Section: Radiology

Original Research Article

PLACENTAL THICKNESS MEASUREMENT VIA ULTRASONOGRAPHY AND ITS ASSOCIATION WITH GESTATIONAL AGE AND FETAL WEIGHT: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Accurate estimation of gestational age (GA) and fetal weight is central to obstetric care. Conventional fetal biometry is widely used but may be unreliable in conditions such as oligohydramnios, fetal anomalies, or syndromes. Placental thickness (PT), measurable at the level of cord insertion by ultrasonography, has emerged as a simple and non-invasive alternative parameter.

Materials and Methods: This prospective observational study was conducted in the Department of Radiology, Index Medical College Hospital & Research Center, Indore, between October 2023 and September 2024. A total of 100 pregnant women with singleton pregnancies beyond 12 weeks of gestation were included. Patients with multiple gestations, systemic illness, gestational diabetes, or preeclampsia were excluded. Gestational age was estimated by fetal biometry (BPD, HC, AC, FL), and PT was measured sonographically at the cord insertion site. Correlations were analyzed using Pearson's coefficient with SPSS v22.0, considering $p < 0.05$ as statistically significant.

Results: The mean maternal age was 25.72 ± 4.22 years, and the mean gestational age was 29.15 ± 6.78 weeks. Placental thickness increased progressively from 12.94 mm at 12 weeks to 36.81 mm at 37 weeks, with a slight decline to 35.95 mm at 42 weeks. A strong positive correlation was observed between PT and GA ($r = 0.9715–0.9943$, $p < 0.00001$ up to 37 weeks) and between PT and fetal weight ($r = 0.8851–0.9789$, $p < 0.00002$ up to 37 weeks). Beyond 38 weeks, correlations were negative and statistically insignificant.

Conclusion: Placental thickness is a reliable adjunct for estimating gestational age and fetal weight up to 37 weeks and may complement conventional biometry, especially in clinically challenging situations.

Keywords: Placental thickness, Gestational age, Fetal weight, Ultrasonography, Antenatal assessment.

INTRODUCTION

The placenta is a unique and vital organ that serves as the primary interface between the mother and the fetus, playing a central role in fetal growth and survival. Placental imaging has become an integral component of routine prenatal care, allowing early recognition of structural and functional abnormalities that may compromise maternal and fetal well-being. Disorders such as placenta previa, placental abruption, and placental insufficiency can be detected with ultrasonography, thereby enabling timely interventions to improve outcomes.[1]

Among the various parameters assessed through sonography, placental thickness has attracted considerable attention as a marker for estimating gestational age (GA). Accurate estimation of GA is essential not only for monitoring fetal development

but also for guiding obstetric decisions in conditions such as preterm delivery, intrauterine growth restriction (IUGR), and uteroplacental insufficiency.[2,3] Furthermore, precise dating of pregnancy provides the basis for planning invasive prenatal procedures, including chorionic villus sampling and amniocentesis, which are highly dependent on gestational timing.[4]

Although fetal biometry—using parameters such as biparietal diameter, head circumference, abdominal circumference, and femur length—remains the standard method for GA estimation, it is not universally reliable. Situations such as multiple gestations, fetal anomalies, syndromic conditions, and maternal factors like oligohydramnios may compromise the accuracy of biometry.[5,6] In such cases, additional parameters are required to provide consistent and reproducible estimates.

Placental thickness, when measured at the level of umbilical cord insertion, has been shown to correlate positively with both GA and fetal weight.[7] This simple, non-invasive measurement can supplement conventional biometry in assessing fetal maturity and predicting perinatal outcomes. The routine imaging of the placenta during antenatal ultrasound also facilitates the evaluation of its location, morphology, thickness, and associated abnormalities, thus contributing to a more comprehensive assessment of pregnancy health.[8,9]

In this context, the present study was designed to evaluate placental thickness as a reliable parameter for estimating gestational age and fetal weight in healthy singleton pregnancies. By exploring this relationship, we aim to strengthen its role as a valuable adjunct to traditional fetal biometry, particularly in cases where standard measurements may be limited.

MATERIALS AND METHODS

This study was designed as a prospective observational study and was conducted in the Department of Radiology, Index Medical College Hospital & Research Center, Indore, over a period of 12 months from October 2023 to September 2024, after obtaining clearance from the Institutional Ethics Committee. A total of 100 pregnant women in their second and third trimesters who underwent routine antenatal ultrasound were enrolled based on predefined inclusion and exclusion criteria.

Inclusion Criteria: Pregnant women with singleton pregnancies who had completed 12 weeks of gestation were included.

Exclusion Criteria: Patients who refused consent, those with multiple pregnancies, severe systemic illnesses, gestational diabetes, or preeclampsia were excluded. Additionally, cases with gestational age <12 weeks or >42 weeks were excluded from the study.

Methodology

A detailed clinical history was obtained from all participants, including the last menstrual period (LMP), gestational age by LMP, and the presence of any co-morbid conditions such as diabetes, hypertension, or asthma. All patients underwent ultrasonographic evaluation using a GE Voluson 8 ultrasound machine equipped with a convex transducer.

Gestational age was initially estimated using standard fetal biometry parameters, including biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL). Subsequently, placental imaging was performed to determine the placental site and to rule out abnormalities such as retroplacental hematoma, abruptio placentae, placenta previa, or morbidly adherent placenta. Placental thickness was measured at the level of umbilical cord insertion, ensuring the probe was positioned perpendicular to the chorionic and basal plates.

Statistical Analysis

The collected data were compiled and analyzed using SPSS version 22.0 software. Correlation between placental thickness and gestational age (as determined by biometry) was assessed using Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant.

RESULTS

In this study, the majority of participants belonged to the younger reproductive age group. More than half of the women (57%) were in the 20–25 years age range, followed by 22% in the 26–30 years group. Only a small proportion of women were above 30 years (10%) or below 20 years (7%), while women aged >35 years constituted just 4%. The mean maternal age was 25.72 ± 4.22 years, reflecting that most pregnancies were concentrated in the early to mid-twenties. With respect to gestational age, the largest proportion of women (44%) were between 25–30 weeks, followed by 30% between 31–37 weeks. Early second trimester cases (13–24 weeks) accounted for 18%, while only 8% of patients were in late-term gestation (37–42 weeks). The mean gestational age of the study cohort was 29.15 ± 6.78 weeks, indicating that most ultrasounds were performed in the mid to late second trimester and early third trimester.

Placental localization showed that anterior location was the most common, observed in nearly half of the cases (47%), followed by posterior (32%) and fundal (11%). Lateral placements were less frequent, with right and left lateral accounting for 5% and 4% respectively. Low-lying placenta was noted in 13% of cases, while placenta previa (partially or completely covering the internal os) was identified in 2%. These findings suggest that anterior and posterior placements dominate normal pregnancies, while a small proportion present with clinically

significant lower uterine segment involvement that may impact obstetric outcomes. Overall, the study population predominantly comprised young women in their mid-twenties, with most pregnancies in the mid-gestational period. The distribution of placental location was consistent with normal anatomical variation, with a minority showing low-lying or previa patterns that warrant closer follow-up. [Table 1]

Table 1: Demographic and Clinical Characteristics of Study Population (n = 100)

Parameter	Category	Frequency (n)	Percentage (%)
Age Distribution	<20 years	7	7
	20–25 years	57	57
	26–30 years	22	22
	>30 years	10	10
	>35 years	4	4
Mean Age	25.72 ± 4.22 years		
Gestational Age (by Biometry)	13–24 weeks	18	18
	25–30 weeks	44	44
	31–37 weeks	30	30
	37–42 weeks	8	8
Mean Gestational Age	29.15 ± 6.78 weeks		
Placental Location	Anterior	47	47
	Posterior	32	32
	Fundal	11	11
	Right lateral	5	5
	Left lateral	4	4
	Low lying placenta	13	13
	Partially/Completely covering OS	2	2

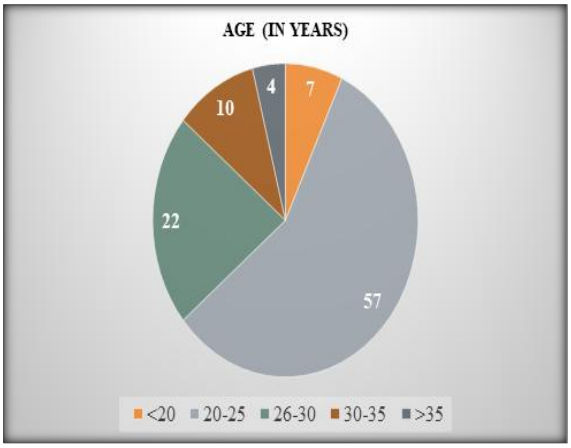

Figure 1: Distribution of study population by Age

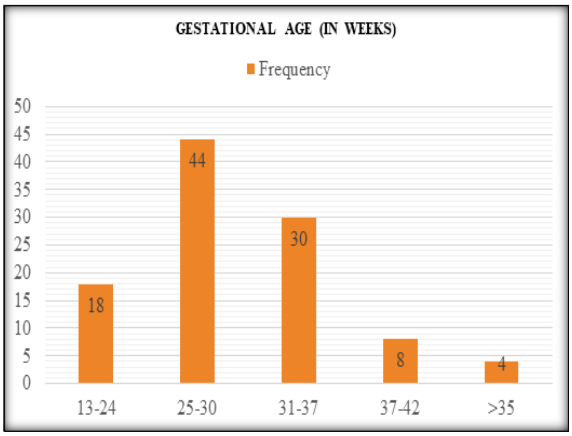

Figure 2: Distribution of study population by gestational age (in weeks)

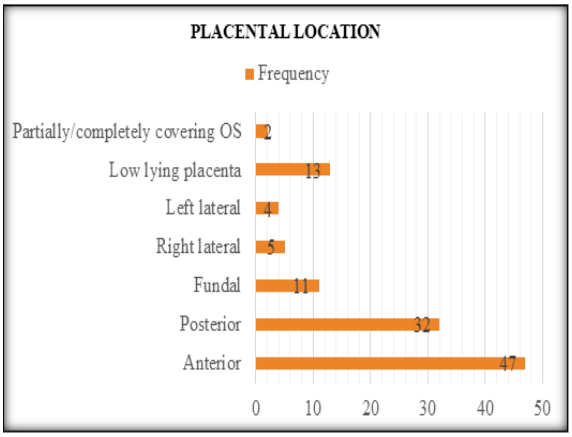

Figure 3: Distribution of study population by placental location

The present study demonstrated a consistent and gradual increase in placental thickness with advancing gestational age from 12 weeks up to 38 weeks. At 12 weeks, the mean placental thickness was 12.94 mm, which steadily increased to 36.81 mm by 37 weeks. This progressive rise indicates a strong physiological correlation between placental development and fetal growth. When analyzed in trimester-specific ranges, the mean placental thickness was 18.82 ± 3.36 mm during 12–24 weeks, 30.57 ± 3.86 mm during 24–37 weeks, and 36.21 ± 0.35 mm beyond 37 weeks. These values highlight that placental thickness almost doubled from the second to the third trimester, reflecting its crucial role in supporting the increasing metabolic demands of the fetus. Interestingly, a slight decline in placental thickness was observed after 37 weeks, with a mean of 35.95 mm at 42 weeks. This reduction can be attributed to the beginning of physiological placental senescence near term, where

structural and vascular changes may limit further growth. The cut-off value of approximately 36 mm at 37 weeks also supports its utility in distinguishing preterm from term pregnancies. Overall, the findings reinforce that placental thickness is a reliable parameter that parallels gestational age. The steady increase until term and plateau or marginal decline thereafter suggests its usefulness in estimating gestational age, particularly when conventional fetal biometry is inconclusive or limited. [Table 2]

Table 2: Mean Placental Thickness Across Different Gestational Age Groups

Gestational Age (weeks)	Mean Thickness (mm)	Standard deviation (±)
12-24	18.82	3.36
25-37	30.57	3.86
37-42	36.21	0.35

The correlation analysis revealed a strong and statistically significant positive relationship between placental thickness and both fetal weight as well as gestational age up to 37 weeks of pregnancy. For placental thickness and fetal weight, a strong correlation was observed in the second trimester (14–24 weeks; $r = 0.8851$, $p < 0.00002$), which became even stronger during the late second and third trimester (25–37 weeks; $r = 0.9789$, $p < 0.00001$). However, beyond 38 weeks, the correlation turned negative, though this was not statistically significant ($p = 0.064$). This indicates that placental thickness serves as a reliable marker for fetal weight up to term, but loses predictive value in late-term or post-term pregnancies due to the onset of placental senescence.

Similarly, for placental thickness and gestational age, a very strong positive correlation was observed both in the early gestational period (12–24 weeks; $r = 0.9715$, $p < 0.00001$) and during 25–37 weeks ($r = 0.9943$, $p < 0.00001$), confirming the utility of placental thickness as a reliable surrogate for dating pregnancy. Beyond 38 weeks, however, the correlation again became negative and statistically insignificant ($p = 0.068$), suggesting that placental thickness reaches a plateau or begins to regress at term, thereby reducing its accuracy for post-term dating. Overall, these findings suggest that placental thickness is a robust and non-invasive parameter for predicting both gestational age and fetal weight during the second and third trimesters up to 37 weeks. Its clinical utility, however, diminishes beyond term due to age-related placental changes. [Table 3].

Table 3: Correlation of Placental Thickness with Fetal Weight and Gestational Age Across Different Gestational Periods

Parameter	Gestational Age (weeks)	Correlation coefficient	P value
Placental thickness and fetal weight	14-24	0.8851	<0.00002
	25-37	0.9789	<0.00001
	38-42	Negative	0.064 (NS)
Placental thickness and gestational age	12-24	0.9715	<0.00001
	25-37	0.9943	<0.00001
	38-42	Negative	0.068 (NS)

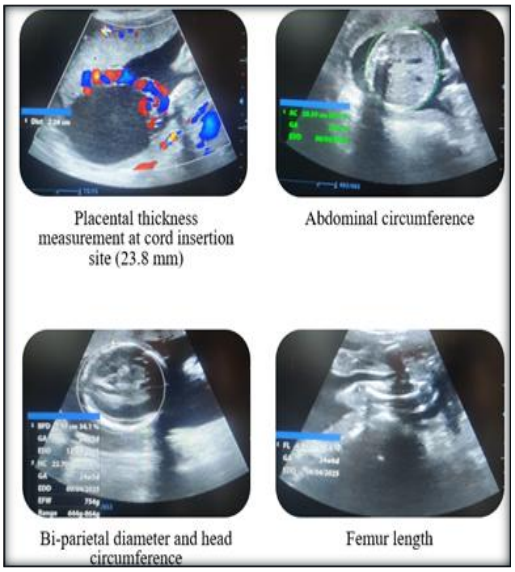

Figure 4: Case 1 showing Ultrasonographic Assessment of Placental Thickness and Fetal Biometry at 24 Weeks Gestation

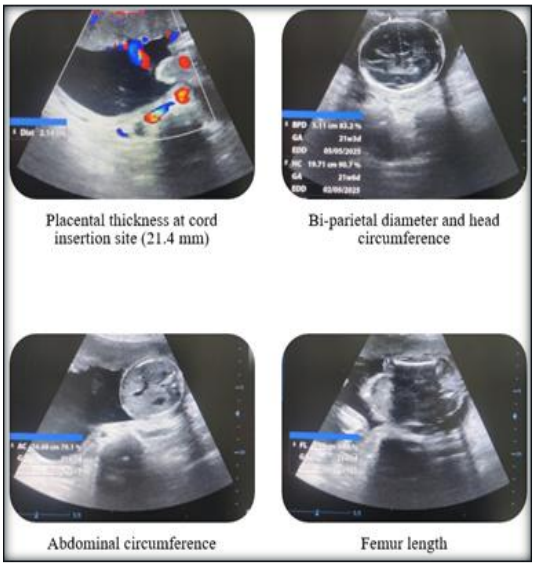

Figure 5: Case 2 showing Ultrasonographic Assessment of Placental Thickness and Fetal Biometry at 21 Weeks Gestation

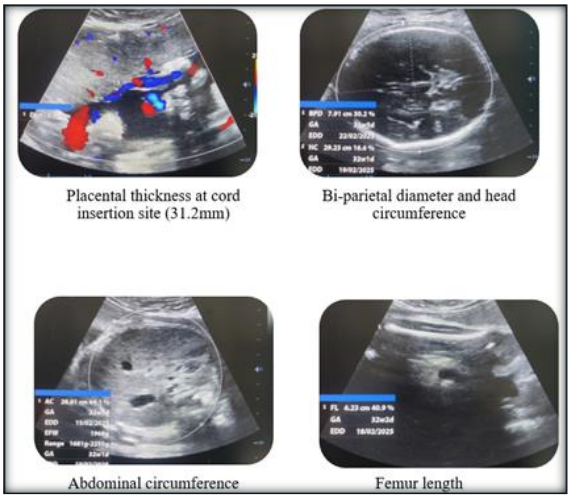

Figure 6: Case 3 showing Ultrasonographic Assessment of Placental Thickness and Fetal Biometry at 32 Weeks Gestation

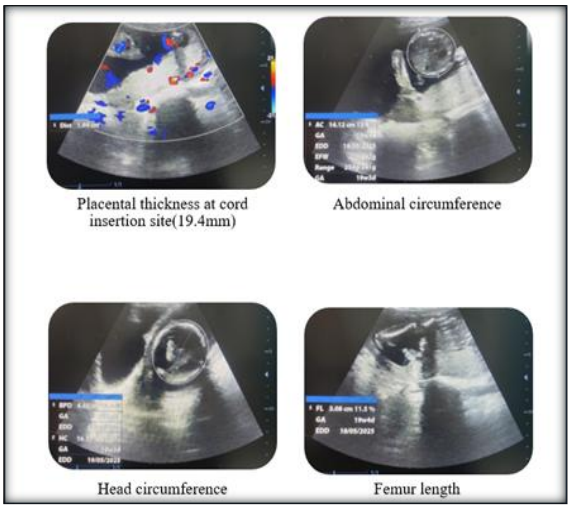

Figure 7: Case 4 showing Ultrasonographic Assessment of Placental Thickness and Fetal Biometry at 19 Weeks Gestation

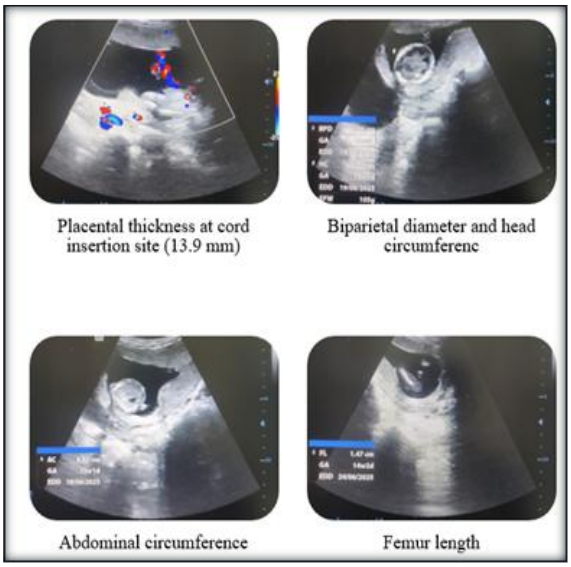

Figure 8: Case showing Ultrasonographic Assessment of Placental Thickness and Fetal Biometry at 14 Weeks Gestation

DISCUSSION

Accurate estimation of gestational age (GA) and fetal weight is fundamental in obstetric practice, as it guides clinical decision-making and influences maternal as well as neonatal outcomes. Antenatal ultrasound serves as the cornerstone for this purpose, with fetal biometry parameters such as head circumference (HC), biparietal diameter (BPD), abdominal circumference (AC), and femur length (FL) routinely employed in the second and third trimesters. However, in clinical scenarios such as fetal hydrocephalus, craniosynostosis, skeletal dysplasias, or other congenital anomalies, fetal biometry may provide inconsistent or unreliable measurements. In such circumstances, placental thickness (PT) emerges as a valuable adjunct parameter, offering an additional non-invasive marker for estimating both GA and fetal weight.

In the present study, the majority of participants were between 25 and 30 weeks of gestation (44%), followed by 31–37 weeks (30%), 13–24 weeks (18%), and 37–42 weeks (8%). Placental thickness demonstrated a steady, progressive increase with advancing gestation, rising from a mean of 12.94 mm at 12 weeks to 36.81 mm at 37 weeks, beyond which a slight decline was noted. The observed placental thickness of 36.81 mm at 37 weeks could serve as a practical cut-off for differentiating between term and preterm pregnancies. This finding is consistent with the work of Humadi et al., who identified a threshold of 36.3 mm to distinguish between term and preterm gestations.[10] Similarly, Erkamp et al. and Njeze et al. corroborated the strong correlation between PT and GA, reinforcing its reliability as a predictor of gestational maturity.[11,12]

Our study found a strong positive correlation between PT and GA from 12 to 38 weeks, which became insignificant and negative beyond 38 weeks, likely reflecting placental senescence and reduced functional reserve near term. These findings closely align with those reported by Karthikeyan et al., who studied 211 uncomplicated singleton pregnancies between 11 and 40 weeks and demonstrated correlation coefficients of r = 0.609, r = 0.812, and r = 0.814 across the three trimesters, respectively.[13] Furthermore, their work emphasized the significant correlation between PT and fetal biometric parameters (BPD, HC, AC, FL) as well as estimated fetal weight (EFW), recommending routine measurement of PT during obstetric ultrasonography as a potential screening tool for subnormal PT, which may indicate adverse perinatal outcomes.

Consistent with these findings, Keshavarz et al. and Azagidi et al. also reported strong associations between PT and GA, further validating its use in clinical practice.[14,15] In relation to fetal weight, the present study demonstrated a strong positive correlation between PT and estimated fetal weight from 14 to 37 weeks of gestation, with the

correlation turning negative and statistically insignificant beyond 37 weeks. This observation parallels the results of Afrakhteh et al., who established a significant relationship between PT and birth weight during the second and third trimesters.[16] Similarly, Hamidi et al. and Salafia et al. highlighted that PT serves as a reliable predictor of fetal growth and neonatal birth weight, underlining its clinical utility in prenatal growth assessments.[17,18]

Taken together, the results of this study confirm that PT is a dependable and reproducible parameter that strongly correlates with both GA and fetal weight up to 37 weeks of gestation. Its role as a supplementary marker is particularly useful when conventional fetal biometry is limited by maternal or fetal factors.

Although the present study provides valuable insights into the correlation between placental thickness and gestational parameters, certain limitations must be acknowledged. The most significant limitation was that only a single measurement of placental thickness was obtained for each participant. Serial follow-up examinations were not performed, which would have allowed assessment of longitudinal changes in placental growth dynamics throughout gestation. Furthermore, the study population was restricted to healthy singleton pregnancies, thereby limiting the generalizability of the findings to high-risk groups such as those with gestational diabetes, preeclampsia, intrauterine growth restriction, or multiple gestations.

To enhance external validity, future research should incorporate larger sample sizes, longitudinal follow-up, and inclusion of diverse patient populations, particularly high-risk pregnancies, to more comprehensively validate the predictive accuracy and clinical applicability of placental thickness.

CONCLUSION

The present study confirms that placental thickness is a reliable and non-invasive parameter for estimating both gestational age and fetal weight, particularly in situations where conventional fetal biometry may be limited or unreliable. A strong positive correlation was demonstrated between placental thickness and gestational age from 12 to 37 weeks, as well as with fetal weight, highlighting its clinical utility in routine obstetric assessment. Beyond 37 weeks, the correlation diminished, likely due to placental senescence, underscoring its primary value in early and mid-gestation.

The findings suggest that incorporation of placental thickness measurement into routine obstetric ultrasonography could complement traditional biometric parameters, improving diagnostic accuracy in pregnancy management. Nevertheless, the study emphasizes the need for population-specific placental thickness reference charts to ensure greater accuracy across diverse clinical settings. By enhancing understanding of the role of placental thickness in prenatal care, this study provides a foundation for further research aimed at optimizing pregnancy monitoring, particularly in cases where conventional assessment tools are inconclusive.

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