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A Systematic Review on Correlation Between Placental Location and Maternal-Fetal Outcome

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Conflict of interest: Nil

Abstract

Background: The placenta is a vital transient organ that mediates all exchanges between the mother and the fetus. Emerging evidence suggests that the site of placental implantation within the uterine cavity exerts a significant influence on the quality of uteroplacental blood flow, thereby affecting both maternal and neonatal outcomes. This systematic review aims to synthesize current evidence on the association between placental location.

Methods: A systematic search of PubMed/MEDLINE, Scopus, The Cochrane Library, and Embase was conducted from 2019 to 2025. Studies reporting on placental location determined by obstetric ultrasonography and its correlation with maternal or fetal outcomes in singleton pregnancies were included. Study quality was assessed using the Newcastle-Ottawa Scale (NOS) for observational studies and AMSTAR 2 for meta-analyses.

Results: 20 studies were included, comprising cross-sectional studies, retrospective and prospective cohort studies, meta-analyses, and one umbrella review. Lateral placentation was consistently associated with the highest burden of adverse outcomes including preeclampsia (OR 1.73–3.48), small for gestational age neonates (OR 1.74), preterm birth (aOR 1.36), and antepartum hemorrhage. Anterior placentation was independently linked to preeclampsia, operative delivery, and lower 5-minute Apgar scores. Low-lying placenta and placenta previa were associated with antepartum hemorrhage, preterm birth, and high rates of caesarean delivery. Fundal placentation was associated with premature rupture of membranes and severe preeclampsia in some studies. Posterior placentation generally had the most favourable outcomes.

Conclusion: Placental location, readily assessable via routine ultrasonography, is a significant determinant of

maternal and fetal outcome. Incorporation of detailed placental site documentation at the mid-trimester anomaly scan could enhance antenatal risk stratification and facilitate targeted surveillance of high-risk pregnancies.

Keywords: Placental location; Anterior placenta; Lateral placenta; Maternal outcomes; Fetal outcomes; Preeclampsia; Fetal growth restriction; Systematic review

Introduction

The placenta is a vital organ that serves as the interface between maternal and fetal circulation, facilitating oxygen and nutrient transfer, waste removal, immune regulation, and hormonal support during pregnancy. Its structural and functional efficiency depends largely on the site of implantation within the uterine cavity, as uterine blood flow is greater in the fundal and posterior regions.[1] Placental implantation occurs between days 6 and 10 after fertilization and influences trophoblastic invasion, spiral artery remodeling, and intervillous perfusion. Defective trophoblastic invasion is strongly associated with preeclampsia, fetal growth restriction, and placental abruption, suggesting that placental location may influence maternal and fetal outcomes through variations in uterine vascular supply.[2,3]

Obstetric ultrasound routinely documents placental location during the mid-trimester anomaly scan mainly to exclude placenta previa. However, the clinical significance of anterior, posterior, fundal, and lateral placentation has gained increasing attention in recent years.[4,5]

Recent studies and meta-analyses published between 2019 and 2025 have demonstrated associations between placental location and adverse pregnancy outcomes. Lateral placentation has been linked with increased risk of preeclampsia, preterm birth, and small-for-gestational-age neonates.[6] Anterior placentation has been associated with higher rates of operative delivery and postpartum hemorrhage.[7,8] Fundal and low-lying placentas have also been associated with premature rupture of membranes, antepartum hemorrhage, and maternal morbidity.[9-10]

Therefore, this systematic review was undertaken to evaluate the association between placental location and maternal-fetal outcomes and to assess its implications for clinical practice and future research.

Methodology

This systematic review was conducted in accordance with PRISMA 2020 guidelines. The research question was structured using the PICO framework, focusing on the association between placental location and maternal-fetal outcomes in singleton pregnancies.

A comprehensive literature search was performed in PubMed/MEDLINE, Scopus, Embase, and The Cochrane Library for studies published between January 2019 and March 2025. Search terms included “placental location,” “anterior placenta,” “posterior placenta,” “lateral placenta,” “fundal placenta,” “placenta previa,” “preeclampsia,” “fetal growth restriction,” “preterm birth,” and related maternal and neonatal outcomes.

Studies were included if they:

1. Involved singleton pregnancies,
2. Determined placental location by obstetric ultrasonography,
3. Reported maternal or fetal outcomes, and
4. Included comparison between placental locations.

Case reports, editorials, conference abstracts, and animal studies were excluded. Two independent reviewers screened studies and extracted data on study characteristics, placental location, and maternal-fetal outcomes.

Quality assessment was performed using the Newcastle–Ottawa Scale (NOS) for observational studies and AMSTAR 2 for systematic reviews/meta-analyses. Due to heterogeneity among studies, a narrative synthesis was primarily conducted, while pooled odds ratios from available meta-analyses were also reported where applicable.

Given the heterogeneity in study designs, outcome definitions, and classification systems for placental location, a narrative synthesis was conducted as the primary method of evidence integration. Where quantitative data were available from meta-analyses, pooled odds ratios (OR) or adjusted odds ratios (aOR) with 95% confidence intervals are reported. Heterogeneity across included studies was assessed using the I^2 statistic where applicable.

Results

Study Selection

The initial database search yielded 1,842 records. After removal of duplicates (n=412) and screening of titles and abstracts (n=1,430), 94 full-text articles were assessed for eligibility. Of these, 76 were excluded for the following reasons: exclusively studied placenta accreta spectrum without comparator placental location data (n=18), did not document placental location by ultrasound (n=24), lacked a comparison group (n=12), reported only on placenta previa without other locations (n=14), and were case reports or editorials (n=8). 20 studies were ultimately included in this systematic review, comprising seven cross-sectional or prospective observational studies, eight retrospective cohort studies, four systematic reviews and meta-analyses, one narrative review, and two umbrella reviews.

Characteristics of Included Studies

The included studies were conducted across multiple countries including India, Israel, Iran, Greece, Canada, South Korea, Sweden, and the United Kingdom. Sample sizes ranged from 300 to more than 138,000 participants. Placental location was most commonly categorized as anterior, posterior, fundal, lateral, and low-lying/previa. Most studies assessed placental location during the mid-trimester anomaly scan.

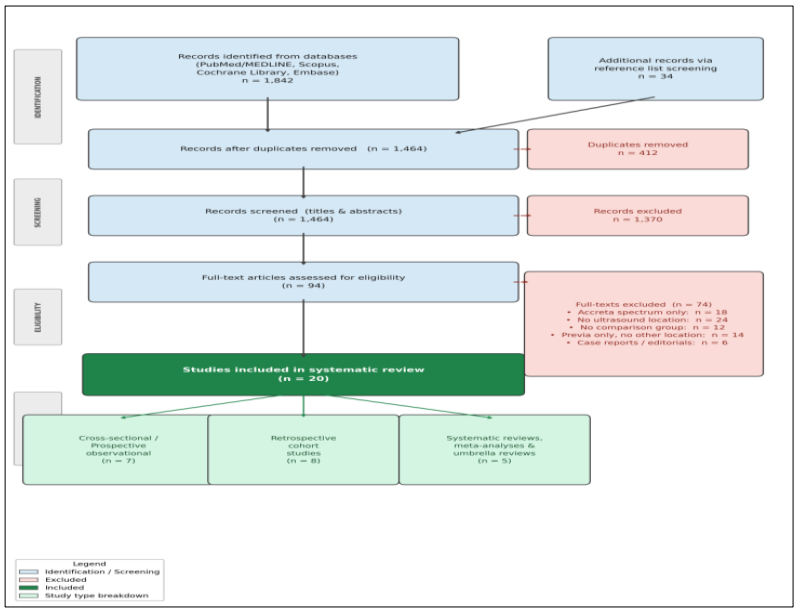

Figure 1: PRISMA 2020 flow diagram illustrating the study selection process. 20 studies were included from 1,842 initially identified records across PubMed/MEDLINE, Scopus, The Cochrane Library, and Embase.

Table 1: Characteristics of Included Studies

Author/Year	Study Design	Main Findings	Quality
Alakonda et al.[9], 2023	Cross-sectional	Fundal and left-lateral placentation associated with severe preeclampsia and PROM	7/9
Doctory et al.[11], 2023	Retrospective cohort	Lateral placenta associated with preterm birth and caesarean delivery	8/9
Alikhani et al.[12], 2024	Observational	Anterior placentation identified as predictor of preeclampsia	7/9
Siargkas et al.[6], 2023	Systematic review & meta-analysis	Lateral placenta associated with SGA and preeclampsia	High
Granfors et al.[4], 2019	Population-based cohort	Posterior placenta had best maternal-fetal outcomes	8/9
Porto et al.[13], 2020	Retrospective cohort	Lateral placentation associated with SGA and preeclampsia	7/9
Nanda and Agarwal[14], 2022	Meta-analysis	Strong association between lateral placenta and preeclampsia	High
Fan et al.[10], 2024	Umbrella review	Placenta previa associated with hemorrhage and preterm birth	High
Dhingra et al.[15], 2019	Prospective study	Anterior placenta associated with IUGR and NICU admission	7/9
Torricelli et al.[7], 2015	Cohort study	Anterior placentation associated with operative delivery and postpartum outcome	7/9
Belachew et al.[8], 2017	Prospective cohort	Anterior placenta associated with postpartum hemorrhage and retained placenta	7/9
Zia et al.[5], 2013	Observational study	Placental location associated with adverse pregnancy outcomes	6/9

Maternal Outcomes by Placental Location

Hypertensive Disorders of Pregnancy

Hypertensive disorders of pregnancy, especially preeclampsia, were the outcomes most consistently associated with placental location. Anterior and fundal placentation were also associated with increased preeclampsia risk, while posterior placentation generally showed the lowest risk profile.

Mode of Delivery

Lateral placentation was independently associated with increased risk of caesarean delivery and preterm birth. Anterior placentation was linked with induction of labor, operative delivery, and postpartum hemorrhage. Placenta previa and low-lying placenta were strongly associated with emergency caesarean section.

Antepartum and Postpartum Hemorrhage

Antepartum hemorrhage was markedly elevated in lateral and low-lying placentation. Placenta previa showed the highest hemorrhagic risk across studies. Anterior placentation was associated with postpartum hemorrhage, while posterior placentation demonstrated comparatively lower hemorrhagic risk.

Premature Rupture of Membranes

Fundal placentation demonstrated a significant association with PROM, while lateral placentation was also associated with PROM/PPROM in several studies.

Fetal and Neonatal Outcomes by Placental Location

Fetal Growth Restriction and Small for Gestational Age

Lateral placentation showed the strongest association with fetal growth restriction and SGA neonates. Meta-analysis demonstrated a pooled OR of 1.74 for SGA in lateral placentation. Anterior placentation was also associated with IUGR and higher NICU admissions, whereas posterior placentation generally had more favorable fetal outcomes.

Preterm Birth

Preterm birth was significantly associated with lateral placentation across multiple studies. Placenta previa and low-lying placenta also demonstrated increased preterm birth risk due to hemorrhage-related and iatrogenic preterm delivery.

APGAR Scores and NICU Admission

Anterior placentation was associated with lower 5-minute Apgar scores and increased NICU admissions related to perinatal asphyxia. Lateral placentation also showed higher NICU admission rates secondary to increased preeclampsia, FGR, and preterm birth.

Summary of Outcomes by Placental Location

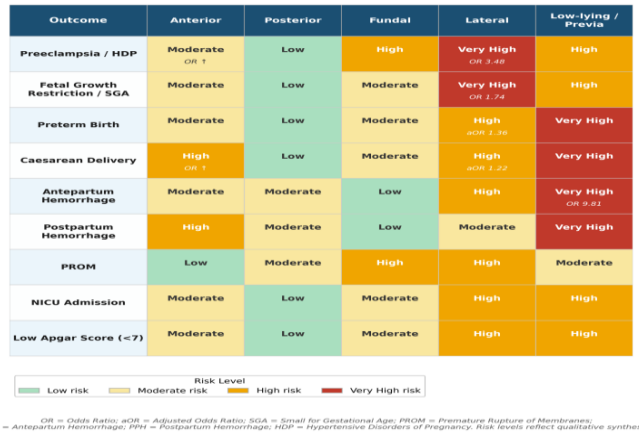

Figure 2: Summary heatmap of maternal and fetal outcome risk stratified by placental location, synthesised from 20 included studies (2015–2025). Risk levels reflect qualitative synthesis; selected OR/aOR values annotated where meta-analytic data are available.

Discussion

This systematic review demonstrates that placental location is an important predictor of maternal and fetal outcomes and may provide clinically useful prognostic information during routine obstetric ultrasonography. Across the included studies, lateral placentation consistently showed the strongest association with adverse outcomes, while posterior placentation was generally associated with the most favorable outcomes.[5–7,13,14] Among all placental positions, lateral placentation emerged as the location most consistently associated with adverse maternal and neonatal outcomes. Meta-analyses demonstrated significantly increased risks of preeclampsia, SGA/FGR, preterm birth, and caesarean delivery in pregnancies with lateral placenta.[6,11–14] The South Indian prospective study further reported very high rates of preeclampsia and FGR among women with lateral placentation.[9]

The biological basis for these findings may relate to asymmetrical uteroplacental blood flow and incomplete spiral artery remodeling, resulting in placental

insufficiency and endothelial dysfunction.[1–3] These mechanisms are implicated in the pathogenesis of preeclampsia and fetal growth restriction and support the role of lateral placentation as a clinically important high-risk marker. Anterior placentation was associated with preeclampsia, operative delivery, postpartum hemorrhage, lower 5-minute Apgar scores, and increased NICU admissions.[7,8,15] Although anterior placentas are often considered clinically benign, the findings suggest that they may influence labor progression, uterine contractility, and neonatal condition at birth.

Anterior low-lying placenta in women with previous caesarean section has also been associated with placenta accreta spectrum and severe hemorrhage.[1,10] These findings emphasize the importance of careful antenatal assessment in women with anterior placentation, particularly in scarred uteri. Posterior placentation generally demonstrated the most favorable maternal and fetal outcomes across included studies and served as the reference low-risk group in many analyses. Lower rates of preeclampsia, SGA, and postpartum hemorrhage were consistently observed with posterior implantation.[5,6,13,14] This may reflect better uteroplacental perfusion and more effective trophoblastic invasion along the posterior uterine wall.[2,4,5] However, some studies reported associations between posterior placentation and placental abruption or PROM, indicating that posterior implantation is not entirely risk free.[9,10]

Fundal placentation was associated mainly with severe preeclampsia and PROM.[9,10] Some earlier studies also suggested associations with breech presentation and shorter third stage of labor.[5]

Placenta previa and low-lying placenta remained strongly associated with antepartum hemorrhage, preterm delivery, emergency caesarean section, and perinatal morbidity.[10–12] Serial ultrasonographic monitoring remains important because placental migration may occur during pregnancy.[1]

Clinical Implications

The findings support routine documentation of placental location during the mid-trimester anomaly scan beyond merely identifying placenta previa.[4,10,13,14] Accurate identification of lateral, anterior, and fundal placentation may improve antenatal risk stratification and guide closer surveillance for hypertensive disorders, fetal growth restriction, and preterm birth.

Because placental location assessment is inexpensive and universally available, its incorporation into existing screening models for preeclampsia and fetal growth restriction may improve predictive accuracy without additional healthcare costs.[2,4,13]

Strengths and Limitations

This review included studies from multiple countries and incorporated cohort studies, systematic reviews, meta-analyses, and umbrella reviews, providing a broad evidence base. The use of validated quality assessment tools also strengthened methodological reliability.

Most included studies were observational, restricting causal inference and leaving potential residual confounding. Furthermore, placental position may change throughout gestation, creating challenges in classification consistency.

Conclusion

This systematic review demonstrates that placental location identified on routine obstetric ultrasonography is significantly associated with maternal and fetal outcomes in singleton pregnancies. Lateral placentation showed the strongest association with adverse outcomes, particularly preeclampsia, fetal growth restriction, preterm birth, and increased caesarean delivery, while anterior placentation

was linked with operative delivery, postpartum hemorrhage, and lower neonatal Apgar scores. In contrast, posterior placentation generally demonstrated the most favorable outcomes, whereas placenta previa and low-lying placenta remained associated with severe hemorrhagic and perinatal complications. These findings support the routine documentation of placental location during the mid-trimester anomaly scan as a simple and cost-effective tool for antenatal risk stratification and targeted surveillance of high-risk pregnancies.

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