

PLACENTAL THICKNESS AND ITS CORRELATION TO GESTATIONAL AGE

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Abstract

Background: Estimating the gestational age of the foetus is a crucial step in modern obstetrics. Fetal crown-rump length (CRL), head circumference (HC), biparietal diameter (BPD), and femur length (FL) are some of the metrics that are available for it. We designed the current study, to determine the association of gestational age with placental thickness so that it can be used as another method for calculating gestational age. **Materials and Methods:** It was a cross sectional study conducted in 380 antenatal women. The cases were recruited for the present study to determine the normal placental thickness for various gestational age and to study the correlation between ultrasonographic measurement of placental thickness and gestational age of the fetus. Ultrasound examination was done for measurement of placental thickness. Also assessment of BPD, HC, AC, and FL was done. After obtaining all the results, the data was compiled by SPSS software. Correlation coefficient was used for assessment of level of significance between placental thickness and gestational age. **Result:** A linear relationship was found between the placental thickness and the gestational age, during the 11 weeks to 40 weeks of gestation. It gradually increased from 10 mm at 11weeks to 39.3mm at 40 weeks of gestation. The correlation between placental thickness and gestational age in weeks was statistically significant, $r=0.977$, $p < 0.001$. Also there was a significant positive correlation between placental thickness with other fetal biometric parameters like BPD, FL, AC and HC ($p < 0.001$). We also derived a regression equation for predicting the gestational age from placental thickness, $y = 1.81 + 9.53 x$ (y = gestational age in weeks, x = placental thickness in cm). **Conclusion:** There appears a linear relationship between gestational age and placental thickness. Thus, placental thickness can be reliably used to estimate gestational age especially for antenatal women whose clinical history is not reliable, who come for antenatal booking in second half of pregnancy and in those with an irregular cycle.

INTRODUCTION

Exact determination of gestational age is crucial for appropriate antepartum care as well as successful outcome of pregnancies. The exact knowledge of gestational age is also important for undertaking various diagnostic procedures that needs to be performed within a narrow range of a particular gestational age. Gestational age is of utmost importance in interpretation of biochemical screening tests for risk assessment of various foetal anomalies, and for clinical decisions which includes caesarean section, elective induction of labour etc.^[1] The gestational age (GA) is frequently over or underestimated, as the conventional gestational age estimation is based on the Last Menstrual Period

(LMP) and on ultrasonography (USG) by foetal biometry. Because of poor memory, an irregular menstrual cycle of varying duration, lactational amenorrhea, bleeding in the first trimester, hormonal contraceptive use before conception, and the fact that many people are unaware of their LMP, dating a pregnancy by LMP may be challenging. Ultrasonography (USG) is frequently used to estimate gestational age (GA) by measuring the fetal biometric parameters such as the Crown Rump Length (CRL), Biparietal Diameter (BPD), Abdominal Circumference (AC), Head Circumference (HC), and Femoral Length (FL). But the accuracy of the gestational age estimation may be hampered by the foetal characteristics, various measurement methods, and positioning issues.^[2]

Also the accuracy of common ultrasound parameters for the estimation of gestational age decreases as pregnancy advances in age.^[3] As a result, it is necessary to investigate other measures that might support the existing foetal biometric parameters in accurately estimating gestational age which is accurate and reproducible. The use of placental thickness (PT) was assessed in the light of the limitations in the use of the standard foetal characteristics in predicting gestational age, based on the finding that placental thickness increases with advancing gestational age.

Primary objective:

To estimate the correlation between placental thickness and gestational age.

MATERIALS AND METHODS

The study was conducted in 380 antenatal women between 11-40 wks of gestation attending antenatal OPD at Government medical college Kottayam who satisfied the inclusion criteria. It was a hospital based cross-sectional study, started after approval from Institutional Ethics Committee. Informed written consent was taken from patient.

Inclusion Criteria

1. Maternal age between 18-40 years.
2. Uncomplicated Singleton pregnancies, 11-40 weeks of gestation
3. Known last menstrual period.
4. A history of regular menstruation.

Exclusion Criteria

1. Maternal Disease
 - Diabetes Mellitus.
 - Hypertensive disorders of pregnancy
 - Anaemia
2. Foetal anomalies.
3. Placenta previa, placental anomalies and poor visualization of the placenta

4. Multiple pregnancy.
5. Rh isoimmunisation

The placental thickness was measured by transabdominal USG, at the level of umbilical cord insertion to placenta, using electronic calipers on a plane perpendicular to the uterine wall, from the chorionic plate to the beginning of the basilar-myometrial interface. Colour flow doppler was used to identify the cord insertion site to the placenta. Each measurement was taken three times and the average value was taken to reduce intra-observer variation and to ensure accuracy. Fetal biometric measures like CRL, BPD, HC, AC and FL were also measured. Data was entered in Microsoft excel and analyzed using SPSS 25 software. Categorical variables were expressed as frequency (percentage) and continuous variables were expressed in mean and standard deviation. Comparison of mean placental thickness with placental position, age group, parity and trimester were done using One-way ANOVA test. Post hoc test was done using Tukey Post Hoc test. Correlation of placental thickness with gestational age in weeks and the various fetal biometric parameters (BPD, HC, AC, FL) were assessed using Pearson correlation test. For all these statistical interpretations, $p < 0.05$ was considered the threshold for statistical significance.

RESULTS

The table shows the distribution of participants in the study population according to the age group, obstetric score and placental position. Out of 380 pregnant women majority belonged to the age group of 21-25 years (45.5%) followed by 26-30 years (29.2%); 35.8 % were primi-gravida; and 44% had placenta in the anterior position.

Table 1: Description of the Population.

Characteristic	Status	Frequency	Percent
Age group	18 - 20 years	43	11.3
	21 - 25 years	173	45.5
	26 - 30 years	111	29.2
	31 - 35 years	44	11.6
	36 - 40 years	9	2.4
Obstetric score	Primi gravida	136	35.8
	Second Gravida	133	35.0
	Third Gravida	93	24.5
	Fourth Gravida	18	4.8
Placental position	Anterior	167	43.9
	Posterior	156	41.1
	Fundal	57	15.0

Table 2: Mean Placental Thickness

Gestational age in Weeks Completed	n	Mean (S.D)
11	4	10.0 (0.0)
12	11	10.8 (0.9)
13	8	12.1 (1.1)
14	13	11.3 (1.8)
15	6	16.7 (2.6)
16	5	17.2 (2.6)

17	2	16.0 (0.0)
18	8	19.0 (1.1)
19	6	19.2 (0.08)
20	1	18.0
21	11	20.5 (0.05)
22	13	21.8 (0.07)
23	9	22.1 (0.13)
24	21	22.8 (0.19)
25	12	23.3 (0.25)
26	16	26.8 (0.20)
27	21	27.1 (0.16)
28	16	28.6 (0.14)
29	12	29.1 (0.08)
30	12	29.8 (0.5)
31	18	30.6 (0.6)
32	6	30.8 (1.0)
33	20	31.9 (1.4)
34	13	32.8 (1.7)
35	14	34.2 (3.1)
36	32	35.7 (2.0)
37	23	36.1 (1.5)
38	30	37.5 (1.6)
39	5	39.0 (1.2)
40	12	39.3 (1.0)

In the first trimester (11 – 14 weeks), 2nd trimester (15-28weeks) and the 3rd trimester (29 – 40 weeks) of sample sizes 36, 147 and 197 respectively, there was an increment in placental thickness with the gestational age. The placental thickness increased by more than 1.5mm in a week in the first trimester. From the 15th to the 19th week, the placental thickness increased by more than 3 mm and from the 21st to the 25th week, it increased by more than 8mm. Between the 19th to the 20th week, the placental thickness decreased by 1 mm. Between the 21st week to the 40th week, the placental thickness increased linearly. The maximum placental thickness was 39.3 mm at 38 weeks and the minimum was 10mm at 11 weeks. The average placental thickness was 27.8mm.

Table 3: Post HOC Test Using Tukey's Test

(I) Trimester	(J) Trimester	Mean Difference (I-J)	P value
First trimester	Second trimester	-1.14	<0.001*
First trimester	Third trimester	-2.29	<0.001*
Second trimester	Third trimester	-1.16	<0.001*

There is a statistically significant difference between the mean placental thickness among patients in different trimesters.

Table 4: Pearson correlation

	n	r	P value
Placental thickness v/s Gestational age in weeks	380	0.977	<0.001*

The correlation between placental thickness and gestational age in weeks was statistically significant, $r = 0.977$, $p < 0.001$. In the study, a regression equation was derived to find out gestational age in weeks from placental thickness in cm. Regression equation: $y = 1.821 + 9.53 x$. (y = gestational age in weeks, x = placental thickness (cm)). The r^2 for this equation was 0.955; that is, 95.5% of the variance in gestational age was predictable from placental thickness.

Table 5: Correlation of fetal biometric parameters to placental thickness

Parameter	N	Correlation coefficient [r]	p value
BPD	355	0.973	<0.001*
HC	355	0.915	<0.001*
AC	355	0.973	<0.001*
FL	355	0.972	<0.001*

The Correlation between various fetal biometric parameters to placental thickness were also studied. There is excellent positive correlation between various fetal biometric parameters and placental thickness. All the parameters like BPD, HC, AC and FL showed a positive correlation with placental thickness. Correlation coefficient between BPD and AC was 0.973 and that of HC 0.915, FL 0.0971 and

the p value was <0.001 for all the fetal biometric parameters.

The [Figure 1] shows mean placental thickness (measures in mm) across placental position, age group, parity and across trimesters. There was no significant difference between placental thickness and various patient parameters. There was increase

in placental thickness with gestational age in each trimester.

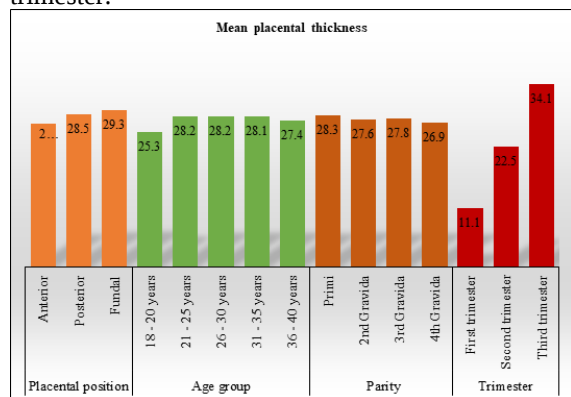


Figure 1: Mean placental thickness

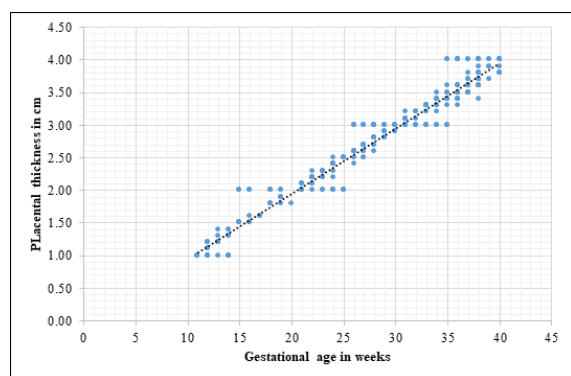


Figure 2: Scatter plot Gestational age in weeks vs placental thickness

There is excellent correlation between placental thickness in cm and gestational age in weeks.

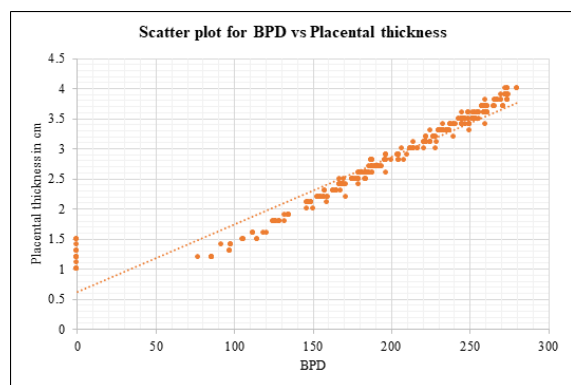


Figure 3: Scatter plot for BPD vs placental thickness

DISCUSSION

It was a hospital based cross-sectional study involving 380 antenatal women with uncomplicated singleton pregnancy. There was a statistically significant linear relationship between placental thickness and gestational age.

In our study there was increase in placental thickness with gestational age in each trimester. The correlation coefficient between placental thickness and gestational age was 0.978. It was found to be significant with p value <0.001. Similar results were

obtained in study done by Karthikeyan,^[5] with correlation coefficient 0.968, which was significant at a 5% confidence Interval. These results show a very high positive correlation between the GA and the placental thickness. Similar results were obtained in a cross-sectional study done by Dr. Abiola O. Olaleye,^[6] which recruited consecutively a total of 406 pregnant women with singleton pregnancies. In another study done by Ritu Mehta^[7] it was shown that average placental thickness was roughly equivalent to gestational age in weeks till 38 weeks, thereafter decreased. The study was conducted in 403 pregnant women. The researcher also noted that there was significant positive correlation between placental thickness and estimated fetal weight. Thus subnormal placental thickness for gestational age can be taken as a marker for FGR.^[7]

In the present study there was no statistically significant difference between placental position and placental thickness as evidenced by P value of 0.13. Similar results were obtained in a study done by Dr Patsy Varghese.^[8] In their study, between 20-32 weeks the P value for correlation coefficient between placental thickness and gestational age was <0.01 which showed a perfect correlation. After 32 weeks this relation was not followed. In our study positive correlation existed in all trimesters except between 19th and 20th weeks where there was a slight decrease in placental thickness. In a study by Lee,^[9] there was a difference of about 7mm in placental thickness between anterior and posterior placentation.

When the mean placental thickness was compared with parity, we did not find any significant correlation between them. Similar results were obtained in the study done by Verma P.^[10] In their study, both composite gestational age and gestational age calculated by Placental thickness had correlation coefficient values (r) above 0.9.

Our study showed a positive correlation with placental thickness and fetal parameters like BPD, HC, AC and FL. Similar results were obtained in study done by Karthikeyan and in another study by Dr. Abiola O. Olaleye.^[5,6]

CONCLUSION

Estimating the gestational age of the foetus is a crucial step in modern obstetrics. There is a linear correlation between placental thickness and gestational age. Gestational age can be derived from placental thickness. Also, Placental thickness has got a strong positive correlation with other fetal biometric parameters. So, placental thickness can be used alone or as an adjunct to other fetal biometric parameters to assess gestational age.

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