Journal of Rare Cardiovascular Diseases
ISSN: 2299-3711 (Print) | e-ISSN: 2300-5505 (Online)
www.jrcd.eu
RESEARCH ARTICLE

Lateral Placental Location in the Third Trimester and Its Association with Maternal and Perinatal Outcomes: A Prospective Observational Study

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Article History
Received: 26.08.2025
Revised: 19.09.2025
Accepted: 06.10.2025
Published: 29.10.2025

Abstract: ***Background***: Placental location can influence pregnancy outcomes. While anterior and posterior placements are generally benign, lateral placentation has been associated with altered uteroplacental blood flow and adverse outcomes. Data from South India on this association are limited. ***Objectives:*** To evaluate whether third-trimester lateral placental location predicts adverse maternal and neonatal outcomes in a South Indian population. ***Methods:*** This prospective observational study was conducted at a tertiary care hospital from June 2023 to May 2024, including 300 singleton pregnancies with confirmed placental location on mid- and third-trimester ultrasound. Women with multiple gestations, chronic hypertension, or chronic renal disease were excluded. Placental location was classified as anterior, posterior, fundal, lateral, or low-lying. Maternal and neonatal outcomes were compared across groups. Statistical analysis was performed using Chi-square/Fisher's exact test and ANOVA, with $p < 0.05$ considered significant. ***Results:*** Lateral placenta in the third trimester was significantly associated with preeclampsia/eclampsia (51.28% vs. 9.96%, $p < 0.001$), fetal growth restriction (43.59% vs. 6.90%, $p < 0.001$), antepartum haemorrhage (25.64% vs. 1.92%, $p < 0.001$), preterm delivery (15.38%, $p = 0.0019$), and PPROM/PROM (23.08%, $p < 0.001$). Mean birth weight was lowest in the lateral group (2.34 +/- 0.74 kg, $p < 0.001$). A history of prior abortions was more frequent in women with lateral placenta (61.54%, $p < 0.001$). ***Conclusions:*** Lateral placental location in the third trimester is associated with higher risks of preeclampsia, growth restriction, antepartum haemorrhage, preterm birth, and low birth weight. Early identification through routine ultrasound could help in targeted antenatal surveillance, especially in resource-limited settings.

Keywords: Lateral placenta, placental location, preeclampsia, fetal growth restriction, ultrasound, pregnancy outcomes.

INTRODUCTION

The placenta plays a vital role during pregnancy acting as the bridge between mother and fetus, ensuring nutrient transfer, hormone production, and proper oxygenation. Any disturbance in its implantation or function can lead to complications such as preeclampsia, fetal growth restriction (FGR), antepartum haemorrhage, and even preterm birth or stillbirth (1,2).

Ultrasound in the mid-trimester allows for straightforward classification of placental location. whether anterior, posterior, fundal, lateral, or low-lying. While anterior and posterior placements are quite common and usually benign, lateral implantation may present subtle but important risks. Lateral placentation has been linked to insufficient blood flow and localized uteroplacental hypoxia, potentially resulting in hypertension or growth restriction (1,3).

Recent studies provide useful insight. A 2023 study found that fundal-left lateral placentation significantly increases the risk of severe preeclampsia and premature rupture of membranes (4). In a prospective Indian cohort, lateral placenta was present in two-thirds of both mild and severe preeclampsia cases, showing good predictive accuracy (sensitivity: 67%, specificity: 78%, likelihood ratio: 3.1) (5). A 2024 meta-analysis confirmed that lateral placentation raises the risk of preterm birth (6).
Given this background, our study aims to evaluate whether third-trimester lateral placental location truly predicts adverse maternal and neonatal outcomes in South India. This area has limited data despite wide access to mid-trimester scans. Identifying lateral placentation as a risk marker could enhance antenatal surveillance in resource-limited settings.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted in the Department of Obstetrics and Gynaecology at a tertiary care hospital between June 2023 and May 2024.

Sample Size Calculation

The sample size was determined using the method for proportions: inequality, two independent groups (Fisher's exact test), based on data from Faizi et al., in which the incidence of preeclampsia/eclampsia was 27.9% in the lateral placenta group and 15.4% in the

posterior placenta group. This yielded a required sample of 294 participants.

Ethical Approval and Consent

The study protocol was reviewed and approved by the Saveetha Medical College and Hospital Institutional Ethics Committee (SMCH-IEC), Chennai, India (Registration No. ECR/724/Inst/TN/2015/RR-19; IEC Reference Number: 076/06/2023/IEC/SMCH; Date of approval: 20 June 2023). Written informed consent was obtained from all participants in their vernacular language after explaining the study objectives, procedures, potential benefits, and risks.

Participants

Inclusion criteria: Pregnant women with a singleton gestation attending the antenatal clinic between 14 and 28 weeks of pregnancy during the study period.

Exclusion criteria: Multiple gestations, chronic hypertension, and chronic renal disease.

Data Collection Procedures

Baseline demographic data including maternal age, parity, medical history, and previous obstetric history were recorded using a structured proforma. A complete physical examination, systemic assessment, and obstetric Evaluation were performed. Gestational age was calculated from the last menstrual period (LMP) when available, or from first-trimester ultrasound (8–10 weeks) if the LMP was uncertain.

Ultrasound assessment:

Conducted between 14 and 28 weeks and repeated in the third trimester using a Toshiba Nimio ultrasound machine equipped with a transabdominal transducer (5 MHz) and a transvaginal transducer (6.5 MHz).

Placental location was classified as anterior, posterior, fundal, lateral, or low-lying when ≥75% of placental mass was in that position.

Placenta previa was diagnosed after 28 weeks when the placental edge was within 2 cm of the internal cervical os.

Placental maturity was graded according to Grannum's classification (Grades 0–3).

Outcome Variables

Maternal outcomes: Preeclampsia/eclampsia, intrauterine growth restriction (IUGR), antepartum haemorrhage (APH), oligohydramnios, preterm labour, gestational age at delivery, intrauterine fetal demise, duration of third stage of labour, fetal distress in labour (resulting in caesarean section), postpartum haemorrhage (PPH), and manual removal of placenta (MROP).

Neonatal outcomes: Early neonatal mortality, Apgar score <7 at 1 or 5 minutes, mean birth weight, and other neonatal complications.

Statistical Analysis

Data were entered in Microsoft Excel and analysed using SPSS version 23 (IBM Corp., Armonk, NY, USA).

Descriptive statistics: Frequencies and percentages for categorical variables; mean and standard deviation (SD) for continuous variables.

Comparative statistics: Associations between categorical variables were tested using the Chi-square test or Fisher's exact test where appropriate.

Analysis of variance (ANOVA) was used to compare mean differences across groups, particularly for birth weight by placental location.

A p-value <0.05 was considered statistically significant.

RESULTS:

Baseline Characteristics

The mean age of the participants was concentrated in the mid-twenties, with the largest proportion belonging to the 26–30 years age group (40%), followed by 21–25 years (32%). Women aged less than 20 years accounted for 20% of the study population, while those above 30 years comprised only 8% (Table 1).

With respect to obstetric score, the majority of participants were multigravida (60%), whereas primigravida constituted 40% (Table 2).

Table 1. Distribution of study population according to age

Age Group (years)	n	%
<20	60	20.0
21–25	96	32.0
26–30	120	40.0
>30	24	8.0

Table 2. Distribution of study population according to obstetric score

Gravida	n	%
Primigravida	120	40.0
Multigravida	180	60.0

Placental Location and Migration from Mid to Third Trimester

In the mid-trimester (14–28 weeks), the anterior placenta was the most frequent location, observed in 40% of cases, followed by posterior (28%), fundal (16%), lateral (13%), and low-lying (3%). By the third trimester, anterior placentas increased slightly to 41.33%, with four cases migrating from the low-lying position. Posterior placentas increased to 28.67% due to two cases migrating from the low-lying group. Lateral and fundal positions remained unchanged, whereas the proportion of low-lying placentas decreased to 1%, indicating migration in most cases (Table 3).

The distribution patterns are shown in Figure 1 (mid-trimester), Figure 2 (third trimester), and Figure 3 (migration trend).

Table 3. Placental location and migration from mid to third trimester

Placental Location	Mid Trimester n (%)	Third Trimester n (%)	Migration Notes	% Change
Anterior	120 (40.0)	124 (41.33)	4 migrated in from low-lying	+1.33
Posterior	84 (28.0)	86 (28.67)	2 migrated in from low-lying	+0.67
Lateral	39 (13.0)	39 (13.0)	No change	0
Fundal	48 (16.0)	48 (16.0)	No change	0
Low Lying / Placenta Previa	9 (3.0)	3 (1.0)	6 migrated to anterior/posterior positions	–2.0

Figure 1. Placental location in mid-trimester (14–28 weeks).

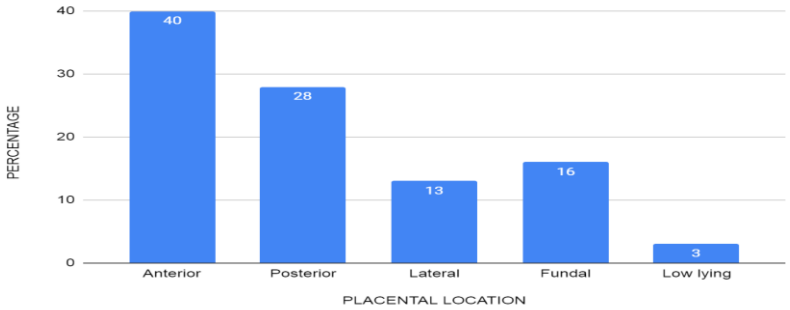


Figure 2. Placental location in third trimester.

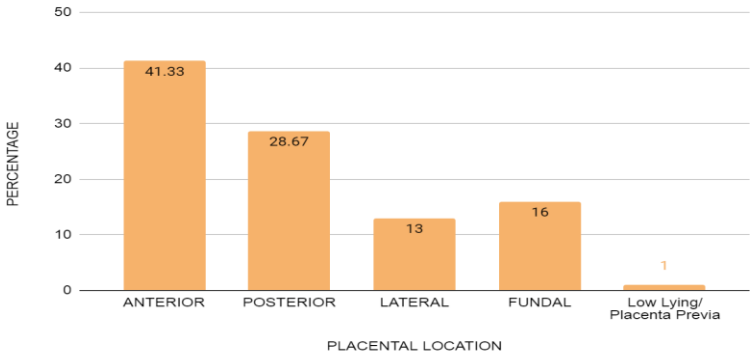
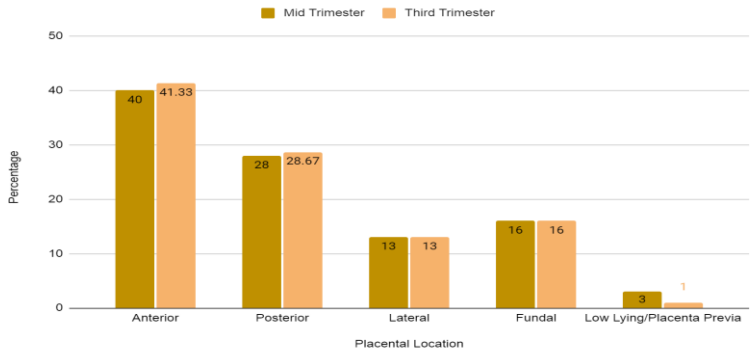


Figure 3. Placental migration between mid and third trimester.



Placental Maturity Grading in Second and Third Trimester

In the second trimester, the majority of placentas were graded as Grade I (56%), followed by Grade II (44%). By the third trimester, most placentas had advanced to Grade II maturity (82%), while 10% remained at Grade I and 8% reached Grade III maturity (Table 4).

Table 4. Placental maturity grading in second and third trimester

Placental Grade	Second Trimester n (%)	Third Trimester n (%)
Grade I	168 (56.0)	30 (10.0)
Grade II	132 (44.0)	246 (82.0)
Grade III	–	24 (8.0)

Maternal Outcomes

Term deliveries predominated, occurring in 96.33% of cases. Cephalic presentation was recorded in 94.67% of participants. Non-reassuring non-stress test (NST) results were noted in 30.33% of cases.

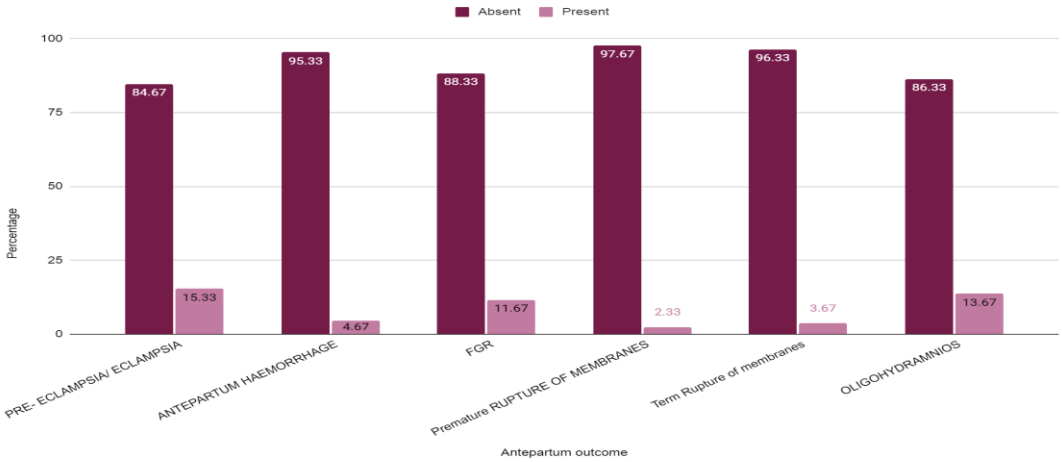
Among antenatal complications, pre-eclampsia/eclampsia was present in 15.33% of women, fetal growth restriction (FGR) in 11.67%, oligohydramnios in 13.67%, and antepartum haemorrhage (APH) in 4.67%. Premature rupture of membranes occurred in 2.33%, term rupture of membranes in 3.67%, and malpresentation in 5.33% of cases.

Postpartum complications were less frequent, with postpartum haemorrhage in 4% and manual removal of the placenta in only 0.67% (Table 5, Figure 4).

Table 5. Distribution of study population according to maternal effects

Maternal Effects	Absent n (%)	Present n (%)
Antepartum outcome		
Pre-eclampsia/Eclampsia	254 (84.67)	46 (15.33)
Antepartum haemorrhage	286 (95.33)	15 (4.67)
FGR	265 (88.33)	35 (11.67)
Premature rupture of membranes	293 (97.67)	7 (2.33)
Term rupture of membranes	289 (96.33)	11 (3.67)
Oligohydramnios	259 (86.33)	41 (13.67)
Intrapartum outcome		
Term	11 (3.67)	289 (96.33)
Preterm	289 (96.33)	11 (3.67)
Cephalic	16 (5.33)	284 (94.67)
Malpresentation	284 (94.67)	16 (5.33)
Non-reassuring NST	209 (69.67)	91 (30.33)
Manual removal of placenta	298 (99.33)	2 (0.67)
Postpartum haemorrhage	288 (96.00)	12 (4.00)

Figure 4. Distribution of maternal effects in the study population



Neonatal Outcomes

Evaluation of neonatal status using the APGAR score at 5 minutes (Table 6, Figure 5) demonstrated that the vast majority of newborns (98.33%) had no depression, reflecting good neonatal health. Mild depression was observed in 1.33% of cases, requiring limited medical intervention. Severe depression was rare, seen in only 0.34% of newborns, and necessitated urgent resuscitative measures.

Table 6. Distribution of study population according to APGAR score at 5 minutes

APGAR Classification	N	%
Severe	1	0.34
Mild	4	1.33
No depression	295	98.33

Association between Placental Location and Maternal/Perinatal Variables

Table 7 Shows the association between placental location in the third trimester and various maternal and perinatal variables, divided into those showing statistically significant relationships ($P < 0.05$) and those without significant association ($P \geq 0.05$).

Table 7: Association between Placental Location in the Third Trimester and Maternal/Perinatal Variables

Variable	Significant?	Key Findings	P Value
Obstetric Score (Gravida)	Yes	Multigravida highest in lateral placenta (76.92%)	0.0002
Previous Abortions	Yes	Lateral placenta more common in those with prior abortions (61.54%)	<0.001
Pre-eclampsia/Eclampsia	Yes	Most frequent in lateral placenta (51.28%)	<0.001
APH	Yes	Lateral (25.64%) & low-lying (33.33%) highest	<0.001
FGR	Yes	Lateral placenta highest (43.59%)	<0.001
Oligohydramnios	Yes	Fundal (22.92%) highest	<0.001
Mean Birth Weight	Yes	Lowest in lateral placenta (2.34 kg)	<0.001
Maternal Age	Yes	Posterior placenta more frequent in <25 yrs	<0.001
PPROM/PROM	Yes	Lateral placenta highest (23.08%)	<0.001
Preterm Birth	Yes	Lateral placenta highest (15.38%)	0.0019
Previous D&C	No	No significant difference	0.47
Non-reassuring NST	No	No significant difference	0.172
Fetal Presentation	No	No significant difference	0.63

Significant Associations

Placental location in the third trimester showed statistically significant associations with several maternal and perinatal factors. Multigravida status was most frequent among women with a lateral placenta, with 76.92 percent falling into this category (P value 0.0002). A history of previous abortions was also more common in the lateral placenta group, seen in 61.54 percent of cases (P value less than 0.001).

Pre-eclampsia or eclampsia was highest in the lateral placenta group, affecting 51.28 percent of women (P value less than 0.001). Antepartum haemorrhage was most often observed in the lateral placenta group at 25.64 percent, with a notable proportion also in low-lying placentas at 33.33 percent (P value less than 0.001). Fetal growth restriction was present in 43.59 percent of women with lateral placentas, which was the highest among all groups (P value less than 0.001).
Oligohydramnios was more frequent in fundal placentas at 22.92 percent, followed by posterior and lateral locations (P value less than 0.001). Mean birth weight was lowest in the lateral placenta group, with an average of 2.34 kilograms and a standard deviation of 0.74 kilograms (P value less than 0.001). Maternal age also showed a significant pattern, with posterior placentas more common in younger mothers, where 83.72 percent were less than 25 years old (P value less than 0.001).

Preterm birth occurred more often in women with a lateral placenta, with a rate of 15.38 percent compared to lower rates in other groups (P value 0.0019). Premature rupture of membranes, including both PPROM and PROM, was also more frequent in the lateral placenta group at 23.08 percent (P value less than 0.001).

Non-significant Associations

Some factors did not show a statistically significant association with placental location. A previous history of dilatation and curettage was not significantly different between groups (P value 0.47). Non-reassuring non-stress test results also did not vary significantly with placental location (P value 0.172). Similarly, fetal presentation did not differ meaningfully between placental location groups (P value 0.63).

Lateral Placenta Composite Risk Association

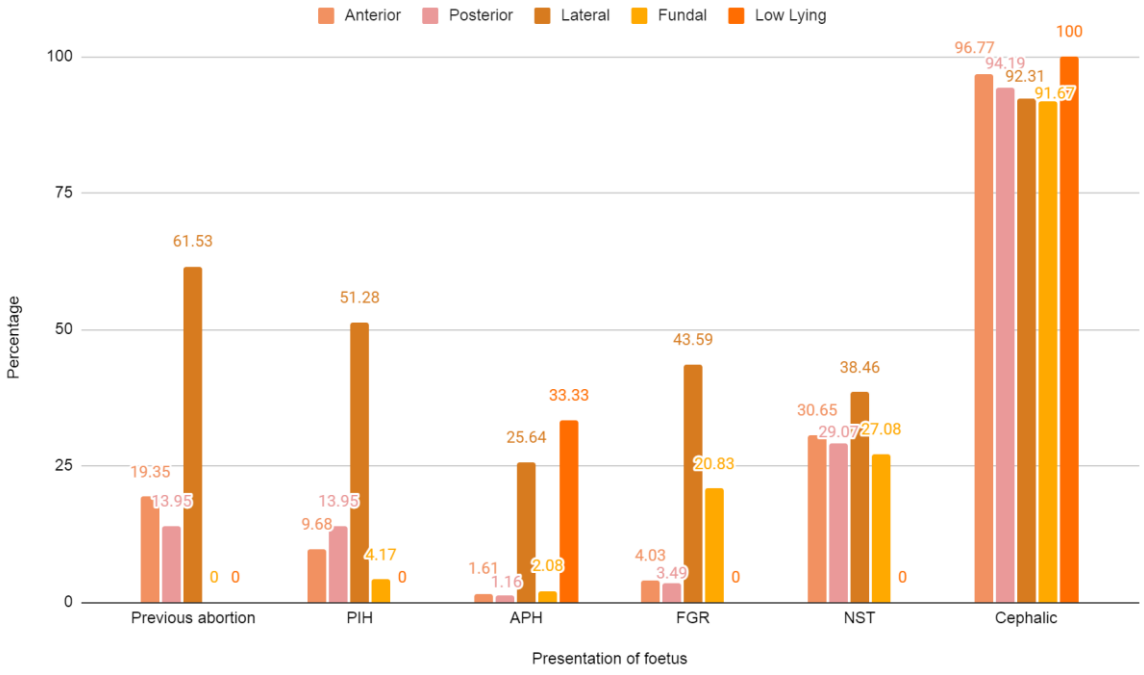
Analysis of placental position in relation to maternal and fetal parameters is presented in **Table 7**. Lateral placental location demonstrated significant associations with several adverse pregnancy outcomes. Women with a lateral placenta had a higher frequency of previous abortions (61.54 percent), pre-eclampsia/eclampsia (51.28 percent), antepartum haemorrhage (25.64 percent), and fetal growth restriction (43.59 percent), all of which were statistically significant ($P < 0.001$).
No significant associations were found between lateral placental location and oligohydramnios, non-reassuring non-stress test results, or fetal presentation.

These findings suggest that a lateral placenta may be an important clinical risk marker and warrants closer antenatal monitoring. The percentage distribution of these associations is illustrated in Figure 6.

Table 8. Association between Lateral Placental Location and Maternal-Fetal Parameters

Parameter	Sub-classification	Lateral (n, %)	Other Placental Locations (n, %)	Chi-square value	P value
Previous abortion	Nil	15 (38.46)	225 (86.21)	96.088	<0.001
	1	12 (30.77)	36 (13.79)		
	2	12 (30.77)	0 (0.00)		
Pre-eclampsia/Eclampsia	Yes	20 (51.28)	26 (9.96)	44.623	<0.001
	No	19 (48.72)	235 (90.04)		
Antepartum haemorrhage	Yes	10 (25.64)	5 (1.92)	40.208	<0.001
	No	29 (74.36)	256 (98.08)		
Fetal growth restriction	Yes	17 (43.59)	18 (6.90)	44.330	<0.001
	No	22 (56.41)	243 (93.10)		
Oligohydramnios	Yes	5 (12.82)	36 (13.79)	0.027	0.270
	No	34 (87.18)	225 (86.21)		
Non-reassuring NST	Yes	15 (38.46)	76 (29.12)	1.401	0.240
	No	24 (61.54)	185 (70.88)		
Cephalic presentation	Yes	36 (92.31)	248 (95.02)	0.494	0.480
	No	3 (7.69)	13 (4.98)		

Figure 6. Percentage distribution of adverse maternal and fetal outcomes across different placental locations



DISCUSSION

Our study reveals that lateral placental location in the third trimester is significantly linked to adverse maternal and fetal outcomes. The incidence of preeclampsia/eclampsia was markedly higher in the lateral placenta group (51.28% vs. 9.96%, $p < 0.001$), as was fetal growth restriction (FGR) (43.59% vs. 6.90%, $p < 0.001$). Antepartum haemorrhage occurred in 25.64% of women with lateral placenta compared to only 1.92% in other locations ($p < 0.001$). The mean birth weight was lowest in the lateral placenta group (2.34 ± 0.74 kg, $p < 0.001$), and preterm delivery was more frequent (15.38% vs. much lower in other groups, $p = 0.0019$). In addition, PPROM/PROM occurred in 23.08% of lateral placenta cases ($p < 0.001$). A history of prior abortions also showed a strong correlation, being present in 61.54% of women with lateral placenta ($p < 0.001$), indicating possible underlying vascular or anatomical factors. These associations persisted even after considering maternal age and obstetric score, suggesting that lateral placentation may serve as a valuable clinical risk marker.

Comparison with Existing Literature

Our findings echo recent Indian and international research. A study from North India reported similar associations: lateral placenta was linked with higher risks of preeclampsia and FGR, whereas posterior placenta was associated with preterm birth and stillbirth (7). Another regional Indian study from Tamil Nadu found that lateral placental location conferred a significantly higher risk of preeclampsia, accounting for 67 percent of both severe and non-severe cases ($p < 0.0001$) with a likelihood ratio of 3.09 (8)

International literature similarly reports that lateral placental implantation is associated with increased incidence of preeclampsia, fetal distress, and caesarean section (3). These results are consistent with our observations, strengthening the credibility of lateral placental location as an indicator of maternal-fetal compromise.

Contrasting results have emerged from some large-scale studies, which have found no significant difference in hypertensive disorders, small-for-gestational-age births, or preterm deliveries between lateral and other placental locations, though higher rates of retained placenta and longer third-stage labour were observed (9,10). This discrepancy might reflect methodological differences, population characteristics, or sample sizes across studies.

Possible Mechanisms

Placental location influences blood flow dynamics. Inadequate remodeling of the uterine spiral arteries disrupts uteroplacental perfusion. Such dysfunction is known to contribute to FGR and preeclampsia (11,12). Lateral implantation may predispose to suboptimal vascular invasion or regional hypoxia, leading to the cascade of adverse outcomes seen.

Clinical Implications

Given that placental location is easily assessed by routine ultrasound, particularly in the mid-trimester, it may serve as an inexpensive, accessible predictor of high-risk pregnancy. In resource-limited settings, identifying lateral placentas early could help target closer surveillance and interventions. Doppler evaluation of uterine arteries, as seen in recent studies, may further refine the prediction of complications among this subgroup (13).

Strengths and Limitations

Strengths of our study include prospective design, STROBE-aligned reporting, and comprehensive follow-up. Limitations include single-centre data, limited sample size, and absence of placental Doppler or histopathology. Future multicentre studies with larger numbers and mechanistic insights (e.g., Doppler, placental pathology) are warranted.

CONCLUSION

In conclusion, lateral placental location appears to be associated with a higher risk of preeclampsia, FGR, antepartum haemorrhage, preterm birth, and low birth weight in our cohort. This simple ultrasound marker may prove clinically useful in identifying women needing heightened antenatal care. Further studies should validate its predictive value and explore pathophysiological underpinnings.

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