Correlation of Placental Thickness with Gestational Age in Normal Singleton Pregnancy in Bangladeshi Population

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Abstract

Background: Estimation of accurate Gestational Age (GA) is essential for antenatal care. There are different methods of estimating GA. Among them first day of Last Normal Menstrual Period (LNMP) is a common if the menstrual cycle is regular. In many countries, it was reported that Placental Thickness (PT) can be used as an alternative ultrasonographic parameter in these regards. The present study was aimed to evaluate the correlation of PT with other traditional ultrasonographic fetal biometrics to estimate GA. To measure and evaluate the placental thickness for the estimation of gestational age by ultrasonography in uncomplicated pregnant women of Chattogram, Bangladesh.

Materials and methods: This cross-sectional observational study was conducted among 112 uncomplicated pregnant women from 11^{th} to 40^{th} week of gestation, living in Chattogram, Bangladesh. The participants of the study were selected who had no medical complications and attended Radiology and Imaging Department of, Chittagong Medical College Hospital (CMCH) and Islami Bank Hospital Agrabad, Chattogram, according to enrollment criteria. The study subjects were divided into three groups, 11^{th}-13^{th}, 14^{th} – 26^{th} and 27^{th} – 40^{th} week.

Results: In this study, the age of the respondents ranged from 18-41. In the present study PT, was observed to increase gradually as Gestational Age (GA) advances. The mean PT was 14.20±3.01 mm in 12^{th} week and 41.67±2.33 mm in 38^{th} week of gestation. Scatter diagram by pearson's correlation test showed significant positive correlation of PT with GA in 11^{th} -13^{th} week as ($r=0.61$, $p<0.05$), 14^{th}-26^{th} week as ($r=0.43$, $p<0.05$) and in 27^{th}-40^{th} week as ($r=0.29$, $p<0.05$).

Conclusion: The observations of this study showed that placental thickness was seen to increase gradually as gestational age advances. Present study demonstrated that placental thickness can be used as an ultrasonographic biometric parameter for the estimation of gestational age.

Key words: Gestational age; Placental Thickness (PT); Ultrasonography (USG).

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Introduction

The placenta performs essential activities for the fetus, including metabolic, immunological, endocrine, respiratory and nutritional roles. The correct structure and function of the placenta are vital for the appropriate growth and development of the fetus. Fetal weight increase exhibited a substantial correlation with both placental weight and volume.[1] The placenta commences development from the chorion frondosum and decidua basalis during the 8th week of intrauterine life. Ultrasonography (USG) can differentiate the chorion frondosum from the thinner chorion laeve by its thickness as early as the 8th to 9th week. Beginning around 10 weeks, the placenta is distinctly identifiable as a disk-shaped organ.[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 cleftted. The fetal surface, on the other hand, is smooth, shining, and transparent.[4] There is considerable evidence that placental thickness influences perinatal outcomes and is associated with fetal development. When the placental diameter is 18 cm or more and the placental thickness is 2 cm at 36 weeks of gestation, there is an increased chance of having a baby born with a low birth weight.[5] Previous research found a positive association between Placental Thickness (PT) and the development of preeclampsia. It should be noted that a thick placenta was found to be a major risk factor. Preterm and term preeclampsia were associated

with placentas that were thicker, measuring about, according to a cohort research that found similar results.[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 selection of interventional method utilized upon identifying an abnormality is determined by the gestational age. Almost all critical clinical choices, including cesarean sections and elective labor inductions, depend on an awareness of gestational age. The gestational age is around 280 days, calculated from the first day of the last menstrual cycle, hence, pregnancy dating begins before conception. Establishing gestational age is a common clinical concern. Ultrasonography (USG) is commonly utilized to determine gestational age by assessing fetal measurements, including Biparietal Diameter (BPD) Abdominal Circumference (AC) Head Circumference (HC) and Femur Length (FL). An ultrasonograph is prone to observer bias due to its dependence on the technical skill of the observers.[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] To measure and evaluate the placental thickness for the estimation of gestational age by ultrasonography in uncomplicated pregnant women of Chattogram, Bangladesh.

Materials and methods

This cross-sectional observational study was conducted in the Department of Anatomy at Chittagong Medical College Hospital. 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 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 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 gestation were selected.

Inclusion criteria

i) Normal healthy singleton pregnant Bangladeshi women of Chattogram with gestational ages between 11th week to 40th week.

ii) Subjects who provided written consent to participate in this study.

Exclusion criteria

i) Placenta with poor visualization.

ii) Placental abnormalities eg. Placenta previa etc.

iii) Uterine or adnexal mass.

iv) Subjects who did not have normal menustrual cycle prior to pregnancy.

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. The data were presented as numbers, percentages, or mean ± standard deviation. The means of PT, BPD, FL, and AC values were calculated and Pearson's correlation test was used to assess the relationship between these measurements and gestational age. 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

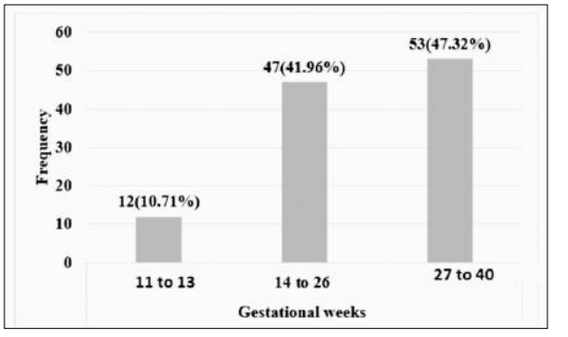

Figure 1 Distribution of respondents according to gestational age (n=112)

Figure 1 shows that In 11th to 13th week of gestational age there was 12 (10.71%) participants, in 14th to 26th week of gestational age there was 47 (41.96%) participants and in 27th to 40th week of gestational age there was 53 (47.32%) participants.

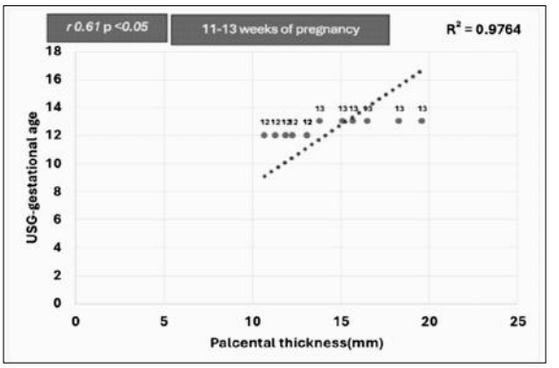

Figure 2 Scatter diagram and correlation graph between placental thickness and gestational age (11-13) weeks of pregnancy (n=12)

Figure 2 showing Pearson's correlation test between placental thickness (mm) and gestational age (week) showed significant positive correlation, r=0.61, R^2=0.9764 and p<0.05.

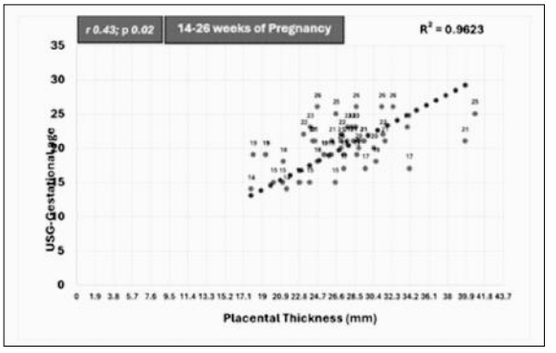

Figure 3 Scatter diagram and correlation graph between placental thickness and gestational age (14-26) weeks of pregnancy (n=47)

Figure 3 shows Pearson's correlation test between placental thickness (mm) and gestational age (week) showed significant positive correlation, r=0.43,R^2=0.9623 and p=0.02

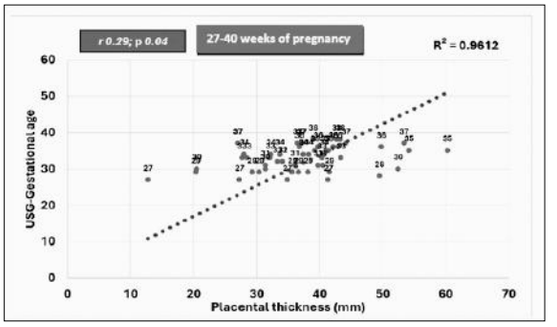

Figure 4 Scatter diagram and correlation graph between Placental thickness (mm) and gestational age (27-40) weeks of pregnancy (n=53)

Pearson's correlation test between placental thickness (mm) and gestational age (week) showed significant positive correlation, r=0.29, R^2=0.9612 and p=0.04

Table I Mean and frequency distribution of Placental thickness at different gestational age (n=112)

GA in □ weeks□	No. of □ participants□	PT Mean ± SD (mm)
11□	Nil□	----------
12□	8□	14.20±3.01
13□	4□	16.08±1.87
14□	2□	21.52±2.56
15□	6□	22.90±2.21
16□	Nil□	----------
17□	3□	30.36±3.42
18□	3□	22.95±2.47
19□	6□	24.18±4.38
20□	3□	28.83±1.70
21□	10□	27.06±9.31
22□	3□	27.30±4.05
23□	5□	28.49±3.55
24□	Nil□	----------
25□	2□	33.70±10.04
26□	4□	29.26±3.42
27□	4□	29.10±12.30
28□	1□	49.5
29□	7□	27.85±12.06
30□	3□	34.80±16.27
31□	4□	36.94±4.16
32□	3□	33.87±0.49
33□	5□	34.43±7.11
34□	6□	35.05±4.55
35□	5□	47.23±9.43
36□	5□	42.30±4.82
37□	7□	37.50±9.29
38□	3□	41.67±2.33
39□	Nil□	----------
40□	Nil□	----------

Discussion

In accordance with inclusion and exclusion criteria, 112 healthy singleton pregnant women underwent ultrasonographic Two-Dimensional (2D) imaging of their growing fetuses, including the placenta. Between the twelfth and thirteenth weeks of pregnancy, the Placental Thickness (PT) grows by 1.88 mm each week. At 12th weeks, the mean thickness is 14.20 ± 3.01mm, and at 13th weeks, it is 16.08 ± 1.84mm. 'In the study conducted by Karthikeyan et al. observed that PT increased by 2.68 mm in 12th to 13th week. In their study mean PT in 12th weeks was 15.16 ± 0.5 mm and in 13th weeks was 17.84 ± 0.79 mm.[8]

The observation of this study is nearly similar to the findings with the current study. In another cross sectional study conducted by Sharami et al. observed that PT was measured by ultrasonography.[9] They found PT in 11th week as 15.48±3.96 mm, 12th week 17.44±2.88 mm and 13th week as 16.61±3.2 mm. Their study showed PT increased by 1.96 mm from 11th to 12th week but from 12th to 13th week PT was seen to decrease by 0.83mm. These observations of this study are not quite similar with the findings of the present study. This quite dissimilarity may be due to racial as well as variation in sample size. In the current study the mean PT was at 14th week as 21.52 ± 2.56 mm and at 26th week it is 29.26 ± 3.42. Sharami et al. found PT at 14th week 20.31±5.35 mm and at 26th week 27.35±4.2 mm. In these weeks PT was seen to increased upto 7.05mm.[9] Vinchurkar et al. observed PT measured by ultrasonography. They found PT in 15th week as 2.06±0.37 cm, 26th week 3.07±0.18 cm.[10] Karthikeyan et. al. in their study in India among 211 subjects reported that mean placental thickness at 14th week was 18 ± 0.46mm and at 26th week was 31.73 ± 0.57mm. In these weeks the PT increased by more than 13.45 mm.[8] In this study mean thickness at 27th week was 29.10 ± 12.30mm and at 40th week it was 41.67 ± 2.32 mm. 'Karthikeyan et al. in their study observed that placental thickness increased by 9.76 mm in 27th - 38th week.[8] In the present study, it has been shown that Gestational Age (GA) (12-13 weeks) was significantly positively correlated with placental thickness in mm (r= 0.61, p<0.05). A study by Karthikeyan et al. reported a positive correlation (r= 0.609, p <0.0001) between placental thickness and fetal age in the 12th- 13th week.[8] Sharami et al. found positive correlation of placental thickness with gestational age (r=0.269, p=0.047) at <14 week.[9] The findings of these studies are similar with the finding of the present study. In the present study, it has been shown that Gestational Age (GA) (14th-26th week) was significantly positively correlated with placental thickness in mm (r= 0.43, p<0.05). Mathai et al. conducted a study to assess the relationship between placental thickness and gestational age. They found positive significant correlation (r=0.135, p= <0.001).[11] In the present study, it has been shown that Gestational Age (GA) (27th-38th weeks) was significantly positively correlated with placental thickness in mm (r 0.29, p=0.04). Karthikeyan et. al. found a significant positive correlation between placental thickness and gestational age in the (r=0.814, p <0.001).[8] Vinchurkar et al. shows a positive significant correlation between placental thickness and gestational age (r=0.814, p <0.001).[10]

Limitation

Long-term follow-up was beyond the scope of the study. In this study there was no participant in 11th,16th, 24th, 39th and 40th week of gestation due to failure of fulfilment the enrolment criteria during the study period of this study .

Conclusion

In the present study placental thickness was observed to increase gradually as gestational age advances. Statistically significant positive correlation was found between placental thickness with gestational age. From the observations of the current study, it can be concluded that placental thickness can be used as an ultrasonographic biometric parameter for the estimation of gestational age among normal pregnant women.

Recommendation

Depending upon the study findings, following recommendations are suggested:

- Further study can be performed in uncomplicated or complicated pregnancies with congenital anomalies of fetus to estimate accurate gestational age especially where other traditionally practiced fetal biometrics might not be reliable to proper estimation of gestational age.
- Placental thickness can be use as a parameter with others fetal biometric parameters to estimate the gestational age in normal singleton pregnancy.
- Placental thickness may also be used as a predictor for the estimation of gestational age in women with unknown LMP (Last Menustral Period).

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Contribution of authors

TAB-Acquisition of data, data analysis, drafting and final approval.
MA-Conception, design, critical revision and final approval.
MBU-Interpretation of data, critical revision and final approval.
AS-Acquisition of data, data analysis, drafting and final approval.

Disclosure

All the authors declared no conflict of interest.

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