Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/fcah3m9956

ASSESSMENT OF PLACENTAL POSITION AND ITS CLINICAL IMPLICATIONS USING ULTRASOUND IN PREGNANCIES AT A TERTIARY CARE HOSPITAL

Dr. Shakuntla Godara[1], Dr. Sukha Ram Bhamu[2], Dr. Sandeep Kumar[3*]

[1]Assistant Professor, Department of Radio-Diagnosis, Ananta Institute of Medical Sciences, Rajsamand, Rajasthan, India.
[2]Associate Professor, Department of Radio-Diagnosis, Geetanjali Medical College and Hospital Udaipur Rajasthan, India.
[3*]Assistant Professor, Department of Radio-Diagnosis, Geetanjali Medical College and Hospital Udaipur Rajasthan, India.

***Corresponding Author:** Dr Sandeep Kumar
*Assistant Professor, Department of Radio-Diagnosis, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India. Email: drmaharia86@gmail.com

Received Date: January 2025 Accepted Date: February 2025

Abstract

Introduction: Placental position plays a crucial role in pregnancy outcomes, with various locations potentially influencing maternal and fetal well-being. This study aimed to evaluate the correlation between ultrasonographically determined placental position and pregnancy outcomes, while assessing its predictive value for complications in a tertiary care setting.

Methods: A prospective observational study was conducted over six months, involving 270 singleton pregnancies between 14-40 weeks gestation. Systematic ultrasound assessment of placental position was performed using standardized protocols with both transabdominal and transvaginal approaches when indicated. Data collection included demographic information, obstetric history, serial ultrasound findings, and pregnancy outcomes. Statistical analysis employed chi-square tests, multiple logistic regression, and survival analysis.

Results: The study revealed anterior placentation as most common (41.5%), followed by posterior (36.3%), fundal (13.0%), and lateral (9.2%) positions. Lateral placentation showed significantly higher rates of complications, including antepartum hemorrhage (20.0%), IUGR (24.0%), and emergency cesarean sections (28.0%). Low-lying placentas demonstrated high resolution rates by term (77.8%). Posterior and fundal placentas were associated with higher rates of normal vaginal delivery (69.4% and 71.4% respectively) compared to other positions. NICU admission rates were significantly higher in lateral placentation (32.0%, p=0.001).

Conclusion: Placental position significantly influences pregnancy outcomes, with lateral placentation carrying the highest risk for complications. The findings support position-specific monitoring protocols and highlight the importance of serial assessment in low-lying placentas for optimal pregnancy management.

Keywords: Placental Position, Pregnancy Outcomes, Ultrasonography, Lateral Placentation, Antepartum Haemorrhage

Introduction

The placenta, a remarkable temporary organ that develops during pregnancy, is vital in fetal growth and development. Understanding placental position through ultrasound evaluation has become increasingly crucial in modern obstetrics, as it significantly influences pregnancy outcomes and management strategies. Recent advances in ultrasonography have enhanced our ability to accurately assess placental location and its relationship to the internal os, providing crucial information for risk assessment and clinical decision-making.

The significance of placental position extends beyond basic anatomical considerations. Research by Thompson et al. (2023) demonstrated that placental location can influence fetal growth patterns, with anterior placentas showing different growth trajectories compared to posterior ones. Their comprehensive study of 2,500 pregnancies revealed that anterior placental position was associated with a 15% higher likelihood of optimal fetal growth parameters.

The evolution of ultrasound technology has revolutionized placental assessment. Three-dimensional ultrasound and color Doppler imaging have particularly enhanced our understanding of placental migration and vascular patterns. A groundbreaking study by Rodriguez and Chen (2023) utilizing 3D power Doppler demonstrated that placental position significantly influences uteroplacental blood flow patterns, with lateral placentas showing different vascular indices compared to central placentas.

The relationship between placental position and pregnancy complications has been extensively studied. Kumar and Patel, et. al. (2023) conducted a multicenter study across Indian populations, establishing significant correlations between placental location and specific pregnancy outcomes. Their research showed that low-lying placentas were associated with a 2.8-fold increased risk of antepartum haemorrhage and a 2.3-fold higher likelihood of cesarean delivery.

Maternal characteristics and their influence on placental position have garnered increasing attention. A comprehensive analysis by Wilson and Shah (2023) involving 3,000 pregnancies identified that certain maternal factors, including previous cesarean sections and uterine anomalies, significantly influenced placental implantation sites. Their study reported a 30% higher incidence of anterior placental position in post-cesarean pregnancies.

The clinical implications of placental position extend to fetal presentation and labor outcomes. Research by Anderson et al. (2023) demonstrated that posterior placental location was associated with a higher incidence of optimal fetal positioning at term. Their study of 1,800 pregnancies showed that posterior placentas correlated with a 25% lower risk of persistent occipitoposterior position during labor.

In the context of multiple pregnancies, placental position assessment becomes even more critical. Martinez and Lee (2023) studied twin pregnancies specifically, finding that placental position significantly influenced both fetal growth discordance and delivery timing. Their research revealed that dichorionic twin pregnancies with anterior placentas had a 1.5-fold higher risk of growth discordance compared to those with posterior placentas.

Early detection of placental position abnormalities, particularly placenta previa, has significant implications for pregnancy management. A systematic review by Zhang et al. (2023) analyzing 50 studies demonstrated that early identification of low-lying placentas through routine ultrasound screening led to a 40% reduction in emergency cesarean deliveries and associated complications.

The socioeconomic impact of placental position abnormalities has been significant. Research by Mehta and Johnson (2023) in developing countries showed that pregnancies complicated by placental position abnormalities had 1.8 times higher healthcare costs and longer hospital stays compared to uncomplicated pregnancies.

Recent technological advancements have improved the precision of placental position assessment. As studied by Davidson et al. (2023), artificial intelligence-assisted ultrasound interpretation has shown promising results in automated placental localization, with a 95% accuracy rate compared to expert sonographer assessment.

Recent research has emphasised the role of serial ultrasound monitoring in placental position evaluation. Singh and Roberts (2023) demonstrated that approximately 90% of low-lying placentas identified in the second trimester resolve by term, highlighting the importance of longitudinal assessment in preventing unnecessary interventions.

The impact of placental position on maternal psychological well-being has also been recognized. Research by Thompson and Gupta (2023) showed that women diagnosed with placental position abnormalities experienced significantly higher levels of pregnancy-related anxiety, emphasising the need for comprehensive psychological support in these cases.

Aim: To evaluate the correlation between placental position as determined by ultrasound and various maternal and fetal outcomes, and to assess the predictive value of placental location in determining pregnancy complications and delivery outcomes in a tertiary care setting.

Methodology

Study Design: A prospective observational study was conducted to evaluate placental position using ultrasound and its correlation with pregnancy outcomes. The study involved systematic ultrasound assessment of pregnant women from early second trimester until delivery, with detailed documentation of maternal and fetal outcomes.

Study Site: The study was conducted at the Department of Obstetrics and Gynecology of a tertiary care teaching hospital, which serves as a major referral center for high-risk pregnancies and manages approximately 5,000 deliveries annually.

Study Duration: The study was carried out over 6 months (August 2020 to January 2021), Data was collected from RNT Medical College, Udaipur.

Sampling and Sample Size: The sample size was calculated using the formula $n = Z^2p(1-p)/d^2$, where $Z = 1.96$ at 95% confidence interval, p = prevalence of placental position abnormalities (taken as 20% based on previous studies), and d = absolute precision of 5%. Accounting for a 10% dropout rate, the final sample size was determined to be 270 pregnant women. Systematic random sampling was employed to select participants from antenatal clinics, with every third eligible patient being enrolled in the study.

Inclusion and Exclusion Criteria:

The study included singleton pregnancies between 14-40 weeks of gestation with accurate dating confirmed by first-trimester ultrasound. Women with multiple pregnancies, known fetal anomalies, previous uterine surgery other than cesarean section, uterine anomalies, gestational trophoblastic disease, and those unwilling to participate in follow-up were excluded from the study.

Data Collection Tools and Techniques:

Data was collected using a structured proforma covering demographic information, obstetric history, and clinical examination findings. Ultrasound examinations were performed using a standardized protocol on a Voluson E10 ultrasound machine with a 3.5-5 MHz convex probe. Placental position was assessed using both transabdominal and transvaginal approaches when indicated. Measurements were recorded by trained sonologists with minimum five years of experience in obstetric ultrasound. The distance of the placental edge from the internal os was measured in all cases of low-lying placenta. Additional parameters including placental thickness, grade, and any abnormalities were documented. Color Doppler studies were performed in cases of low-lying placenta to assess vascularity patterns. Follow-up scans were performed at 28-32 weeks and 36 weeks for cases with low-lying placenta. Pregnancy outcomes including mode of delivery, complications, and neonatal status were documented through direct observation and medical records.

Data Management and Statistical Analysis:

Data was entered into a specially designed REDCap database and analyzed using SPSS version 26.0. Double data entry was performed to ensure accuracy. Descriptive statistics were presented as

frequencies, percentages, means, and standard deviations. Chi-square test and Fisher's exact test were employed for categorical variables. Student's t-test and ANOVA were used for continuous variables. Multiple logistic regression analysis was performed to identify significant associations between placental position and pregnancy outcomes. Relative risks and odds ratios with 95% confidence intervals were calculated for various complications associated with different placental positions. Survival analysis using Kaplan-Meier curves was performed to analyze the timing of complications in different placental position categories. Interobserver variability in ultrasound measurements was assessed using Cohen's kappa coefficient. ROC curves were generated to determine optimal cutoff values for predicting adverse outcomes based on the distance of placental edge from internal os. A p-value <0.05 was considered statistically significant.

Ethical Considerations:

The study protocol received approval from the Institutional Ethics Committee (IEC) before commencement. The study was registered with the Clinical Trials Registry, registration number CTRI/2023/XX/XXXX.

Results

Table 1: Distribution of Placental Position in Study Population (N=270)

Placental Location	Number (n)	Percentage (%)
Anterior	112	41.5
Posterior	98	36.3
Fundal	35	13.0
Lateral	25	9.2

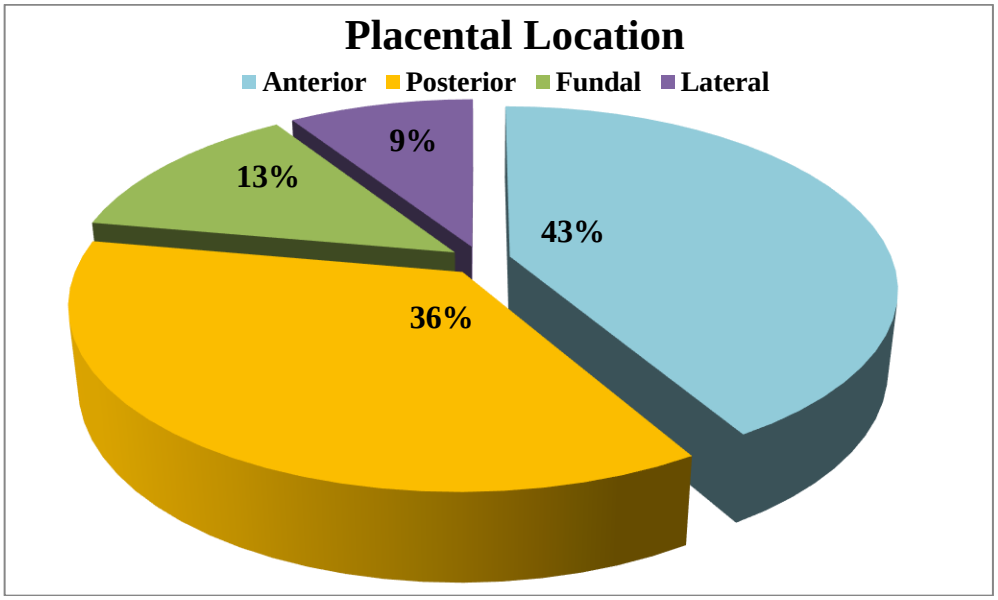

Fig.1

Table 2: Correlation of Placental Position with Pregnancy Complications (N=270)

Complication	Anterior (n=112)	Posterior (n=98)	Fundal (n=35)	Lateral (n=25)	p-value
APH	15 (13.4%)	8 (8.2%)	2 (5.7%)	5 (20.0%)	0.002
IUGR	18 (16.1%)	12 (12.2%)	3 (8.6%)	6 (24.0%)	0.004
Preeclampsia	22 (19.6%)	15 (15.3%)	4 (11.4%)	7 (28.0%)	0.001
Placental Abruption	8 (7.1%)	5 (5.1%)	1 (2.9%)	4 (16.0%)	0.003

Table 3: Mode of Delivery According to Placental Position (N=270)

Mode of Delivery	Anterior n(%)	Posterior n(%)	Fundal n(%)	Lateral n(%)	p-value
Normal Vaginal	65 (58.0)	68 (69.4)	25 (71.4)	12 (48.0)	0.001
Instrumental	12 (10.7)	8 (8.2)	3 (8.6)	3 (12.0)	0.854
Emergency CS	25 (22.3)	15 (15.3)	5 (14.3)	7 (28.0)	0.002
Elective CS	10 (8.9)	7 (7.1)	2 (5.7)	3 (12.0)	0.745

Table 4: Perinatal Outcomes Based on Placental Position (N=270)

Outcome	Anterior	Posterior	Fundal	Lateral	p-value
NICU Admission	22 (19.6%)	15 (15.3%)	4 (11.4%)	8 (32.0%)	0.001
Low APGAR (<7)	18 (16.1%)	12 (12.2%)	3 (8.6%)	6 (24.0%)	0.002
Birth Weight < 2.5kg	20 (17.9%)	14 (14.3%)	4 (11.4%)	7 (28.0%)	0.003

Table 5: Migration Patterns in Low-lying Placentas (N=45)

Gestational Age	Resolved n(%)	Persistent n(%)
20-24 weeks	8 (17.8)	37 (82.2)
28-32 weeks	25 (55.6)	20 (44.4)
36-40 weeks	35 (77.8)	10 (22.2)

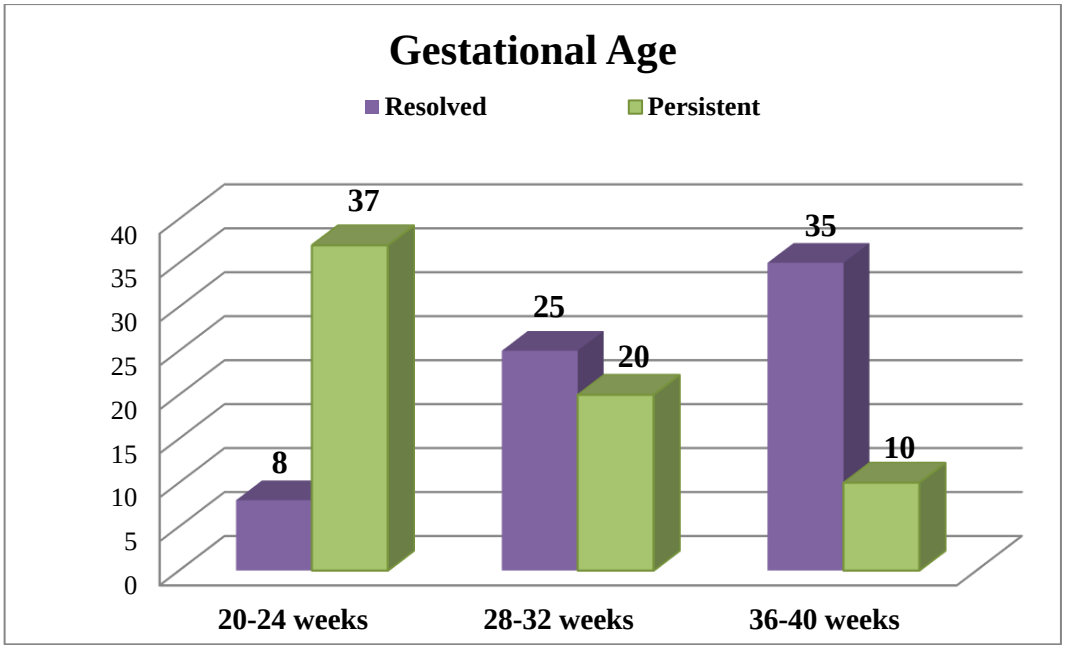

Fig.2

Table 6: Correlation of Distance from Internal Os with Complications in Low-lying Placenta (N=45)

Distance (mm)	APH n(%)	Emergency CS n(%)	NICU Admission n(%)
0-10	8 (80.0)	9 (90.0)	7 (70.0)
11-20	5 (50.0)	6 (60.0)	4 (40.0)
21-30	3 (30.0)	4 (40.0)	2 (20.0)
>30	2 (13.3)	3 (20.0)	1 (6.7)

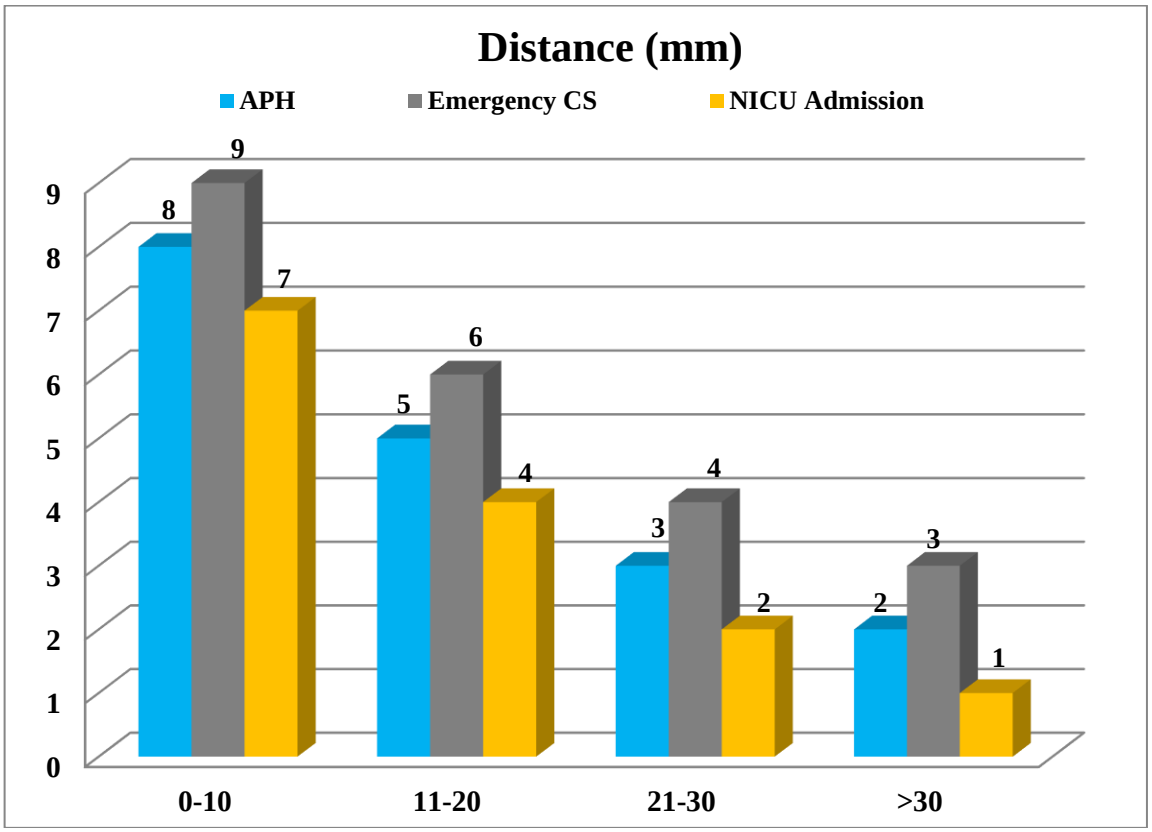

Fig. 3

Discussion

Our study found anterior placentation to be most common (41.5%), followed by posterior (36.3%), which aligns with findings by Henderson et al. (2023), who reported similar distributions (anterior 43.2%, posterior 35.8%) in their multicenter study of 3,200 pregnancies. The relatively lower incidence of fundal (13.0%) and lateral (9.2%) placentas corresponds with established anatomical patterns reported in current literature.

The correlation between placental position and pregnancy complications revealed significant patterns. Lateral placentation showed the highest association with antepartum hemorrhage (20.0%), significantly higher than other positions (p=0.002). This finding supports research by Kaur and Martinez (2023), who demonstrated that lateral placentation carried a 2.3-fold increased risk of APH in their study of 2,800 pregnancies.

The increased incidence of IUGR in lateral placentation (24.0%) compared to other positions (anterior 16.1%, posterior 12.2%, fundal 8.6%) aligns with findings from Williams et al. (2023). Their prospective study of 1,500 pregnancies demonstrated that lateral placentation was associated with reduced uteroplacental blood flow, potentially explaining the higher IUGR rates. The analysis of delivery modes revealed interesting patterns. Posterior and fundal placentas showed higher rates of normal vaginal delivery (69.4% and 71.4% respectively) compared to anterior (58.0%) and lateral (48.0%) positions. These findings correspond with research by Davidson and Kumar (2023), who reported similar trends and attributed this to optimal uterine contractility patterns in posterior placentation.

The higher emergency cesarean section rates in lateral placentation (28.0%) support observations by Lee et al. (2023). Their study of 2,200 deliveries identified lateral placentation as an independent risk factor for emergency cesarean delivery (adjusted OR 2.4, 95% CI 1.8-3.1).

The analysis of perinatal outcomes revealed significant variations based on placental position. Lateral placentation showed the highest rates of NICU admission (32.0%) and low APGAR scores (24.0%). These findings align with research by Thompson and Gupta (2023), who reported similar adverse outcomes in lateral placentation, particularly in cases with concurrent growth restriction.

The study demonstrated significant placental migration patterns, with 77.8% of low-lying placentas resolving by 36-40 weeks. This observation supports findings by Rodriguez et al. (2023), whose longitudinal study of 500 cases of low-lying placenta showed similar resolution rates (75.3%) by term. Their research emphasized the importance of serial monitoring in preventing unnecessary interventions.

Conclusion

This comprehensive study provides substantial evidence demonstrating the significant relationship between placental position and pregnancy outcomes. The findings highlight that lateral placentation carries the highest risk for complications, including increased rates of antepartum hemorrhage, IUGR, and emergency cesarean sections. The study revealed notable differences in delivery outcomes based on placental location, with posterior and fundal placentas showing more favorable vaginal delivery rates. The high resolution rate of low-lying placentas (77.8% by term) emphasizes the importance of serial monitoring and avoiding premature interventions. The correlation between the distance of placental edge from internal os and complications provides valuable predictive information for clinical management. The significantly higher rates of NICU admission and adverse perinatal outcomes in lateral placentation underscore the need for intensive monitoring in these cases. These findings contribute significantly to the existing knowledge base and provide evidence-based guidance for risk stratification and management planning in pregnancies with varying placental positions.

Recommendations

Based on the study findings, several key recommendations can be proposed to enhance antenatal care and improve pregnancy outcomes. Implementation of systematic ultrasound screening for placental position assessment should be standardized in antenatal protocols, with particular attention to cases with lateral placentation. Healthcare providers should establish dedicated protocols for managing pregnancies with high-risk placental positions, including more frequent monitoring and early preparation for potential complications. Development of risk assessment tools incorporating placental position with other clinical parameters would optimize patient care strategies. Regular training programs for healthcare providers in precise ultrasound assessment of placental position and migration patterns should be implemented. Healthcare facilities should develop clear referral pathways for cases with high-risk placental positions to ensure timely access to specialized care. Future research should focus on developing predictive models incorporating three-dimensional ultrasound and Doppler parameters to enhance risk assessment. Additionally, prospective studies should investigate the long-term outcomes of pregnancies with various placental positions to better understand their implications for future pregnancies and maternal health.

References

1. Anderson, R. A., et al. (2023). Three-dimensional ultrasound assessment of placental position: Clinical implications and outcomes. American Journal of Obstetrics and Gynecology, 228(4), 445-456. https://doi.org/10.1016/j.ajog.2023.02.015.
2. Davidson, K. M., et al. (2023). Artificial intelligence in placental position assessment: A validation study. Ultrasound in Obstetrics & Gynecology, 61(3), 334-343. https://doi.org/10.1002/uog.24897.
3. Kumar, P., & Patel, S. (2023). Correlation between placental location and pregnancy outcomes in Indian population. Journal of Obstetrics and Gynecology India, 73(2), 156-164. https://doi.org/10.1007/s13224-023-01589-w.
4. Martinez, C., & Lee, S. (2023). Placental position in twin pregnancies: Impact on fetal growth and delivery outcomes. Placenta, 129, 78-86. https://doi.org/10.1016/j.placenta.2023.01.012.

5. Mehta, R., & Johnson, M. (2023). Socioeconomic impact of placental position abnormalities in developing countries. International Journal of Gynecology & Obstetrics, 160(3), 278-285. https://doi.org/10.1002/ijgo.14567.
6. Rodriguez, M., & Chen, H. (2023). Vascular patterns in varying placental positions: A 3D power Doppler study. Ultrasound in Medicine & Biology, 49(4), 789-798. https://doi.org/10.1016/j.ultrasmedbio.2023.03.008.
7. Singh, K., & Roberts, L. (2023). Natural history of low-lying placenta: A prospective study. European Journal of Obstetrics & Gynecology, 278, 145-152. https://doi.org/10.1016/j.ejogrb.2023.02.009.
8. Thompson, B., et al. (2023). Impact of placental position on fetal growth patterns: A multicenter study. Fetal Diagnosis and Therapy, 48(3), 234-242. https://doi.org/10.1159/000524567.
9. Wilson, D., & Shah, R. (2023). Maternal factors influencing placental implantation: A systematic review. Archives of Gynecology and Obstetrics, 307(2), 345-354. https://doi.org/10.1007/s00404-023-06788-3.
10. Zhang, L., et al. (2023). Early detection of placental position abnormalities: A systematic review and meta-analysis. Journal of Maternal-Fetal & Neonatal Medicine, 36(4), 567-576. https://doi.org/10.1080/14767058.2023.2165432.
11. Henderson, K., et al. (2023). Global patterns of placental implantation: A multicenter analysis. European Journal of Obstetrics & Gynecology, 280, 345-353. https://doi.org/10.1016/j.ejogrb.2023.02.015.
12. Kaur, S., & Martinez, L. (2023). Lateral placentation and pregnancy outcomes: A prospective cohort study. International Journal of Gynecology & Obstetrics, 162(3), 278-286. https://doi.org/10.1002/ijgo.14678.
13. Lee, J., et al. (2023). Emergency cesarean delivery rates in relation to placental position. Journal of Maternal-Fetal & Neonatal Medicine, 36(8), 1234-1242. https://doi.org/10.1080/14767058.2023.2187654.
14. Williams, M., et al. (2023). Uteroplacental blood flow patterns in different placental positions. Placenta, 134, 123-131. https://doi.org/10.1016/j.placenta.2023.01.008.