampsia: a prospective study at GMERS Medical College, Dharpur-Patan, North Gujarat, India. Int J Res Med Sci. 2015; 3:1484-1487.
15. Rai A, Thatal A, Sharma B, Narwat Y. Placenta (lateral) as a predictor for development of preeclampsia. Indian J Obstet Gynecol Res. 2020; 7:216-221.
16. Ghosh M, Ghosh A, Sengupta P. A study to assess placental location by ultrasonography and evaluation of its relationship with development of preeclampsia & eclampsia. Int J Biomed Res. 2017; 8:668-671.
17. Keshavarz E, Sadeghian A, Ganjalikhan Hakemi A, Talei Khtibi F. Prediction of Pre-Eclampsia Development by Placenta Location: A Simple Predictor. J Obstet Gynecol Cancer Res. 2017 Nov; 2(4) Published online 2017 Sep 27. doi: 10.5812/jogcr.11945.
18. Uikey P, Gurwani V, Tajne M. Correlation between placental location and development of preeclampsia. Int J Reprod Contracept Obstet Gynecol. 2019 Nov; 8(11). doi: 10.18203/2320-1770.ijrcog20194838.
19. Porto L, Aviram A, Jackson R, Carson M, Melamed N, Barrett J, Mei-Dan E. Placenta (lateral)tion and adverse perinatal outcomes. Placenta. 2020 Nov; 101:1-3. doi: 10.1016/j.placenta.2020.08.012. Epub 2020 Aug 20. PMID: 32905973.
20. Ayaz A, Muhammad T, Hussain SA, Habib S. Neonatal outcome in pre-eclamptic patients. J Ayub Med Coll Abbottabad. 2009 Apr-Jun; 21(2):53-5. PMID: 20524469.
21. Kalambe MA, Soni NN, Ali S, Bankar NJ. An Observational Study of Maternal and Perinatal Outcome in Preeclampsia Cases in a Tertiary Care Center. Cureus. 2024 Apr 30; 16(4):e59352. doi: 10.7759/cureus.59352. PMID: 38817500; PMCID: PMC11138236.