International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Tyagi S et al. Int J Reprod Contracept Obstet Gynecol. 2026 Sep;15(9):3590-3596
www.ijrcog.org

pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20263045

Original Research Article

Impact of mid-trimester placental location on maternal and fetal outcome

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Received: 15 July 2026
Revised: 11 August 2026
Accepted: 13 August 2026

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ABSTRACT

Background: Mid-trimester placental location is routinely documented during fetal anatomy scans, but its potential to predict maternal and fetal complications remain under-researched. This study evaluated the impact of implantation sites anterior, posterior, fundal, or lateral on pregnancy outcomes.
Methods: A prospective cohort study of 200 singleton pregnancies was conducted between January 2024 and January 2026. Placental location was assessed via ultrasound between 18-24 weeks and correlated with subsequent maternal and neonatal events.
Results: Anterior placentas were most common (44%), followed by fundal (26.5%) and posterior (21%). Lateral placentation (8.5%) was significantly associated with maternal complications (70.6%), including pre-eclampsia (40%). Posterior location was linked to higher rates of GDM (64.3%), PROM (55.6%), low birth weight (23.8%), and poor 1-minute APGAR scores (44.4%).
Conclusions: Mid-trimester placental localization is a significant prognostic indicator of maternal and neonatal risk. Routine placental mapping at 18–24 weeks serves as a cost-effective screening tool for identifying high-risk pregnancies.

Keywords: Fetal outcome, Maternal outcome, Mid-trimester, Placental location, Pre-eclampsia

INTRODUCTION

Pregnancy and motherhood are among the most beautiful and profoundly life-altering experiences that a woman can ever encounter. To be pregnant is to be vitally alive and profoundly woman, making pregnancy a unique period marked by transition, growth, and profound beginnings. Central to this transformative process is the placenta, a complex and vital organ that plays a key role throughout pregnancy. The human placenta acts as the critical interface between mother and foetus, mediating the transfer of nutrients, gases, and waste removal, thereby supporting foetal development and growth.[1]

The placenta is the largest foetal organ and performs indispensable functions not only in providing nutrition but also in protecting the foetus and maintaining pregnancy. Its formation and location in the uterus have significant implications for pregnancy outcomes. The site of implantation and the resultant placental location within the uterine cavity likely influence placental blood flow and thus the success of pregnancy. Uterine blood supply, a primary determinant of placental circulation, is not evenly distributed. When the placenta is centrally located, it receives a balanced blood supply from both uterine arteries. Conversely, a placenta located laterally relies predominantly on the uterine artery closest to its side, which typically provides low-resistance, good blood flow, while the other artery's contribution via collateral circulation is reduced. This disparity in blood flow distribution creates physiological differences that can impact placental function and foetal well-being.[2]

Anatomical and vascular variations across different uterine areas further affect placental performance. Apart from known risks associated with placenta previa, other placental locations such as anterior, posterior, lateral, fundal, or cornual implantations may also be linked with adverse pregnancy, delivery, and infant outcomes.[3-5] Despite the routine documentation of placental site during mid-trimester foetal anatomy ultrasound scans, its detailed evaluation, except for low-lying or previa placentas, has been insufficiently explored in large prospective studies.[6] Moreover, the potential for placental location to predict maternal and foetal complications remains under-researched.[7]

Mid-trimester placental location is an underutilized yet potentially valuable marker for anticipating maternal and foetal risks during pregnancy. A comprehensive understanding of this relationship could guide maternal-foetal medicine practice towards better individualized monitoring and intervention, ultimately improving perinatal outcomes.

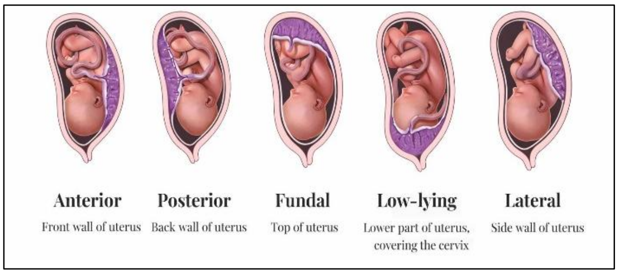

Figure: Types of placental location.

METHODS

This prospective cohort study was conducted at the Department of Obstetrics and Gynaecology, Tirath Ram Shah Charitable Hospital, New Delhi, over a two-year period between January 2024 and January 2026. The study population included all pregnant women attending the antenatal clinic or admitted to the hospital.

Inclusion criteria

Primigravida or multigravida women with a singleton pregnancy and a gestational age between 18-24 weeks who were willing to undergo follow up and deliver at the study hospital.

Exclusion criteria

Women with the following were excluded, including fetal structural abnormalities, overt diabetes mellitus, chronic hypertension, multiple pregnancies, polyhydramnios or oligohydramnios, women with unknown last menstrual period, intrauterine death at the time of first ultrasonographic examination and ultrasound findings of placenta previa/low-lying placenta.

A sample size of 200 was determined based on complication proportions reported in reference literature. Trans-abdominal ultrasound scans were performed using a SIEMENS ACUSON X300 machine by the radiologist. Placental locations were classified as anterior, posterior, fundal, or lateral. 1) Anterior was attached primarily to the front wall of the uterus, 2) Posterior was attached to the back (spinal) wall of the uterus, 3) Fundal was situated at the top of the uterus, potentially extending forward or backward, 4) Lateral was greater portions of the placenta confined to either the left or right-side wall of the uterus.

Maternal outcomes tracked included pre-eclampsia, preterm delivery, abruption placentae, gestational diabetes mellitus, and premature rupture of membranes; neonatal outcomes included low birth weight, intra-uterine death, poor APGAR scores, and NICU admissions. Data were summarized using descriptive statistics and analysed via Chi-square or ANOVA tests, with $p<0.05$ considered significant.

RESULTS

The majority of the 200 study participants were aged 21-25 years, accounting for 67.5% (n=135) of the total. Only 5% (n=10) were aged 20 or younger, while the remaining participants were distributed almost equally between the 26-30 (13.5%) and >30 (14%) age groups. The study population consisted primarily of women with lower gravidity.

Specifically, 39.5% were primigravida (G1), and 38% were second gravida (G2). Women with gravida 3 represented the smallest portion of the cohort at 22.5% (n=45). The most common placental location observed was anterior, found in 44% (n=88) of participants. This was followed by fundal (26.5%) and posterior (21%) locations. Lateral placental location was the least frequent, occurring in only 8.5% (n=17) of the study population.

Regarding the mode of delivery, more than half of the participants (59.5%, n=119) underwent a normal vaginal delivery (NVD). The remaining 40.5% (n=81) delivered via lower segment caesarean section (LSCS). In this cohort, 71.5% (n=143) of the study participants did not experience any maternal complications. However, complications were present in 28.5% (n=57) of the cases.

Among the 57 participants who experienced complications, pre-eclampsia was the most common (26.3%, n=15), followed closely by GDM at 24.6% (n=14). Preterm delivery (17.5%) and PROM (15.8%) were also notable, while eclampsia was the least common complication (5.3%). The vast majority of newborns (90%, n=180) had a normal birth weight of 2.5 kg or more. Low birth weight (less than 2.5 kg) was recorded in 10% (n=20) of the deliveries.

Out of 199 live births (following one intrauterine death), 12.6% (n=25) of neonates required NICU admission. The majority (87.4%) did not require intensive care.

At the 1-minute mark, 91% of neonates had a healthy APGAR score of ≥7. APGAR scores improved at 5 mins, with 99.5% of infants achieving an APGAR score of ≥7, and only one infant (0.5%) remaining below that threshold.

There was no statistically significant association between maternal age and placental location (p=0.603). This suggests that age does not influence where the placenta implants in the uterus (Table 1).

Table 1: Association of age groups based on placental location (n=200).

Age group (in years)	Total, N (%)	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Chi square test	P value
<20	10 (5)	4 (4.5)	4 (7.5)	1 (5.9)	1 (2.4)	7.328	0.603
20-25	135 (67.5)	58 (65.9)	36 (67.9)	10 (58.8)	31 (73.8)		
26-30	27 (13.5)	15 (17)	5 (9.4)	1 (5.9)	6 (14.3)		
>30	28 (14)	11 (12.5)	8 (15.1)	5 (29.4)	4 (9.5)		
Total	200 (100)	88 (100)	53 (100)	17 (100)	42 (100)		

Table 2: Association of gravida status with placental position (n=200).

Gravida status	Total, N (%)	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Chi square test	P value
G1	79 (39.5)	30 (34.1)	22 (41.5)	8 (47.1)	19 (45.2)	5.770	0.449
G2	76 (38)	37 (42)	21 (39.6)	3 (17.6)	15 (35.7)		
G3	45 (22.5)	21 (23.9)	10 (18.9)	6 (35.3)	8 (19)		
Total	200 (100)	88 (100)	53 (100)	17 (100)	42 (100)		

The data shows no significant link between gravida status and placental position (p=0.449). Placental distribution remained relatively consistent across G1, G2, and G3 categories (Table 2).

The association between the mode of delivery (NVD vs. LSCS) and placental position was not statistically significant (p=0.138). While LSCS rates appeared higher in lateral and posterior positions compared to anterior or fundal, the difference did not reach significance (Table 3).

Table 3: Association of mode of delivery with placental position (n=200).

Mode of delivery	Total, N (%)	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Chi square test	P value
NVD	119 (59.5)	56 (63.6)	35(66)	7 (41.1)	21 (50)	5.506	0.138
LSCS	81 (40.5)	32 (36.4)	18 (34)	10 (58.8)	21 (50)		
Total	200 (100)	88 (100)	53 (100)	17 (100)	42 (100)		

Table 4: Association of presence of maternal complications with placental position (n=200).

Mode of delivery	Total, N (%)	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Chi square test	P value
Absent	143 (71.5)	77 (87.5)	36 (67.9)	5 (29.4)	25 (59.5)	29.122	0.001*
Present	57 (28.5)	11 (12.5)	17 (32.1)	12 (70.6)	17 (40.5)		
Total	200 (100)	88 (100)	53 (100)	17 (100)	42 (100)		

*Statistically significant

A highly significant association was found between the presence of maternal complications and placental location (p=0.001). Specifically, complications were most frequent in the lateral (70.6%) and posterior (40.5%) positions, whereas the anterior position had the lowest complication rate (12.5%) (Table 4).

Placental position was significantly associated with specific complications, including pre-eclampsia (p=0.018), eclampsia (p<0.001), and preterm delivery (p<0.001). GDM (p<0.001) was frequently linked to the posterior position (64.3%), while eclampsia was exclusively associated with lateral positions in this study (Table 5).

There was a statistically significant association between birth weight and placental position (p=0.001). Low birth weight (<2.5 kg) was most prevalent in participants with posterior (23.8%) and lateral (23.5%) placentas compared to those with anterior (3.4%) or fundal (5.7%) placentas (Table 6).

Table 5: Association of types of maternal complication with placental position (n=200).

Complications	Total, N (%)	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Chi square test	P value
Pre-eclampsia	15 (100)	4 (26.7)	5 (33.3)	6(40.0)	0	10.046	0.018*
Eclampsia	3 (100)	0	0	3 (100)	0	32.728	0.001*
Abruptio placentae	6 (100)	3 (50)	3 (50)	0	0	3.164	0.367
Preterm delivery	10 (100)	0	3 (30.0)	4 (40.0)	3 (30.0)	16.184	0.001*
PROM	9 (100)	2 (16.7)	1 (8.3)	1 (8.3)	5 (55.6)	6.128	0.106
GDM	14 (100)	0	5 (35.7)	0	9 (64.3)	21.817	0.001*
Total	57 (100)	9 (15.7)	17 (29.8)	14 (24.5)	17 (29.8)		

*Statistically significant

Table 6: Association of birth weight with placental positions (n=200).

Birth weight in kg	Total, N (%)	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Chi square test	P value
<2.5 kg	20	3 (3.4)	3 (5.7)	4 (23.5)	10 (23.8)	17.7	0.001*
≥ 2.5 kg	180	85 (96.6)	50 (94.3)	13 (76.5)	32 (76.2)		

*Statistically significant

Table 7: Association of NICU admissions with placental position (n=200)#.

Variable	Total, N (%)	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Chi square test	P value
Yes	25 (12.6)	6 (6.8)	4 (7.7)	6 (35.3)	9 (21.4)	14.769	0.002*
No	174 (87.4)	82 (93.2)	48(92.3)	11(64.7)	33 (78.6)		

#One foetal death; *Statistically significant

The need for NICU admissions was significantly associated with placental position (p=0.002). Neonates from lateral (35.3%) and posterior (21.4%) placental locations were more likely to be admitted to the NICU compared to those with anterior (6.8%) or fundal (7.7%) locations (Table 7).

Placental position showed a significant association with 1-minute APGAR scores (p=0.004), with the highest rate of low scores (<7) found in the posterior (44.4%) and lateral (22.2%) groups. However, the association was not significant for the 5-minute APGAR score (p=0.41) (Table 8).

Table 8: Association of APGAR scores with placental position (n=199)#.

Variable		Total, N (%)	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Chi square	P value
APGAR score 1 min	<7	18	4 (22.2)	2 (11.2)	4 (22.2)	8 (44.4)	13.3	0.004*
	≥ 7	181	84 (46.4)	50 (27.6)	13 (7.1)	34 (18.7)		
APGAR score 5min	<7	1	0	1 (100)	0	0	2.86	0.41
	≥ 7	198	88 (44.4)	51 (25.7)	17 (8.5)	42 (23.2)		

#One foetal death; *Statistically significant

Table 9: Association of IUFD with placental positions (n=200).

Death	Total, N	Anterior, N (%)	Fundal, N (%)	Lateral, N (%)	Posterior, N (%)	Fisher's exact	P value
Yes	1	0	1 (1.9)	0	0	-	-
No	199	88 (100)	52 (98.1)	17 (100)	42 (100)		

Only one case of intrauterine fetal death (IUFD) occurred in the study, which was seen in the fundal placental group. Due to the single occurrence, a p-value for statistical significance (Table 9).

DISCUSSION

The primary objective of the present study was to evaluate the impact of mid-trimester placental location on maternal and foetal outcomes, identifying how specific implantation sites serve as anatomical markers for obstetrics and neonatal risks. The findings of the present study demonstrate that placental location, as determined by ultrasound between 18 and 24 weeks, is a significant prognostic indicator of pregnancy health.

The primary finding is that non-anterior placental positions, specifically lateral and posterior locations, are associated with a heightened risk of maternal complications and adverse neonatal events. Lateral placentation emerged as a critical predictor for hypertensive disorders, suggesting that physiological remodelling of spiral arteries may be less efficient in lateral uterine segments.[8] Furthermore, the study highlights a clear association between posterior and lateral locations and suboptimal neonatal outcomes, reinforcing the clinical utility of mid-trimester placental localization as a screening tool for high-risk pregnancies.

The present study cohort represents a typical cohort of pregnant mothers attending a tertiary care hospital in India. More than two-thirds (67.5%) of the study participants were between 21-25 years of age and primigravida (39.5%) or second gravida (38%). In their study from Karnataka, Sitimani et al, found that the majority of pregnant women were from 21-25 years age group (43.33%) followed by 26-30 years age group (40%), while majority were gravida 2-3 (39.17%) and primigravida (38.33%). Cheema et al, from North India, studied 1000 pregnant females, and reported a mean maternal age of 26.51±4.25 years.[9]

Among mothers in the study cohort, the commonest placental location in the present study was anterior (44%) followed by fundal (26.5%), posterior (21%) and lateral (8.5%). Alakonda et al, observed that 36.8% patients had an anterior location, 22.2% had a fundal location, 3.6% had a left lateral area while 30% had a posterior location in their study on 1301 participants. Several other authors have reported similar findings, including Pai et al, Patel et al, Devrajan et al, Kakkar et al, on the other hand, reported lateral placenta as more typical.[10,11] These variations can result from different standards for classifying the central and lateral placentas.

In this study, GDM (n=14) cases were observed in mothers with fundal (35.7%) and posterior (64.3%) location of the placenta. This distribution is not in agreement with prior research, such as Zia et al, who reported a higher incidence of GDM with anterior placentation (6.0%) compared to fundal (2.7%) or posterior (1.6%) locations (p<0.001), attributing it possibly to variations in uterine blood supply influencing metabolic adaptations.[3] The predominance of GDM in fundal and posterior placentas in the present study cohort may reflect localized vascular dynamics or hormonal influences at these sites that exacerbate insulin resistance, warranting further investigation into placental implantation as a modifiable risk factor for GDM screening in high-risk pregnancies.[12]

Regarding mode of delivery, 59.5% of patients had vaginal deliveries, while 40.5% underwent caesarean sections (LSCS), with no significant association between placental location and mode of delivery. Aggarwal et al reported 70% as vaginal and 30% as caesarean sections (LSCS) deliveries, with no significant association between placental location and mode of delivery.[13] This is consistent with findings from Kalanithi et al, who also observed no association between placental location and delivery mode. In contrast, Wasil et al, and Alakonda et al, found a statistically significant association between placental location and mode of delivery, with caesarean sections being common in low-lying placentas (exclusion criteria in our study) followed by lateral positions. Yadav et al also reported a significant rise in emergency LSCS among cases with lateral placenta positions (51.6%).[14]

The present study shows a significant association between lateral placentation and hypertensive disorders, with 40% of lateral placentas linked to pre-eclampsia. Similar results have been reported by other Indian studies. Aggarwal et al, (2025) reported a significant association between lateral placentation and preeclampsia was observed in their study (p=0.002). These findings were consistent with findings by Nair et al, and Fung et al, who reported a higher risk of preeclampsia with lateral placentation.[15] This supports the interpretation that suboptimal remodelling of spiral arteries in the lateral uterine segment increases vascular resistance.

However, recent global data presents a more nuanced view. A 2024 retrospective cohort study of over 23,000 women found no significant association between lateral placentation and hypertensive disorders, suggesting no notable compromise in the placental perfusion in these cases. This discrepancy seen in the present study is probably due to the small sample size and the presence of other comorbid factors like maternal nutrition and anaemia, which may exacerbate the physiological stress of a lateral placenta.

The present study found a significant association between posterior placental location and PROM (55.6%). A higher proportion of PROM was also observed by Wasil et al, (2013) in their sample of 125 women from Uttar Pradesh and Dhingra et al, from their cohort of 200 mothers from Tamil Nadu (2019).[4] The anatomical rationale is that a posterior placenta may exert unique mechanical stress on the foetal membranes near the internal OS due to uterine contouring.[16]

The present study demonstrates a significant association between posterior placental location and low birth weight (LBW) at 23.8%, suggesting impaired foetal nutrition due to potential vascular differences in the posterior uterine wall. Aggarwal et al, reported that 34.1% of the babies in their cohort were low birth weight, the majority being associated with posterior placentation. Dhingra et al, also reported significantly higher proportion of others with posterior and lateral placentation and LBW babies.[4] Nair et al, found posterior placentation linked to adverse outcomes like preterm birth and FGR, though LBW specifics were not quantified. In contrast, no association was found between mean birth weight and placentation by Yadav et al. and several other studies. Yadav et al, reported mean birth weights between 2.5-2.85 kg but no association with location of placenta.

In the present study, low 1-minute APGAR scores (<7) were most common in posterior placentas (44.4%), compared to anterior (22.2%), fundal (11.2%), and lateral (22.2%), with statistically significant differences. Low 5-minute APGAR scores (<7) were seen in only one which had a fundal placental location. These findings indicate placental location as a risk factor for perinatal asphyxia, guiding targeted intrapartum monitoring. Srushti et al, reported lower APGAR scores in children of mothers with posterior placenta location.[17] On the other hand, Kalanthi et al, and Zia et al failed to find any statistically significant link between APGAR scores at 1 and 5 minutes based on placental location.[3] Contrasting evidence of lower APGAR scores (<7) at 5 mins in lateral placental implementation has been reported by Yadav et al and Wasil et al, who reported lowest scores 1 min and 5 min APGAR scores with lateral placental locations.

The present study found higher NICU admission rates for lateral (35.3%) and posterior (21.4%) and placental positions, significantly higher than fundal (7.7%) and anterior positions (6.8%). These findings mirror recent Indian evidence where lateral and posterior positions were associated with higher neonatal morbidity and low birth weight. In their study, Wasil et al, observed that posterior and lateral placental positions were associated with higher rates of NICU admissions. These findings matched Dhingra et al, who reported increased NICU admissions with low-lying, posterior and lateral placental locations.[4] Patil et al reported NICU admissions in 29.3% of cases with lateral placenta.[18] In a study by Nair et al, number of lateral placentae having NICU admissions were significantly higher (26%) compared to lateral positions (16.4%). In contrast, studies conducted by Aggarwal et al, Zia et al and Jaisal et al found no association with placental location and NICU admissions.[3,19] Intra-uterine Foetal deaths (IUFDs) are rare events. There was a single case of IUFD that occurred with fundal placenta localisation which can be an incidental finding. Similarly, a single death was reported their cohort of 120 mothers by Aggarwal et al.

CONCLUSION

Placental location identified during the routine second-trimester ultrasound appears to have potential clinical value in antenatal risk assessment. Non-anterior placental implantation, particularly lateral and posterior locations, may help identify pregnancies that require closer maternal and fetal surveillance. Incorporating placental localization into routine obstetric evaluation could support early risk stratification and facilitate timely monitoring and intervention. Further large-scale, multicentric prospective studies are needed to validate these findings and clarify the role of placental location as an independent predictor of adverse pregnancy outcomes.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Tyagi S, Srivastava J, Makhija N, Gupta N, Gupta S. Impact of mid-trimester placental location on maternal and fetal outcome. Int J Reprod Contracept Obstet Gynecol 2026;15:3590-6.