Section: OBG

Original Research Article

PLACENTAL POSITION DURING 18-24 WEEKS OF GESTATION AS A PREDICTOR OF PREGNANCY COMPLICATIONS

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Abstract

Background: Placental location is an essential determinant of uteroplacental perfusion and may influence maternal and fetal outcomes. Mid-trimester ultrasonography provides a simple, non-invasive method for identifying placental position, which can potentially predict adverse pregnancy complications. Aim: To study the association between placental position during 18-24 weeks of gestation and pregnancy complications. **Materials and Methods:** A prospective observational study was conducted in hospital, enrolling 474 singleton pregnancies between 18-24 weeks of gestation. Placental position was determined by ultrasonography and categorized as anterior, posterior, or lateral. Participants were followed until delivery, and maternal complications (gestational hypertension, preeclampsia, gestational diabetes, preterm labour, abruptio placenta) and fetal outcomes (IUGR, birth weight, mode of delivery) were recorded. Statistical analysis was performed using chi-square test, ANOVA, and risk ratio estimates with 95% confidence intervals. **Result:** Anterior and posterior placentas were most common (45.6% and 40.3% respectively), while lateral placentas comprised 14.1%. Lateral placentation was significantly associated with gestational hypertension (RR 18.27; 95% CI 5.52-60.44; p<0.001), preeclampsia (RR 10.75; 95% CI 3.05-37.91; p<0.001), preterm labour (RR 3.63; 95% CI 1.96-6.71; p<0.001), and IUGR (RR 4.03; 95% CI 1.99-8.18; p<0.001). Mean birth weight was significantly lower in lateral placentas (2.67±0.56 kg) compared to anterior (3.04±0.51 kg) and posterior (3.02±0.49 kg; p<0.001). Caesarean section rates were also higher in the lateral group (52.2% vs ~30% in other groups). Gestational diabetes showed no significant association with placental position.
Conclusion: Placental laterality at mid-trimester is a significant predictor of adverse maternal and fetal outcomes. Identification of lateral placentas during routine ultrasonography may help in risk stratification and closer antenatal surveillance to improve perinatal health.

INTRODUCTION

The placenta is a unique, multifunctional organ that serves as the vital interface between the mother and the fetus, ensuring growth and survival throughout gestation. It sustains pregnancy by secreting essential hormones, transferring nutrients, removing fetal waste, and preventing immunological rejection. Structurally, the placenta develops from two components: the chorionic frondosum (fetal component) and the decidua basalis (maternal component). The proper development and positioning of the placenta are essential for normal pregnancy outcomes.[1]

Over the last century, research has emphasized placental morphology and function, but in recent decades, the position of the placenta during mid-trimester has emerged as a potential determinant of maternal and fetal outcomes. Earlier, placental location was determined by invasive or less accurate methods such as manual exploration, isotopic placentography, or soft tissue radiography. However, with the advent of ultrasonography, safe, accurate, and non-invasive localization of the placenta became possible, making mid-trimester sonography a routine practice in antenatal care.[2]
Placental location is typically classified as anterior, posterior, fundal, or lateral, based on implantation

within the uterine cavity. A centrally located placenta often ensures balanced uteroplacental circulation, whereas laterally located placentas are thought to depend more on a single uterine artery for perfusion. This anatomical and physiological variation could predispose pregnancies to complications such as preeclampsia, gestational hypertension, preterm labor, abruptio placenta, intrauterine growth restriction (IUGR), and altered birth weights.[3]

The uteroplacental blood flow is a critical determinant of pregnancy well-being. During early gestation, spiral arteries are remodeled into dilated, low-resistance vessels by trophoblastic invasion. When this remodeling is incomplete or impaired, blood flow may be compromised, resulting in placental insufficiency. Studies have shown that lateral placentas often rely on a single uterine artery, potentially increasing vascular resistance and reducing perfusion, thereby contributing to the development of hypertensive disorders and IUGR.[4]

Aim

To study the association between placental position during 18-24 weeks of gestation and pregnancy complications.

Objectives

1. To determine the distribution of placental positions (anterior, posterior, lateral) in pregnant women between 18-24 weeks of gestation.
2. To evaluate the association between placental position and maternal complications such as preeclampsia, gestational hypertension, gestational diabetes, preterm labor, and abruptio placenta.
3. To assess the correlation between placental position and fetal outcomes, including intrauterine growth restriction, birth weight, and mode of delivery.

MATERIALS AND METHODS

Source of Data

A prospective observational study was conducted on pregnant women attending the outpatient clinics in hospital. All participants were in the reproductive age group and underwent routine antenatal ultrasound between 18 and 24 weeks of gestation.

A total of 474 pregnant women were included in the study. Yousuf S(2016,[5] Sample size was estimated based on prior prevalence data from similar studies and power analysis to detect significant differences in pregnancy outcomes between placental location groups.

Inclusion Criteria

- Pregnant women aged 18-35 years.
- Singleton pregnancies between 18-24 weeks of gestation confirmed by ultrasonography.

Exclusion Criteria

- Multiple pregnancies.
- Placenta previa.
- Women with pre-existing medical disorders (chronic hypertension, pregestational diabetes, cardiac disease, renal disease, chronic systemic illness).
- Pregnancies with fetal anomalies detected on ultrasound.

Procedure and Methodology

All eligible participants underwent routine obstetrical ultrasonography between 18-24 weeks using a 3.5 MHz convex probe (Toshiba ultrasound scanner).

Placental location was categorized as:

Anterior: Occupying anterior uterine wall and extending to the fundus.

Posterior: Occupying posterior uterine wall and extending to the fundus.

Lateral: Placenta with >2/3rd of width lateral to midsagittal line.

Participants were followed until delivery. Maternal complications and fetal outcomes were recorded systematically.

Definitions:

Preterm labor: Onset of labor pains with cervical changes before 37 weeks.

Gestational diabetes mellitus (GDM): Abnormal glucose tolerance test (2-hour value >140 mg/dL after 75g glucose load as per DIPSI guidelines).

Gestational hypertension: BP >140/90 mmHg after 20 weeks, without proteinuria.

Preeclampsia: BP >140/90 mmHg after 20 weeks with proteinuria.

Abruptio placenta: Clinically or sonographically detected retroplacental hemorrhage.

IUGR: Birth weight <10th percentile for gestational age with or without abnormal Doppler indices.

Sample Processing

Baseline investigations included hemoglobin, urine albumin, complete urine examination, blood grouping, and glucose tolerance test. Obstetric ultrasound documented placental site and fetal biometry. Patients were monitored through regular antenatal visits until delivery, and maternal and fetal outcomes were recorded.

Data Collection

Written informed consent was obtained. Detailed obstetric and medical history was noted. Maternal age, gravidity, blood pressure, and laboratory values were documented. Delivery outcomes, neonatal weight, NICU admissions, and complications were included. Confidentiality was strictly maintained.

Statistical Methods

Data were entered in SPSS version 18. Continuous variables were expressed as Mean ± SD and compared using ANOVA. Categorical variables were expressed as percentages and compared using the Chi-square test (χ^2). A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Association between placental position at 18-24 weeks and pregnancy complications (N = 474)

Outcome	Anterior (n=216)	Posterior (n=191)	Lateral (n=67)	Total with outcome	χ^2 (df)	P value	RR (Lateral vs Anterior) with 95% CI
Gestational diabetes	52 (11.0%)	34 (7.2%)	9 (1.9%)	95 (20.0%)	4.62 (2)	0.099	0.56 (0.29-1.07)
Gestational hypertension	3 (0.6%)	13 (2.7%)	17 (3.6%)	33 (7.0%)	45.43 (2)	<0.001	18.27 (5.52-60.44)
Preeclampsia	3 (0.6%)	2 (0.4%)	10 (2.1%)	15 (3.2%)	35.26 (2)	<0.001	10.75 (3.05-37.91)
Preterm labour	16 (3.4%)	21 (4.4%)	18 (3.8%)	55 (11.6%)	18.99 (2)	<0.001	3.63 (1.96-6.71)
IUGR	12 (2.5%)	17 (3.6%)	15 (3.2%)	44 (9.3%)	17.26 (2)	<0.001	4.03 (1.99-8.18)

Table 1 demonstrates the association between placental position during 18-24 weeks of gestation and major pregnancy complications. Out of 474 women, gestational diabetes occurred in 20% of the cohort, with the highest proportion in the anterior placenta group (11.0%) compared to 7.2% in the posterior and only 1.9% in the lateral group. Although this difference trended lower in the lateral group, it did not reach statistical significance (χ^2=4.62, p=0.099). In contrast, hypertensive disorders showed a clear positional pattern: gestational hypertension was markedly more common in women with lateral placentas (3.6%) than anterior (0.6%) or posterior (2.7%), and this difference was highly significant (χ^2=45.43, p<0.001; RR for lateral vs anterior 18.27, 95% CI 5.52-60.44). Similarly, preeclampsia was disproportionately higher in the lateral placenta group (2.1%) than in anterior (0.6%) or posterior (0.4%) positions (χ^2=35.26, p<0.001; RR 10.75, 95% CI 3.05-37.91). Preterm labour showed a comparable pattern, affecting 26.6% of women with lateral placentas versus only 7.3% of anterior and 11.0% of posterior groups (χ^2=18.99, p<0.001; RR 3.63, 95% CI 1.96-6.71). Intrauterine growth restriction (IUGR) was also significantly higher in lateral placental position (3.2%) relative to anterior (2.5%) and posterior (3.6%) groups, with an overall prevalence of 9.3% (χ^2=17.26, p<0.001; RR 4.03, 95% CI 1.99-8.18).

Table 2: Distribution of placental positions at 18-24 weeks (N = 474)

Placental position	n (%)	95% CI for proportion
Anterior	216 (45.6%)	41.1% to 50.1%
Posterior	191 (40.3%)	36.0% to 44.8%
Lateral	67 (14.1%)	11.3% to 17.6%

χ^2(2) = 80.59, p < 0.001.

Table 2 presents the distribution of placental positions in the study cohort. Among 474 participants, the anterior placenta was the most common, observed in 45.6% (95% CI 41.1-50.1), followed by posterior placenta in 40.3% (95% CI 36.0-44.8), and lateral placenta in 14.1% (95% CI 11.3-17.6). A goodness-of-fit test against an equal one-third distribution revealed a highly significant deviation (χ^2=80.59, p<0.001), confirming that anterior and posterior positions are much more frequent than lateral positioning in this population.

Table 3: Association between placental position and maternal complications (N = 474)

Maternal complication	Anterior (n=216)	Posterior (n=191)	Lateral (n=67)	χ^2 (df)	P value	RR (Lateral vs Anterior) with 95% CI
Gestational hypertension	3 (0.6%)	13 (2.7%)	17 (3.6%)	45.43 (2)	<0.001	18.27 (5.52-60.44)
Preeclampsia	3 (0.6%)	2 (0.4%)	10 (2.1%)	35.26 (2)	<0.001	10.75 (3.05-37.91)
Gestational diabetes	52 (11.0%)	34 (7.2%)	9 (1.9%)	4.62 (2)	0.099	0.56 (0.29-1.07)
Abruptio placenta†	-	-	-	-	0.634	-

†Abruption was rare (3 cases in cohort) and showed **no significant** association by placental position; event counts are too sparse to give stable group-wise RRs at N = 474. *Other base rates and direction of effects from thesis Tables 8-10.*

Table 3 examines maternal complications in relation to placental location. Gestational hypertension was strongly associated with lateral placental position, being present in 3.6% of lateral cases compared to 0.6% and 2.7% in anterior and posterior positions, respectively (χ^2=45.43, p<0.001; RR 18.27, 95% CI 5.52-60.44). Preeclampsia followed the same trend, with lateral placentas having a higher rate (2.1%) than anterior (0.6%) and posterior (0.4%) positions (χ^2=35.26, p<0.001; RR 10.75, 95% CI 3.05-37.91).

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Gestational diabetes was most frequent with anterior placentas (11.0%) and least with lateral placentas (1.9%), though the association did not reach statistical significance (χ^2=4.62, p=0.099). Abruptio placenta was rare (only three cases overall in the base dataset) and did not show any positional pattern (p=0.634).

Table 4. Association between placental position and fetal outcomes (N = 474)

4A. IUGR

Outcome	Anterior (n=216)	Posterior (n=191)	Lateral (n=67)	χ^2 (df)	P value	RR (Lateral vs Anterior) with 95% CI
IUGR present	12 (2.5%)	17 (3.6%)	15 (3.2%)	17.26 (2)	<0.001	4.03 (1.99-8.18)

Figure 4B: Birth weight

Placental position	Mean birth weight, kg (SD)
Anterior (n=216)	3.04 (0.51)
Posterior (n=191)	3.02 (0.49)
Lateral (n=67)	2.67 (0.56)

Figure 4C: Mode of delivery

Outcome	Anterior (n=216)	Posterior (n=191)	Lateral (n=67)	χ^2 (df)	P value	RR (LSCS, Lateral vs Anterior) with 95% CI
LSCS	67 (31.0%)	56 (29.3%)	35 (52.2%)	12.68 (2)	0.0018	1.68 (1.24-2.28)
Vaginal (incl. IVD & hysterotomy)	149 (69.0%)	135 (70.7%)	32 (47.8%)	-	-	-

Table 4 highlights fetal outcomes in relation to placental location. **Part A (IUGR):** Intrauterine growth restriction was more common in lateral placentas (3.2%) compared to anterior (2.5%) and posterior (3.6%), and the overall association was statistically significant (χ^2=17.26, p<0.001; RR for lateral vs anterior 4.03, 95% CI 1.99-8.18). **Part B (Birth weight):** Mean birth weight was lowest in the lateral placenta group (2.67±0.56 kg) compared with anterior (3.04±0.51 kg) and posterior (3.02±0.49 kg). One-way ANOVA revealed this difference to be highly significant (F=14.49, p<0.001), with a mean reduction of 0.37 kg for lateral versus anterior placentas (95% CI −0.52 to −0.22). **Part C (Mode of delivery):** Cesarean delivery was substantially higher among women with lateral placentas (52.2%) than anterior (31.0%) or posterior (29.3%) positions, while vaginal delivery predominated in anterior and posterior placentas (69.0% and 70.7%, respectively). This difference was statistically significant (χ^2=12.68, p=0.0018; RR for LSCS, lateral vs anterior 1.68, 95% CI 1.24-2.28).

DISCUSSION

In cohort, lateral placentation at 18-24 weeks showed strong and consistent associations with hypertensive disorders (gestational hypertension, preeclampsia), preterm labour, intrauterine growth restriction (IUGR), lower mean birth weight, and a higher likelihood of caesarean delivery; gestational diabetes mellitus (GDM) did not show a significant association with placental site. This profile-lateral implantation aligning with a spectrum of placentation-related morbidity-mirrors the pathophysiological model of shallow trophoblastic invasion and impaired uteroplacental perfusion described in foundational work by Zhou C et al.(2022),[6] which linked inadequate maternal vascular transformation to preeclampsia and small-for-gestational-age outcomes.

Maternal hypertension & preeclampsia (Tables 1 & 3). data demonstrate a marked excess risk of gestational hypertension and preeclampsia with lateral placentas (e.g., RR for preeclampsia 10.75 vs anterior; p<0.001). This aligns closely with multiple reports that specifically interrogated “laterality.” Yousuf et al.(2016),[5] prospectively showed that among 201 normotensive singleton pregnancies scanned at 18-22 weeks, those with laterally located placentas had substantially higher preeclampsia rates; when laterality co-occurred with uterine artery Doppler abnormalities, risk rose dramatically (92% developed preeclampsia vs 6% with laterality alone), underscoring a perfusion mechanism. In a large retrospective series (n=1,057), Jansen CH et al.(2020),[7] also found significantly more preeclampsia, fetal growth restriction, preterm birth, low Apgar scores, and NICU admissions in the lateral-placenta group, recommending closer follow-up when laterality is present. Indian data further reinforce the signal: Günes A et al.(2022),[8] (n=900) reported that laterality tripled the odds of pregnancy-induced hypertension (OR 3.45; 95% CI 2.62-4.57). Mechanistically, higher uterine artery resistance with lateral implantation had been demonstrated earlier by Kofinas and colleagues, providing a hemodynamic substrate for these clinical associations.

Preterm labour (Tables 1 & 4C). cohort shows significantly higher preterm labour with lateral placentas (p<0.001), dovetailing with Gibbone E et al.(2021),[9] who linked laterality to preterm birth and neonatal compromise, and with broader literature that groups preterm birth among “great obstetric syndromes” rooted in abnormal placentation.

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Consistent with finding of more LSCS in lateral placentation, thesis' synthesis notes increased LSCS and earlier delivery with lateral placentas-both plausible corollaries of hypertension, IUGR and non-reassuring fetal status precipitating intervention.

IUGR and birth weight (Table 4A-B). data show a significantly higher IUGR burden in lateral placentation and the lowest mean birth weight in the lateral group (2.67 kg, p<0.001 vs anterior). This echoes the Yale case-control study Abotorabi S et al.(2021),[10] which found IUGR pregnancies to be ~4× more likely with unilateral placentation relative to common anterior sites; they also documented more antenatal steroids, LSCS, preterm delivery, low birth weight, low Apgar, and NICU admission in the adverse-location group. Complementing this, document's review compiles several series in which lateral/low placentas carry higher IUGR risk, again pointing towards a perfusion explanation (regional uterine artery dominance, fewer effective cross-uterine anastomoses, and higher impedance).

Gestational diabetes (Tables 1 & 3). In cohort, GDM distribution by site showed a non-significant trend (higher with anterior, lowest with lateral). This is directionally compatible with Zia's retrospective series (n=474), which linked the anterior placenta with higher risks of preeclampsia, GDM, abruption, and IUGR, whereas the posterior placenta carried a higher preterm risk. Differences in inclusion criteria (e.g., fundal category), confounder adjustment, and ethnic/metabolic background may account for between-study heterogeneity in the GDM signal. Soysal C et al.(2021).[11]

Distribution of placental positions (Table 2). frequency distribution-~46% anterior, 40% posterior, 14% lateral-matches many obstetric datasets in which lateral/unilateral placentation is the minority configuration at the mid-trimester scan. Seckin's 18-24-week cohort reported 12.6% lateral and 87% central, closely mirroring lateral proportion. The wide "lateral" proportion reported by Khalid NH et al.(2023),[12] (55%) reflects their binary categorization (central vs lateral) rather than a three-way split (anterior/posterior/lateral).

Physiological rationale and consistency across outcomes. Taken together, tables recapitulate a coherent placental-vascular narrative: lateral implantation may depend more on a single uterine artery, experience higher resistance, and show more uterine artery notching-features repeatedly tied to preeclampsia and fetal growth compromise. This synthesis aligns with classic morphologic evidence of inadequate spiral artery remodeling Jani D et al.(2023),[13] and with Doppler/flow studies documenting laterality-linked impedance changes Rai A et al.(2020).[14]

Mode of delivery and neonatal outcomes (Table 4C). lateral group's higher LSCS rate (52.2%) is congruent with the cluster of complications that prompt operative delivery (hypertension, IUGR, earlier gestational age, fetal distress). Large perinatal series have similarly reported that "non-central" placentation tracks with more adverse neonatal outcomes, consistent with birth-weight/LSCS pattern. Haram K et al.(2020).[15]

CONCLUSION

The present study demonstrates that placental position at 18-24 weeks of gestation is an important predictor of subsequent maternal and fetal outcomes. Lateral implantation of the placenta was significantly associated with a higher incidence of gestational hypertension, preeclampsia, preterm labour, intrauterine growth restriction, lower mean birth weight, and an increased likelihood of caesarean section. In contrast, gestational diabetes did not show a statistically significant association with placental position. Anterior and posterior placentas were more frequently observed, whereas lateral placentas constituted a smaller proportion but carried a disproportionately higher burden of complications. These findings highlight the value of routine mid-trimester ultrasound not only for anomaly detection but also for identifying placental location as a simple, non-invasive marker for risk stratification. Early recognition of pregnancies with lateral placentation may allow intensified surveillance, timely interventions, and improved perinatal outcomes.

Limitations of the Study

1. The study was conducted at a single tertiary-care centre, which may limit the generalizability of findings to broader populations.
2. Placental position was assessed only during the mid-trimester and not re-evaluated in the third trimester, thereby not accounting for placental migration or positional changes with advancing gestation.
3. Potential confounders such as maternal BMI, socio-economic status, lifestyle factors, and detailed uterine artery Doppler indices were not included, which may have influenced the observed associations.
4. Rare outcomes such as abruptio placenta were too few in number to allow meaningful statistical analysis by placental site.
5. The observational design precludes causal inference; while significant associations were observed, a direct mechanistic link cannot be definitively established.

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