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Original Research Article

Placental location and fetomaternal outcome: a prospective study

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ABSTRACT

Background: The placental position within the uterus can significantly influence pregnancy outcomes, impacting maternal and fetal well-being. It has been associated with complications such as preeclampsia, intrauterine growth restriction (IUGR), and premature rupture of membranes (PROM). Understanding how different placental locations affect pregnancy outcomes is essential for optimizing clinical management and improving maternal and neonatal health. Objective of this study was to assess the effect of placental location on maternal and fetal outcomes.
Methods: This prospective study was conducted in the Department of Obstetrics and Gynaecology, Himalayan Institute of Medical Sciences, Dehradun, over 12 months from June 2023 to May 2024. 120 pregnant women with singleton pregnancies over 18 weeks of gestation were recruited. After determining placental location via ultrasonography, the participants were divided into three groups: anterior (n=53), posterior (n=46), and lateral (n=21). Maternal and fetal outcomes were assessed and analysed using SPSS software (version 23), with a p-value of less than 0.05, considered statistically significant.
Results: The most common placental location was anterior (44.1%), followed by posterior (38.3%) and lateral (17.5%). A significant association was observed between lateral placental location and hypertensive disorders including per-eclampsia (p=0.01), while anterior placental location was significantly associated with a higher incidence of PPROM/PROM (p=0.002). Regarding fetal outcomes, lateral placentation was significantly associated with IUGR (p=0.01). Although NICU admission rates were higher in the anterior placental group (35.8%), no significant correlation was found between placental location and neonatal outcomes.
Conclusions: Placental location, particularly lateral positioning, is significantly associated with adverse maternal and fetal outcomes, including hypertensive disorders and IUGR. Anterior placental location showed a strong association with PPROM/PROM. Further research is necessary to confirm these findings and refine clinical management strategies for pregnancies with abnormal placental locations.

Keywords: Placental location, Fetomaternal outcome, Hypertensive disorders, NICU admissions, Pregnancy outcomes

INTRODUCTION

The human placenta is a special transient organ that maintains the mutual coexistence of the mother and fetus, controls the latter's growth and development, and is considered to be a natural example of allogenic engraftment.[1]

The placenta's placement is determined by the appropriateness of the uterine lining, known as the maternal uteroplacental environment.[2] The blood flow is not uniformly distributed, implicating the site of implantation and ensuing placental location as important determining factors of placental blood flow and, consequently, pregnancy success.[3]

Numerous research studies have investigated that the placenta's placement can have unique consequences for expectant mothers, including but not limited to preterm birth, intrauterine growth retardation, fetal malposition, malpresentation, and the onset of hypertension.[4-6]

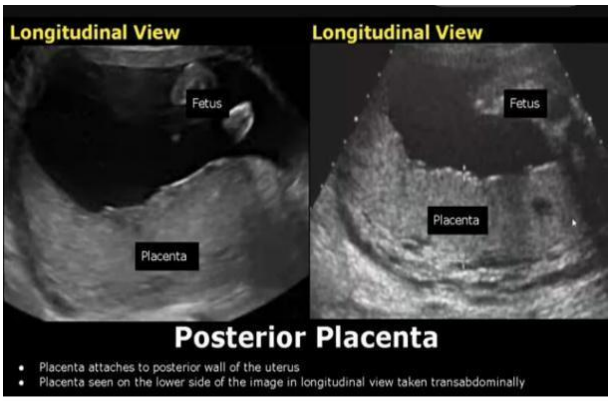

Figure 1: Ultrasonographic image of posterior placenta Dr. Sam's imaging library. Ultrasound image of placental position; posterior placenta [23.10.2022].

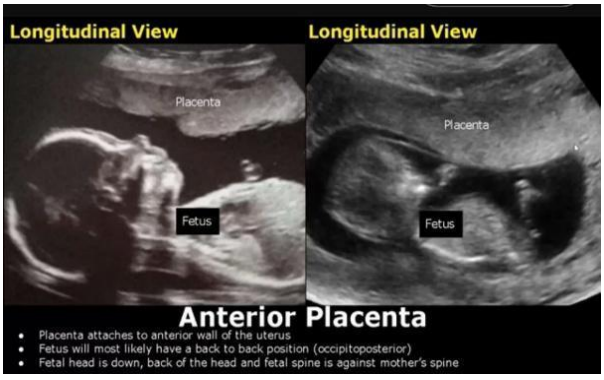

Figure 2: Ultrasonographic image of anterior placenta Dr. Sam's imaging library. Ultrasound image of placental position; anterior placenta [23.10.2022].

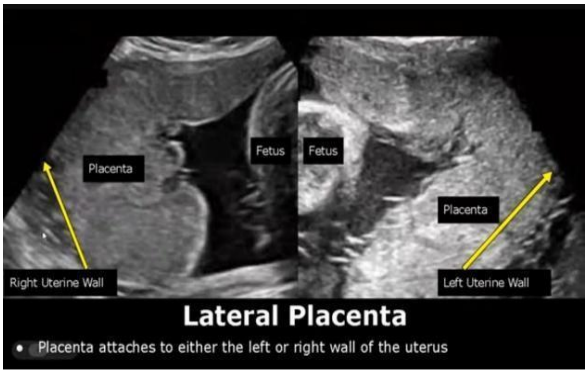

Figure 3: Ultrasonographic image of lateral placenta Dr. Sam's imaging library. Ultrasound image of placental position; lateral placenta [23.10.2022].

The advent of real-time three/four-dimensional ultrasonography, which allows visualization of in-utero fetal activity during different stages of gestation, has enabled the identification of most severe placental abnormalities before delivery.[7] This is why placenta localization by ultrasound is important, as it may show some insights into other obstetric difficulties that may not have physically developed.[8]

Given the potential risks associated with abnormal placental positioning, it is important to understand how different placental locations affect maternal and fetal outcomes.[9]

This study aims to assess the relationship between placental location and its impact on maternal and fetal health outcomes, contributing to better clinical management and improved prognosis in pregnancy.

METHODS

This study was conducted on 120 pregnant women in the Department of Obstetrics and Gynaecology at the Himalayan Institute of Medical Sciences, Swami Rama Nagar, Dehradun, over 12 months from June 2023 to May 2024 following approval from the Institutional Ethical Committee. Informed written consent was obtained from all participants before their inclusion in the study.

The inclusion criteria were pregnant women with singleton pregnancies greater than 18 weeks of gestation who attended the antenatal outpatient department (OPD). Women were excluded if they were less than 18 weeks pregnant, had known comorbidities prior to pregnancy, had multiple pregnancies, had gross placental or umbilical cord abnormalities, or had known uterine as well as fetal congenital malformations and women with known case of placenta previa.

Data collection involved a case reporting form, ultrasonography, and laboratory investigations. To determine placental location, real-time trans-abdominal ultrasound scanning was performed using a 1-5 MHz biconvex probe. Lab investigations included routine tests such as haemograms, TSH levels, urine routine microscopy, glucose challenge tests, and, where necessary, liver and kidney function tests.

Study protocol

Participants were divided into three groups based on their placental location as determined by ultrasonography. Group A included women with anterior placenta, Group B included those with posterior placenta, and Group C included women with lateral placentas (right or left). Detailed maternal history was documented, including age, height, pre-pregnancy weight, obstetric history, and past medical or surgical conditions. A general physical, systemic, and obstetric examination was also performed.

Maternal outcomes assessed

Maternal outcomes included the incidence of gestational hypertension, preeclampsia, antepartum hemorrhage, gestational diabetes mellitus, preterm premature rupture of membranes (PPROM), threatened preterm labor, premature rupture of membranes (PROM), malpresentation, mode of delivery, postpartum hemorrhage, and uterine inversion.

Fetal outcomes evaluated

Fetal outcomes studied included gestational age at delivery, fetal sex, birth weight, intrauterine growth restriction (IUGR), congenital anomalies, intrauterine fetal death, stillbirth, APGAR scores at 1 and 5 minutes, and NICU stay requirements.

Statistical analysis

Data were compiled using Microsoft Excel and analyzed using SPSS software version 23. Categorical data were presented as frequencies, while continuous data were expressed as mean ± standard deviation or median. Associations between categorical variables were assessed using Pearson's chi-square test, with a p-value of <0.05 considered statistically significant. The results were visually represented using tables, bar charts, and pie diagrams.

RESULTS

The majority of women had an anterior placental location (44.1%), followed by posterior (38.3%) and lateral (17.5%).

Table 1: Relationship between age distribution and placental location.

Age (years)	Anterior (n=53)	Posterior (n=46)	Lateral (n=21)	Total (%) (n=120)
< 20	0	1	0	1 (0.83)
21–25	19	12	7	38 (31.67)
26–30	25	22	8	55 (45.83)
>30	9	11	6	26 (21.67)
Mean±SD	27.42±4.15	28.33±4.37	28.43±4.15	-
P value	-	-	-	0.498

Table 2: Relationship between BMI distribution and placental location.

BMI (kg/m²)	Anterior (n=53)	Posterior (n=46)	Lateral (n=21)	Total (%) (n=120)
<18.5	0	0	0	0
18.5–24.9	28	24	1	53 (44.16)
25–29.9	23	19	19	61 (50.83)
>30	2	3	1	6 (5.00)
Mean±SD	24.98±3.25	25.37±2.29	27.71±1.77	-
P value	-	-	-	0.001

Table 3: Relationship between gravidity distribution and placental location.

Gravidity	Anterior (n=53)	Posterior (n=46)	Lateral (n=21)	Total (%) (n=120)
1	26	23	12	61 (50.83)
2–3	24	15	6	45 (37.50)
≥4	3	8	3	14 (11.67)
P value	-	-	-	0.303

The majority of women in the study were aged between 26 and 30 (45.83%). There was no significant association between age and placental location (p=0.498).

Most patients were overweight (50.83%), and no patients were underweight. A significant association was found between higher BMI and lateral placental location (p=0.001).

The majority of women were primigravida (50.83%). No significant association was found between gravidity and placental location (p=0.303).

The study showed a statistically significant association between anterior placental location and PPROM/PROM (p=0.002) and between lateral placental location and hypertensive disorders including per-eclampsia (p=0.01).

A statistically significant association was found between lateral placental location and IUGR (p=0.01).

In this study, 34.1% of the babies were of low birth weight (<2.5 kg), with the highest percentage observed in the posterior placental location group (41.3%). However, no statistically significant association was found between placental location and low birth weight (p=0.272).

Table 4: Association between maternal complications and placental location.

Complication	Anterior % (n=53)	Posterior % (n=46)	Lateral % (n=21)	Total (%) (n=120)	P value
Threatened abortion	5 (9.4)	3 (6.5)	0	9 (7.5)	0.341
Anaemia	7 (13.2)	7 (15.2)	2 (9.5)	16 (13.34)	0.810
Thyroid disorder	4 (7.5)	4 (8.69)	0	8 (6.67)	0.393
Hypertensive disorders	11 (20.75)	10 (21.7)	10 (47.61)	31 (25.83)	0.04
Per-eclampsia	9 (16.9)	6(13.04)	9(42.8)	23(20)	0.01
PPROM/PROM	14 (26.41)	6 (13.0)	4 (19)	24 (20)	0.002
Malpresentation	5 (9.4)	2 (4.3)	3 (14.2)	10 (8.3)	0.483

Table 5: Association between fetal complications and placental location.

Complication	Anterior % (n=53)	Posterior % (n=46)	Lateral % (n=21)	Total (%) (n=120)	P value
Intrauterine growth restriction (IUGR)	10 (18.87)	6 (13.04)	9 (42.8)	25 (20.83)	0.01
Preterm birth	9 (16.9)	8 (17.39)	7 (33.34)	24 (20)	0.24
Intrauterine fetal demise (IUFD)/stillbirth	1 (1.8)	0	2 (9.5)	3 (2.5)	0.064

Table 6: Neonatal outcomes associated with placental location.

Outcome	Anterior % (n=53)	Posterior % (n=46)	Lateral % (n=21)	Total % (n=120)	P value
Low birth weight (<2.5 kg)	14 (26.4%)	19 (41.3%)	8 (38.1%)	41 (34.1%)	0.272
APGAR score at 1 min (Mean±SD)	7.82±2.14	7.40±1.15	8.02±2.60	7.82±1.86	0.302
APGAR score at 5 min (Mean±SD)	8.64±1.86	8.71±1.94	8.05±2.79	8.51±1.89	0.432

Table 7: Neonatal complications associated with placental location.

Complication	Anterior % (n=53)	Posterior % (n=46)	Lateral % (n=21)	Total % (n=120)	P value
NICU admission	19 (35.8%)	12 (26.1%)	4 (19.0%)	35 (29.1%)	0.302
Respiratory distress	5 (9.4%)	4 (8.6%)	2 (9.5%)	11 (9.1%)	0.667
Hypoglycemia	4 (7.5%)	3 (6.5%)	2 (9.5%)	9 (7.5%)	0.710
Hypothermia	1 (1.8%)	3 (6.5%)	1 (4.7%)	5 (4.1%)	0.510
Necrotizing enterocolitis	1 (1.8%)	0 (0%)	0 (0%)	1 (0.8%)	0.710
Neonatal jaundice	4 (7.5%)	2 (4.3%)	2 (9.5%)	8 (6.7%)	0.760
Sepsis	7 (13.2%)	2 (4.3%)	1 (4.7%)	10 (8.3%)	0.760

The mean APGAR scores at 1 minute and 5 minutes did not show significant differences across the placental locations.

Approximately 29.1% of the neonates required NICU admission, with the highest percentage from the anterior placenta group (35.8%). The most common reasons for NICU admission were respiratory distress (9.1%), hypoglycemia (7.5%), and neonatal jaundice (6.7%). No

significant association was found between placental location and neonatal complications.

DISCUSSION

Ultrasound is an indispensable tool in prenatal care, allowing clinicians to monitor placental location and fetal growth throughout pregnancy. Placental location is classified as anterior, posterior, lateral, or low-lying, each with varying impacts on maternal and fetal outcomes. Centrally located placentas (anterior and posterior) typically receive blood flow from both uterine arteries. In contrast, lateral placentas rely more on one side, which can lead to increased vascular resistance and potential complications like preeclampsia or IUGR.

In our study, most women had anterior placentas (44.1%), followed by posterior (38.3%), and lateral (17.5%). These findings were consistent with studies by Nair et al, where the frequency of central placenta (83.8%) was more than lateral (16.2%).[13] In terms of maternal age, the majority of participants (45.83%) were between 26 and 30 years old, a trend that aligns with Nair's findings but contrasts with the study by Sitimani.[14]

Our study also found a significant relationship between body mass index (BMI) and placental location, with higher BMI being associated with lateral placentation ($p=0.001$).[15] This is in contrast to studies by Chhabra et al which did not observe such an association.

In this study, lateral placentation was more common in primigravida women, with 57% of lateral placenta cases occurring in first-time mothers. This may be linked to the higher incidence of preeclampsia in primigravida, as lateral placentation can increase vascular resistance, leading to hypertensive disorders. A significant association between lateral placentation and preeclampsia was observed in our study ($p=0.002$), consistent with findings by Nair et al and Fung et al, who reported a higher risk of preeclampsia with lateral placentation.1[3,16]

In terms of preterm premature rupture of membranes (PPROM) and premature rupture of membranes (PROM), we found that anterior placentation was associated with a higher incidence (26.41%) of PPROM/PROM ($p<0.02$).[17,18] This contrasts with studies by Hadley et al and Seckin et al who found fundal and lateral placentation, respectively, to be risk factors for PPROM.

Other maternal complications such as anemia, gestational diabetes mellitus (GDM), intrahepatic cholestasis of pregnancy (IHCP), abruption, and oligohydramnios were studied, but no significant associations were observed in relation to placental location.

Regarding mode of delivery, 70% of patients had vaginal deliveries, while 30% underwent caesarean sections (LSCS), with no significant association between placental location and mode of delivery.[19] This is consistent with findings from Kalanithi et al who also observed no association between placental location and delivery mode.

We also found a significant association between lateral placentation and IUGR ($p=0.01$).[18,19] Similar findings have been reported by Kalanithi et al. and Seckin et al who observed a higher incidence of IUGR in pregnancies with lateral placentation. This could be explained by the reduced blood supply in lateral placentas, which receive blood primarily from one uterine artery, leading to compromised fetal growth.

In terms of neonatal outcomes, 34.1% of the babies were low birth weight, with the majority being associated with posterior placentation. However, no statistically significant association was found between placental location and low birth weight or APGAR scores. These results contrast with studies by Dhingra et al who found a significant association between posterior and lateral placentation and adverse neonatal outcomes such as preterm labor, PROM, and NICU admission.[3]

In our study, 29.1% of babies were admitted to the NICU, with respiratory distress syndrome (9.1%) being the most common cause, followed by hypoglycemia (7.5%) and neonatal jaundice (6.6%). No significant association was observed between placental location and NICU admission, which is in line with studies by Zia et al.[7]

Despite the valuable insights provided by this study, several limitations exist. Firstly, the small sample size at some placental locations limited the ability to perform in-depth analyses. Secondly, the study may have introduced observer variation due to different sonographers with varying levels of experience. To further validate these findings, a large-scale prospective study with standardized placental location assessments by a single sonographer is recommended.

CONCLUSION

Placental location can be an important factor in predicting fetomaternal outcomes, particularly in relation to preeclampsia, IUGR, and PPROM/PROM. However, more extensive research is needed to fully understand the role of placental location in pregnancy complications.

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