

Correlation of Placental Thickness with Biparietal Diameter in Normal Singleton Pregnancy among Bangladeshi Women

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ABSTRACT

Background: Accurate estimation of Gestational Age (GA) is crucial for effective antenatal care. While the first day of the Last Normal Menstrual Period (LNMP) is commonly used when menstrual cycles are regular, alternative methods are needed in certain situations. Placental Thickness (PT) has been reported in various countries as a reliable ultrasonographic parameter for GA estimation. This study aimed to assess the relationship between PT and conventional fetal biometric measurements to evaluate its usefulness in estimating GA. To measure and assess placental thickness as an ultrasonographic parameter for estimating gestational age in uncomplicated pregnancies in Chattogram, Bangladesh.

Materials and methods: A cross-sectional observational study was carried out among 112 healthy pregnant women between 11 and 40 weeks of gestation. Participants with no medical complications were recruited from the Radiology and Imaging departments of Chittagong Medical College Hospital and Islami Bank Hospital Agrabad, Chattogram. The study population was categorized into three gestational groups: 11–13 weeks, 14–26 weeks and 27–40 weeks.

Results: Placental thickness was found to increase progressively with Biparietal Diameter (BPD) as gestational age advanced. At 12–13 weeks, there was a moderately strong positive correlation between PT and BPD. During 14–26 weeks, the correlation remained statistically significant but mild, while a weaker yet significant positive correlation was observed between 27–38 weeks of gestation.

Conclusion: The findings indicate that placental thickness increases steadily with gestational age and can serve as a reliable ultrasonographic biometric parameter for estimating gestational age in normal pregnancies.

Key words: Biparietal Diameter (BPD); Placental Thickness (PT); Ultrasonography (USG).

Introduction

The placenta plays crucial metabolic, immunological, endocrine, respiratory and nutritional roles essential for fetal well-being. Its proper structure and function are

critical to support normal fetal growth and development. A strong positive association has been observed between fetal weight and both placental weight and volume.¹ Placental development begins from the chorion frondosum and decidua basalis by the 8th week of gestation. On ultrasonography, the thicker chorion frondosum can be distinguished from the thinner chorion laeve as early as the 8th to 9th week. By around the 10th week, the placenta becomes clearly recognizable as a disk-shaped structure.² The full term placenta is 15-25 cm in diameter and 3 cm in thickness.³ Its thickest section remains in the middle and gradually thins out toward the edges. Both the maternal and fetal surfaces of the placenta are covered by the amniotic membrane. The maternal surface has lobules or cotyledons that are irregularly grooved or clefted. The fetal surface, on the other hand, is smooth, shining, and transparent.⁴ Substantial evidence indicates that placental thickness plays a significant role in perinatal outcomes and is linked to fetal growth. A placental diameter of 18 cm or more combined with a thickness of 2 cm at 36 weeks of gestation is associated with a higher likelihood of delivering a low birth weight infant.⁵ Earlier studies have demonstrated a positive correlation between Placental Thickness (PT) and the

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onset of preeclampsia, identifying increased placental thickness as a significant risk factor. Both preterm and term preeclampsia have been linked to placentas that are notably thicker, as supported by findings from a cohort study showing similar outcomes.⁶ Placental thickness can exhibit sonographic abnormalities as a result of various maternal complications, such as preeclampsia, diabetes mellitus (DM) anemia, cytomegalovirus (CMV) infection, toxoplasma gondii infection, or syphilis.^{4,7} The choice of intervention following the detection of an abnormality is primarily guided by gestational age. Accurate knowledge of gestational age is essential for making critical clinical decisions, such as performing cesarean sections or scheduling elective inductions. Gestational age is typically estimated as 280 days from the first day of the last menstrual period, meaning pregnancy dating begins prior to conception. Determining gestational age is a routine clinical consideration and Ultrasonography (USG) is frequently used for this purpose by measuring fetal parameters such as biparietal diameter (BPD). However, ultrasound assessments can be affected by observer bias, as the accuracy depends on the operator's technical expertise.⁸ The reliability of an ultrasonograph relies on the expertise of the people using it and making it vulnerable to observer bias. The accuracy of the gestational age estimation can be compromised by fetal factors, variable measurement methodologies and positioning difficulties.⁸ The purpose of the study is to measure and assess placental thickness as an ultrasonographic parameter for estimating gestational age in uncomplicated pregnancies in Chattogram, Bangladesh.

Materials and methods

This hospital-based cross-sectional observational study was conducted in the outpatient Department of Anatomy at Chittagong Medical College Hospital and IBH Agrabad, Chattogram. The study participants were chosen based on enrollment criteria, specifically those without medical difficulties who attended the Radiology and Imaging Departments at Chittagong Medical College and Hospital and Islami Bank Hospital, Agrabad, Chattogram. The investigation was conducted from July 2023 to June 2024. The research was conducted following consent from the Ethical Review Committee of Chittagong Medical College, the authority of IBH and the relevant Departments. Informed consent was acquired from every patient. Utilizing non-probability purposive sampling methods, 112 uncomplicated pregnant women in the 11th to 40th week of gestations were selected.

Inclusion criteria

- Normal healthy singleton pregnant Bangladeshi women of Chattogram with gestational ages between 11th week to 40th week.
- Had given consent for study.
- Residence in Chattogram, Bangladesh.

Exclusion criteria

- Placenta with poor visualization.
- Placental abnormalities eg. Placenta previa etc.
- Uterine or adnexal mass.
- Abnormal menstrual cycle.

'Data were compiled into a master sheet using Microsoft Excel, then imported into the Statistical Package for Social Sciences (SPSS-26) for further processing and analysis. Pearson's correlation test was used to assess the relationship between placental thickness and biparietal diameter.' Results were considered statistically significant if the p-value was <0.05 at a 95% confidence level. The findings were displayed in tables and figures.'

Results

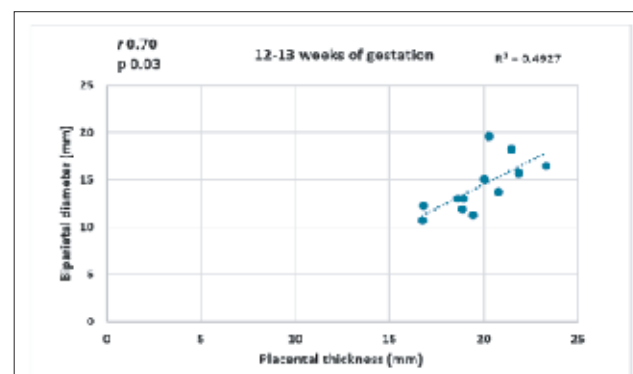


Figure 1 Placental thickness and biparietal diameter correlation at 12-13 weeks of gestation (n=12)

This scatter plot shows a moderately strong positive correlation ($r = 0.70$, $p = 0.03$) between placental thickness and biparietal diameter at 12-13 weeks gestation, meaning as placental thickness increases, fetal head size (BPD) also tends to increase significantly. Placental thickness explains only about ($R^2 = 0.4927$) of the variation in fetal head size at this stage.

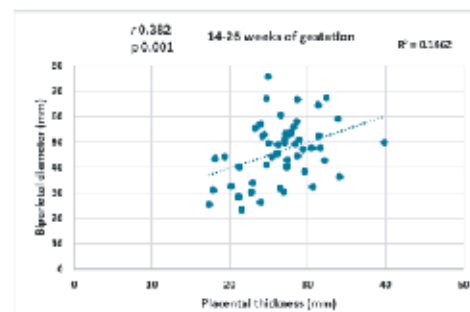


Figure 2 Placental thickness and biparietal diameter correlation at 14-26 weeks of gestation (n= 47)

There is a statistically significant but mild positive correlation ($r = 0.382$, $p = 0.001$) between biparietal diameter and placental thickness during 14-26 weeks of gestation. Placental thickness explains only about ($R^2 = 0.1462$) of the variation in fetal head size at this stage.

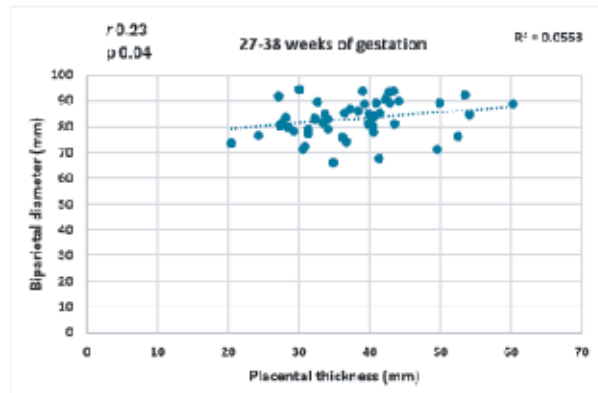


Figure 3 Placental thickness and biparietal diameter correlation at 27-40 weeks of gestation ($n = 53$)

Based on the data for 27-38 weeks of gestation, there is a statistically significant and positive correlation ($r = 0.23$, $p = 0.04$) between biparietal diameter and placental thickness, indicating that placental thickness explains only about ($R^2 = 0.0529$) of the variation in fetal head size during this late stage of pregnancy.

Table I Correlation between placental thickness and Biparietal diameter

Gestational week□	Correlation (r)□ PT vs BPD□	p-value
12-13 weeks□	0.70□	0.03*
14-26 weeks□	0.38□	0.001*
27-38 weeks□	0.23□	0.04*

* p-value significant at < 0.05 ; and highly significant at < 0.01

In Table I shows that the correlation between placental thickness with biparietal diameter in 12-13 weeks ($r=0.70$, $p=0.03$), 14-26 weeks ($r=0.23$, $p=0.001$) and 27-38 weeks ($r=0.23$, $p=0.04$) which are positive and statistically significant.

Discussion

In the first trimester, the study found a significant positive correlation between gestational age at 12–13 weeks and placental thickness ($r = 0.70$, $p < 0.03$). This finding is similar to Karthikeyan et al. who reported $r = 0.609$ ($p < 0.0001$) for the same gestational weeks and Sharami et al. (2023) who found $r = 0.269$ ($p = 0.047$) at < 14 weeks. Verma et al. also reported a strong positive correlation between both PT and BPD with GA ($p = 0.000$).^{8,9,10}

The current study identified a substantial positive association between gestational age and placental thickness, indicating that placental thickness consistently increases as pregnancy advances. This discovery aligns with the findings of Mathai et al. and Verma et al. who showed a very strong correlation ($p = 0.000$).^{11,10} Ganjoo S et al. also found significant positive correlation between PT, GA, and BPD in the second trimester ($p < 0.001$).¹²

In the third trimester, the study found a significant positive correlation between gestational age at 27–38 weeks and correlation between placental thickness and biparietal diameter is $r=0.23$ and $p=0.04$, which is positive and statistically significant. Karthikeyan et al. and Vinchurkar et al. both reported $r = 0.814$ ($p < 0.001$) for PT and GA. Verma et al. again confirmed strong correlation ($p = 0.000$). Singhal M et al. found a significant positive correlation from 13–33 weeks, which became less strong but still significant from 34–40 weeks ($r = 0.291$, $p = 0.023$).^{8,13,10,14}

The present study demonstrates that placental thickness increases with biparietal diameter and both parameters show a significant association with gestational age across all trimesters. These findings are consistent with previous studies, including those by Mungamuru et al. and Verma et al. which also reported a strong positive relationship between placental thickness, biparietal diameter and gestational age throughout pregnancy.^{15,10}

Limitation

As there is no recognised scale for placental thickness measurement, that's why we couldn't directly calculate gestational age by measuring placental thickness to find out expected date of delivery.

Conclusion

The study observed a gradual increase in placental thickness with advancing gestational age and a significant positive correlation between placental thickness and biparietal diameter, indicating its close association with gestational age. These findings suggest that placental thickness can serve as a reliable ultrasonographic biometric parameter for estimating gestational age in normal pregnancies.

Recommendation

Based on the study findings, it is recommended that future research include both uncomplicated and complicated pregnancies, particularly those with fetal anomalies, to improve the accuracy of gestational age estimation when conventional biometric parameters are unreliable. Placental thickness should be considered alongside other fetal measurements for gestational age assessment in normal singleton pregnancies and may serve as a useful predictor in cases where the last menstrual period is unknown.

Disclosure

The authors declare no conflict of interest.

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