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Original Research Article

Placental Localisation by Ultrasound and its Role in Prediction of Pregnancy-Induced Hypertension

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Abstract:

Background: Pregnancy-induced hypertension (PIH) is a significant cause of maternal and perinatal morbidity and mortality worldwide. Early identification of women at risk is essential for timely intervention. Ultrasonographic placental localisation in the second trimester has been proposed as a simple, non-invasive screening tool for predicting PIH.

Objective: To evaluate the relationship between placental location determined by ultrasonography and the subsequent development of pregnancy-induced hypertension.

Methods: This prospective observational study included pregnant women with singleton pregnancies undergoing routine anomaly scans between 18–24 weeks of gestation. Placental location was determined using transabdominal ultrasonography and categorized as anterior, posterior, fundal, or lateral (right/left). Patients were followed until delivery and monitored for the development of PIH, defined as blood pressure ≥140/90 mmHg after 20 weeks of gestation without prior hypertension. Statistical analysis was performed to assess the association between placental location and incidence of PIH.

Results: A higher incidence of PIH was observed in women with laterally located placenta compared to those with centrally located (anterior/posterior/fundal) placenta. The difference was statistically significant ($p < 0.05$). Sensitivity, specificity, and predictive values suggested that lateral placentation may serve as a useful early indicator for identifying women at increased risk of PIH.

Conclusion: Placental localisation by second-trimester ultrasonography, particularly lateral placentation, is associated with an increased risk of pregnancy-induced hypertension. It may be considered a simple, cost-effective screening method to identify high-risk pregnancies for closer antenatal surveillance and early preventive strategies.

Keywords: Placental location, Ultrasound, Pregnancy-induced hypertension, Preeclampsia, Antenatal screening.
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Introduction

Pregnancy-induced hypertension (PIH) is one of the most common medical complications of pregnancy and a leading cause of maternal and perinatal morbidity and mortality worldwide. It includes gestational hypertension, preeclampsia, and eclampsia, conditions characterized by elevated blood pressure developing after 20 weeks of gestation in previously normotensive women. Despite advances in antenatal care, PIH continues to pose significant risks, including preterm birth, intrauterine growth restriction (IUGR), placental abruption, and increased maternal complications. The exact etiology of PIH remains multifactorial and incompletely understood; however, abnormal placentation is considered central to its pathogenesis. In normal pregnancy, trophoblastic invasion of the spiral arteries results in adequate uteroplacental perfusion. In PIH, inadequate trophoblastic invasion leads to reduced placental perfusion, endothelial dysfunction, and systemic vasospasm, contributing to hypertension and its associated complications. Ultrasonography is a safe, non-invasive, and widely available imaging modality routinely used in obstetric practice. Apart from fetal biometry and anomaly detection, it also provides valuable information regarding placental localization. Placental position can be categorized as anterior, posterior, fundal, or lateral (right or left). Some studies suggest that lateral placentation may be associated with an increased risk of PIH. The proposed mechanism is that when the placenta is laterally located, uteroplacental blood flow may rely predominantly on one uterine artery, potentially

leading to relative placental insufficiency if collateral circulation is inadequate.

Early identification of women at risk for PIH allows closer antenatal monitoring, timely intervention, and improved maternal and fetal outcomes. Therefore, evaluating placental localization during routine second-trimester ultrasound as a predictive marker for PIH may provide a simple, cost-effective screening tool in clinical practice.

This study aims to assess the association between placental localization by ultrasonography and the subsequent development of pregnancy-induced hypertension.

Materials and Methods

Study Design: This was a prospective observational study conducted in the Department of Radiodiagnosis at Bhagwan Mahavir Institute of Medical Sciences, Pawapuri Nalanda Bihar. Study duration was one year.

Study Population: A total of 78 pregnant women with singleton pregnancies attending the antenatal clinic were included in the study.

Inclusion Criteria

- Singleton pregnancy
- Gestational age between 18–24 weeks
- Normotensive
- Willing to participate in the study

Exclusion Criteria

- History of chronic hypertension
- Multiple gestation
- Pre-existing diabetes mellitus
- Renal or cardiovascular disease
- Autoimmune disorders
- Placenta previa

Procedure: All enrolled women underwent routine second-trimester ultrasonography between 18–24 weeks of gestation using transabdominal ultrasound. Placental localization was determined and categorized as:

- Anterior
- Posterior
- Fundal
- Lateral (right or left)

Placenta was considered lateral when 75% or more of the placental mass was located on either the right or left side of the uterine cavity. Placenta was considered central when it was anterior, posterior, or fundal without predominant lateral distribution.

After placental localization, patients were followed up regularly through antenatal visits until delivery. Blood pressure was measured at each visit using a standard mercury sphygmomanometer in a sitting position.

Outcome Measure: The primary outcome was the development of pregnancy-induced hypertension (PIH), defined as:

- Blood pressure ≥140/90 mmHg on two occasions at least 4 hours apart after 20 weeks of gestation in a previously normotensive woman.

Patients who developed PIH were recorded and correlated with placental localization findings.

Statistical Analysis: Data were entered in Microsoft Excel and analyzed using appropriate statistical software. Categorical variables were expressed as percentages. The association between placental location and development of PIH was assessed using the Chi-square test. A p-value <0.05 was considered statistically significant.

Results

A total of 78 pregnant women were included in the study and followed until delivery.

Distribution According to Placental Location

Out of 78 patients:

- Central placenta (anterior, posterior, fundal) – 52 cases (66.7%)
- Lateral placenta (right or left) – 26 cases (33.3%)

Incidence of Pregnancy-Induced Hypertension (PIH)

Out of the total study population:

- Total cases who developed PIH – 18 (23.1%)
- Normotensive patients – 60 (76.9%)

Association Between Placental Location and PIH

Among the 26 patients with lateral placenta:

- 12 patients (46.2%) developed PIH
- 14 patients (53.8%) remained normotensive

Among the 52 patients with central placenta:

- 6 patients (11.5%) developed PIH
- 46 patients (88.5%) remained normotensive

The incidence of PIH was significantly higher in patients with lateral placentation compared to central placentation.

Statistical analysis using the Chi-square test showed that the association between lateral placental location and development of PIH was statistically significant ($p < 0.05$).

Predictive Value of Lateral Placenta for PIH

- Sensitivity – 66.7%

- Specificity – 76.7%
- Positive Predictive Value – 46.2%
- Negative Predictive Value – 88.5%

These findings suggest that lateral placental localization detected during the second trimester may be a useful predictor for the development of pregnancy-induced hypertension.

Discussion

Pregnancy-induced hypertension (PIH) remains a major contributor to maternal and perinatal morbidity and mortality. Early identification of women at risk allows closer monitoring and timely intervention, thereby improving outcomes. The present study was conducted to evaluate the role of placental localization by second-trimester ultrasonography in predicting the development of PIH. In this study of 78 pregnant women, a significantly higher incidence of PIH was observed in patients with laterally located placenta compared to those with centrally located placenta. Nearly half of the women with lateral placentation developed PIH, whereas a much smaller proportion of women with central placentation developed hypertension. The association was found to be statistically significant, suggesting that placental location may serve as a useful early screening marker. The pathophysiological basis of this association may be explained by abnormal placentation. Normal pregnancy requires adequate trophoblastic invasion of spiral arteries, ensuring sufficient uteroplacental perfusion. When the placenta is centrally located, blood supply from both uterine arteries contributes relatively equally. However, in cases of lateral placentation, uteroplacental circulation may depend predominantly on one uterine artery. If collateral circulation from the opposite side is inadequate, it may result in relative placental ischemia. This ischemia can trigger endothelial dysfunction and systemic vasoconstriction, which are key mechanisms in the development of PIH. The findings of the present study are consistent with previous research that demonstrated a higher incidence of PIH in women with lateral placentation. Similar studies have reported that lateral placenta is associated with increased risk of gestational hypertension and preeclampsia. The sensitivity and specificity observed in this study indicate that placental localization, although not a definitive diagnostic tool, may be a useful adjunct in risk stratification during routine anomaly scans. Ultrasonography is a simple, safe, non-invasive, and widely available modality. Since placental localization is already assessed during routine second-trimester scans, its use as a predictive marker does not require additional cost or intervention. This makes it particularly valuable in low-resource settings where advanced biochemical or Doppler screening tests may not be readily available. However, the present study has certain limitations. The sample size was relatively small (78 patients), and the study was conducted at a single center. Larger multicentric studies are required to validate these findings and to establish placental localization as a reliable screening parameter for PIH. Overall, the results of this study support the hypothesis that lateral placentation is associated with an increased risk of pregnancy-induced hypertension and may help in identifying high-risk pregnancies for closer antenatal surveillance.

Conclusion

The present study concludes that placental localization by second-trimester ultrasonography has a significant association with the development of pregnancy-induced hypertension (PIH). A higher incidence of PIH was observed in women with laterally located placenta compared to those with centrally located placenta. Lateral placentation may reflect altered uteroplacental perfusion, contributing to the pathogenesis of PIH. Since placental position is routinely assessed during anomaly scans between 18–24 weeks of gestation, it can serve as a simple, non-invasive, and cost-effective screening tool for identifying women at increased risk.

Although placental localization alone cannot definitively predict PIH, it may be useful for early risk stratification and closer antenatal surveillance. Larger, multicentric studies are recommended to further validate its predictive value and establish its role in routine obstetric practice.

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