

Gestational age determination by ultrasonic placental thickness measurement

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Abstract

Introduction: Gestational age is frequently estimated based on last menstrual period and on ultrasonography. Many people are unaware of their last menstrual period due to irregular menstruation and ultrasonography is bound to have a bias, thereby posing difficulties in the estimation of gestational age. Placenta is a fetal organ which provides the physiological link between pregnant women and her fetus. Placental growth can be estimated by measuring the thickness and estimating its volume. Placental thickness is directly related to the gestational age of the fetus till certain weeks of pregnancy.

Objectives: To study the correlation between ultrasonographic placental thickness and gestational age of the fetus

Methods: This is an observational study done at ESIC Medical College & PGIMS Chennai. 333 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.

Results: Placental thickness for gestational age 11-40 weeks calculated, it gradually increased from 14.6 mm at 11 weeks to 38.9 mm at 40 weeks gestation. Correlation coefficient is 0.98 and p value <0.0001. There is a significant positive correlation of placental thickness with other fetal biometry parameters like BPD, FL, AC, HC and CRL. (p < 0.0001) for BPD, FL, AC and HC and (p=0.02) for CRL.

Discussion: There appears to be a linear relationship between gestational age and placental thickness. Thus, placental thickness can be reliably used to estimate gestational age importantly for mothers whose clinical history is not reliable, who come for antenatal booking in second half of pregnancy and in conditions where BPD measurements becomes less reliable.

Keywords: Placental thickness, Gestational age, Ultrasonography, Fetal biometry.

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Introduction

Placenta is a fetal organ with important metabolic, endocrine and immunological function and provides the physiological link between pregnant women and fetus. The placenta develops from chorionic villi at implantation site at about 5 week of gestation and by 10 week the granular echotexture of placenta is apparent on ultrasonography.^{1,2} Ultrasonography has provided a safe and non-invasive means to evaluate the placenta. Its size and growth pattern have a bearing on fetal outcome. Placental thickness also helps in differentiating normal from abnormal pregnancy. Small and thin placenta is associated with Intrauterine growth restriction (IUGR) of fetus.³ Thicker placenta are seen in fetal hydrops, antepartum infections, maternal Diabetes and maternal Anaemia. Placental thickness and volume have been used to predict chromosomal anomalies and diseases such as pre-eclampsia, thalassemia.

Gestational age is of utmost important in interpretation of biochemical screening test for risk

assessment of various fetal anomalies. Even clinical decision which includes caesarean section, elective induction of labour etc. depend on knowledge of gestational age.⁴

Gestational age is frequently improperly estimated when many women who do not recall last menstrual period and have irregular periods the use of ultrasonography helps in estimating the correct gestational age. Ultrasonography is commonly used to estimate the gestational age by measuring the fetal dimensions like BPD, AC, HC and FL. Mitra et al showed that BPD was not reliable in the fetus which had a premature rupture of membrane⁵. So there is a need of another parameter for supplementing the gestational age estimation with minimum error. Placental size is expressed in terms of thickness in the mid portion of the organ. At term, the placenta is discoid with a diameter of 15-25 cm and is approximately 3cm thick and weighs 500-600 gms. Placental thickness increases with age of fetus. We think that placental thickness should have certain relationship with fetal growth parameters especially BPD and AC.

Determination of the placental size is a part of the overall assessment of intrauterine environment. The purpose of this study was to evaluate placental thickness as a sonological indicator for estimation of gestational age of fetus.

Material and Methods

The present prospective observational study was conducted on 333 antenatal women attending antenatal clinics in the department of Obstetrics and Gynaecology in collaboration with the department of Radiology at ESIC Medical College, Chennai. Ethical committee clearance was obtained from the Institutional Ethical Committee. Written informed consent was taken from the volunteers.

Women with uncomplicated, singleton pregnancy from 11-40 weeks were included in the study. Women with irregular periods, not sure of LMP, pregnant women with polyhydramnios, diagnosed IUGR, Hydrops, multiple pregnancy, fetal anomalies, diabetes mellitus, hypertensive, heart disease, anaemia were excluded from the study. Detailed history was taken to rule out medical and surgical illness which could affect our study. Thorough general physical and obstetrics examination were done.

Ultrasonography examination was performed in Radiology Department with model LOGIQ200 pro-series 2D USG and 3.5 Mhz convex transducer.

Scanning Technique C

During scanning, the pregnant women was made to lie in supine position with the abdomen facing upwards, the probe was placed on the skin and a layer of gel was applied to the skin above the pubic area. To rule out oligohydramnios and polyhydramnios, amniotic fluid volume was measured by taking AFI. AFI was obtained

by adding the vertical length of deepest fluid pocket in 4 uterine quadrants⁶. Adnexa were looked for the presence of any mass. Fetus was also seen for the presence of any major congenital anomaly. Fetal lie and position were identified by moving the probe all over the abdomen and following fetal parameters were taken to rule out IUGR, BPD, AC, HC, FL and EFW. The placenta was identified as a hyperechoic area separated from fetus by a hypoechoic area of amniotic fluid. The two edges of placenta were focused in a single ultrasonographic field in transverse and longitudinal section. The probe was moved all over the localised placenta and the level of cord insertion was identified over the fetal surface. A straight line was drawn from the level of cord insertion upto the maternal surface of the placenta and the thickness (T) was measured. The maximum thickness was noted in the cross section. Each placenta was measured to a 1mm precision, at its greatest thickness, which was perpendicular to the uterine wall. The uterine myometrium and retroplacental veins were excluded. Data was analysed using statistical software package, version 17. Pearson's correlation coefficient was done to assess the relationship between placental thickness and gestational age. Regression analysis was done for estimation of gestational age using the measure of placental thickness. Association between placental thickness and placental location in each trimester was analyzed using one way ANOVA test.

Results

Table 1: Correlation between Placental Thickness and other variables

Variable	Correlation Coefficient(r^2) with Placental Thickness	'p'
Gestational Age	0.98	< 0.0001 Significant
Biparietal Diameter	0.93	< 0.0001 Significant
Femur Length	0.92	< 0.0001 Significant
Abdominal Circumference	0.91	< 0.0001 Significant
Head Circumference	0.22	< 0.0001 Significant
Crown Rump Length	0.35	0.0215 Significant

Table 2: Association between Placental Location and Thickness in each trimester

Placental Location	I Trimester		II Trimester		III Trimester	
	No. of cases	Mean \pm SD	No. of cases	Mean \pm SD	No. of cases	Mean \pm SD
Anterior	5	14.86 \pm 0.75	63	22.83 \pm 2.67	79	32.97,3.07
Posterior	4	14.5 \pm 0.32	67	22.71 \pm 2.95	76	33.19 \pm 2.63
Lateral	3	15.2 \pm 0.1	8	24.3 \pm 2.1	10	33.71 \pm 3.86
Fundal	3	16 \pm 0.2	7	22.77 \pm 3.95	8	31.67 \pm 0.25
'p'	0.2707 Not significant		0.9508 Not significant		0.7035 Not significant	

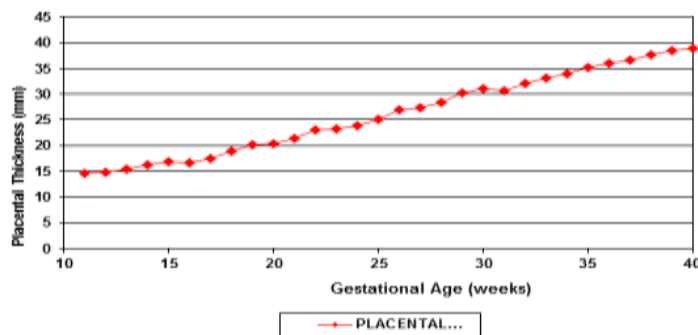


Fig. 1: Correlation between placental thickness and gestational age

This study included 333 antenatal women in the age group of 18 to 40 years. Of the total number, 149 were primi and 184 were multiparous. 15 women were in 1st trimester, 145 in 2nd trimester and 173 in 3rd trimester. Women with varying gestational age 11-40 weeks had undergone ultrasonographic examination along with the routine antenatal checkup. USG measurements included routine fetal biometry like CRL, BPD, HC, AC and FL, liquor volume and location and grading of placenta. The placental thickness was analysed in relation to gestational age.

Placental thickness had a linear relationship with gestational age. As gestational age increases placental thickness also increases as is evident from Fig 1. As the correlation was significant regression equation was calculated for estimation of gestational age with the placental thickness as Gestational Age (GA) = 1.061*Placental Thickness - 1.749.

Placental thickness with fetal biometry like BPD, FL, AC, HC and CRL also showed a positive correlation (Table 1). Comparison of the association between placental thickness and Placental location did not show statistical significance in all the three trimesters (Table 2).

Discussion

In our study a total of 333 antenatal women of all different gestational age were studied for their placental thickness. The mean value of placental thickness was calculated for different gestational ages from 11-40 weeks. It was observed that placental thickness gradually increased from 14.6 mm at 11 weeks to 38.9mm at 40 weeks gestation.

Controversy exists as to finding a significant correlation between placental thickness and gestational age. Appiah⁷ observed no significant correlation between placental thickness and the gestational age ($r=0.09$, $p>0.05$) and concluded that an increase in gestational age did not influence the thickness of the placenta significantly whereas, Nyberg and Finberg⁸ reported as gestational age increases placental thickness also increases.

The present study assessed the relationship between gestational age and placental thickness in which there appears to be a linear relationship between

gestational age and placental thickness thus a regression equation was calculated to measure gestational age with placental thickness as follows $GA=1.061*Placental\ Thickness - 1.749$.

Our results are also consistent with observation made by Mittal et al⁹ and Aditi Tiwari¹⁰ who reported placental thickness to match from 22-35 weeks of gestational age. Anupama Jain et al⁶ also in their study reported that placental thickness matched gestational age from 27-33 weeks.

Hellman et al¹¹ explained that as placental growth ceases after 37 weeks the thickness becomes lesser in the four weeks. Similar to this, our results report that the mean placental thickness was slightly in the higher range for the corresponding gestational age upto 19 weeks. From 20 weeks to 36 weeks gestation the placental thickness in mm is almost matched with corresponding gestational week. After 36 weeks, placental thickness started decreasing by 0.5 to 1mm to corresponding gestational age till 40 weeks.

Placental thickness almost had a positive correlation with other fetal biometry parameters like BPD and FL. This finding is consistent with other studies.^{12,13}

Durnwald et al¹⁴ quoted that placental location is significantly correlating with the placental thickness. Lee et al¹⁵ stated that there is a difference of about 7mm in placental thickness between anterior and posterior placentation. We did not observe a significant relevance between the placental location and thickness. Elchalal et al¹⁶ analysed sonographically thick placenta (> 4cm or >90th centile) is associated with increased perinatal mortality and morbidity like fetal anomalies, SGA or LGA infants at term. In our study none of the woman had placental thickness of more than 4 cm.

Conclusion

The linear increase in mean placental thickness with gestational age was observed. Placental thickness has a strong positive correlation with BPD and AC with both parameters having identical relationship with placental thickness. It is a useful adjunct to other biometric parameters in estimation of gestational age. Including placental thickness into routine fetal biometry might improve pregnancy dating and might also

minimize the discrepancy even late in second and third trimester. Measurement of placental parameters are effective for peripheral centres in India which do not have Doppler and 3DUSG facilities for timely referral and safe outcome of fetus.

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