International Journal of Clinical Obstetrics and Gynaecology

ISSN (P): 2522-6614
ISSN (E): 2522-6622

www.gynaecologyjournal.com
2020; 4(1): 74-78
Received: 01-11-2019
Accepted: 03-12-2019

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Study of placental thickness with respect to gestational age and fetal weight by ultrasonographical evaluation

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DOI: https://doi.org/10.33545/gynae.2020.v4.i1b.443

Abstract
Background: Placental thickness (PT) plays an important role when the menstrual age is not known. The present study was undertaken to first calculate the PT at level of insertion of umbilical cord and correlate it with gestational age and fetal weight, thereby establishing a nomogram for PT at different gestations.
Method: A total of 100 antenatal women from 11 to 40 weeks of gestation with singleton pregnancy and with no other obstetric or medical high risk factor were included in the study. A detailed history was taken from all the patients. Basic antenatal investigations, clinical and ultrasonography examination were done.
Results: The maximum (37%) patients were >30 weeks of gestation. 36% were between 20 to 30 weeks of gestation and 27% were between 12- 20 weeks of gestation. The mean PT was directly proportional to the advancing gestational age and had linear correlation with gestational age from 11 to 40 weeks. It was observed that the mean PT was 14mm at 12 weeks of gestation and proportionately increased and was 35mm at 40 weeks of gestation. The mean PT was 25.50±6.52mm and the mean estimated fetal weight was 1275.75±982.29gm. Thus, the significant positive correlation was found between PT and estimated fetal birth weight, (p value 0.000).
Conclusion: The linear correlation and statistical compatibility of placental thickness in estimation of gestational age makes it an alternate parameter for gestational age and fetal weight estimation.

Keywords: Placental thickness, umbilical cord, nomogram gestation, antenatal, ultrasonography

Introduction

Placenta is a fetal organ with important metabolic endocrine and immunologic functions besides being responsible for nutrition, respiration and excretion of the fetus. It provides physiological link between a pregnant woman and the fetus. The placenta develops from the chorionic villi at the implantation site at 5th week of gestation and by 9th to 10th week the diffuse echotexture of the placenta is clearly apparent on sonography [1, 2]. The role of ultrasonography in obstetrics has been immense. With advances in gray scale from 2D to 3D and Doppler sonography, it is possible to study sonographic appearance of placenta and its relation to uteroplacental blood flow measurement and intrauterine growth [3, 4]. It has been demonstrated that sonographically determined gestational age is more accurate than one based on the last menstrual period.
However making appropriate decision and delivering timely obstetric care is relied upon the gestational age derived from various methods. Precise knowledge of gestational age is required to identify the earliest fetal growth restriction and need of timely intervention. Various formulas and nomograms of various ultrasonographic parameters (CRL, BPD, HC, FL and AC) allow accurate assessment of gestational age and describe the normal growth of fetal structures [5].
Formula for gestational age from sonographic parameters;-

GA= -0.0007(CRL) 2 +0.1584(CRL) +5.287
GA= 39.1 +2.1(BPD)

Placenta, a physiologic link between mother and fetus has been widely studied but little is interpreted regarding its role in estimation of gestational age. Placental volume, surface area, thickness and grading of placenta show progressive increase in values with increasing gestational age. However placental thickness appears to be the simplest parameters in terms of ease of measurement and need of expertise for measurement. Placental thickness measured at the level of umbilical cord insertion can be used as a new parameter to estimate gestational age of the fetus [6]. Hence the present study was undertaken to first calculate the placental thickness at

level of insertion of umbilical cord and correlate it with gestational age and fetal weight, thereby establishing a nomogram for placental thickness at different gestations.

Materials and Methods

After obtaining Institutional Ethics Committee approval and written Informed consent from all the patients, this observational prospective study was conducted at LTMMC and LTMGH, Sion, Mumbai from May 2017 to October 2018 for a period of 18 months. Total 100 normal antenatal patients from 11 to 40 weeks of gestation with live singleton pregnancy attending OPD or admitted as inpatients were included in the study. Patients with hypertensive disorder of pregnancy, gestational diabetes mellitus, IUGR, twin gestation and patient with oligohydramnios/ polyhydramnios pregnancy were excluded from the study. All the selected patients were subjected to detailed history about age, obstetric history, and menstrual age from last menstrual period, medical history followed by clinical examination and basic antenatal investigations like haemoglobin, blood group, blood sugar levels and ultrasonography.

Ultrasonographic examination was done using 3.5Mhz convex assay and linear assay by "Toshiba-SSA-660A XARIO-USG" USG machine. The ultrasonograhy was done by Senior Medical Officer of the Radiology department and in a single machine to avoid errors. The woman was asked to lie in supine position. The estimation of gestational age was done by composite measurement of Biparietal diameter (BPD), Head Circumference (HC), Abdominal Circumference (AC) and femur length (FL). These fetal biometric measurements were taken using the standardized technique. Estimated gestational age and fetal weight were computed by the ultrasound machine based on Hadlock tables by inbuilt computation software. The Placental thickness was measured at the level of cord insertion. Transducer was oriented perpendicular to scan both the chorionic and basal plates. The measurement of placental thickness was done in millimetres. Amniotic fluid index was also measured to make sure there is no polyhydramnios or oligohydramnios.

Observations and Results

The mean age of study population was 24.93±3.99 years, ranging from 19-36years. Majority (87%) of patients belonged to reproductive age group of 20-30years. The difference between mean placental thickness and age group was not statistically significant, (P value 0.487). Thus there was no correlation between age group and placental thickness, (Table 1).

Table 1: Comparison of placental thickness with age group

Age Group	Frequency (%)	Mean Placental thickness
<20 years	05 (5%)	22.40±7.89
20-30 years	87 (87%)	25.56±6.44
>30 years	08 (8%)	26.81±6.94

Half (53%) of the study population were primigravidas followed by 2nd gravidas (29%) whereas parity ranged from 0-3. When mean placental thickness was compared with the parity, it was observed that mean placental thickness at a particular gestation has no correlation with parity and the p value was non-significant (0.258), (Table 2).

Table 2: Correlation between parity and placental thickness (MM)

Gravida/ Parity	Frequency (%)	Mean Placental Thickness (mm)	P value
Primi	53 (53%)	25.28±6.53	0.258, (>0.05) Not significant
G2P1L1	29 (29%)	24.45±6.50	
G3P2L2	16 (16%)	27.33±6.52	
G4P3L3	02 (2%)	32.00±0.71	

The maximum i.e. 37% of the population were above 30 weeks of gestation. 36% were between 20 to 30 weeks of gestation and 27% were between 12- 20 weeks of gestation.

The study calculated mean placental thickness at the insertion of umbilical cord at gestational ages from 11-40 weeks. It was observed that the mean placental thickness varied directly in proportion with gestational age from 14mm at 12 weeks to 35mm at 40 weeks. The mean thickness increased in correlation to the advancing gestational age. The placental thickness was found to have linear correlation with gestation age as shown in figure 1.

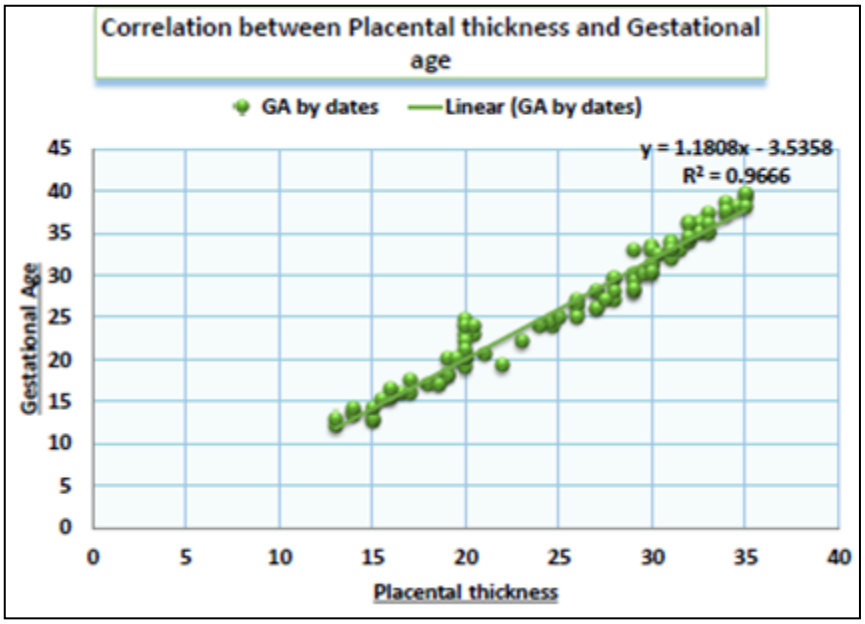

Fig 1: Correlation between placental thickness and gestational age

When assessed categorically, From 12 to 20 weeks, the mean placental thickness (17.02±2.45) was 2-3mm more than the gestational age. It has strong positive correlation and was statistically significant. From 20 to 30 weeks, the mean placental thickness (25.14±3.48) almost coincided with gestational age. It has a very strong positive correlation and was statistically significant. From 30-40weeks, the mean placental thickness (32.04±1.71) was 2-3mm less than the gestational age. It has a moderate positive correlation. Overall correlation from 12to 40 weeks, Mean placental thickness and gestational age have a very strong positive correlation.

The mean placental thickness was 25.50±6.52mm and the mean estimated fetal weight was 1275.75±982.29gm. The pearsons's correlation coefficient between the two was 0.936 proving the significant positive correlation between placental thickness and estimated fetal birth weight. Thus as the placental thickness increases the estimated fetal weight increases (p value 0.000), (Figure 2).

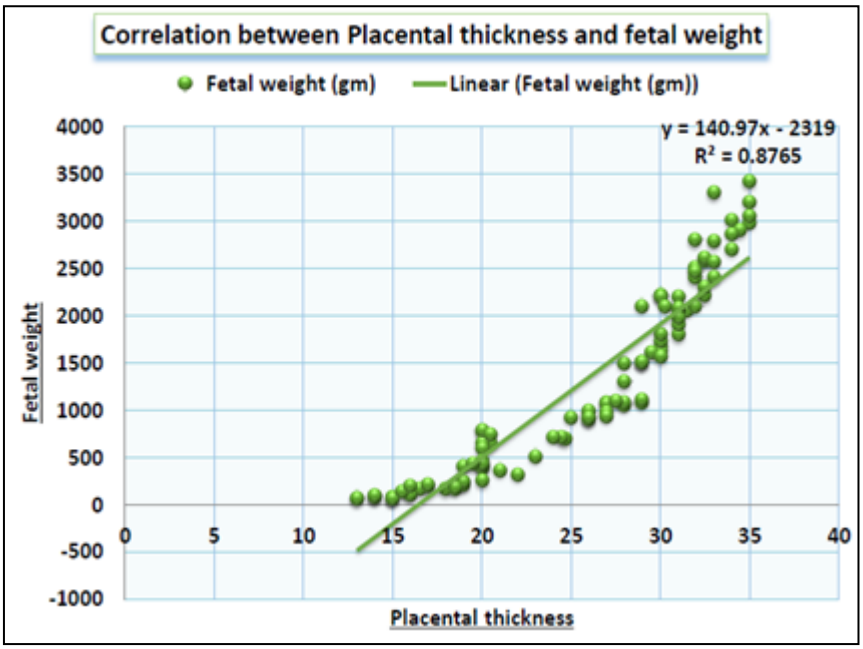

Fig 2: Correlation between placental thickness and fetal weight

Discussion

Accurate determination of gestational age has become important for deciding appropriate time for termination of pregnancy as well as to monitor the fetal growth during the entire period of pregnancy. The present study was done to find a suitable parameter for estimating gestational age and fetal weight in women who don't remember their LMP have irregular cycles and who have not got dating scan done and report to the hospital in late second and third trimester. In such women placental thickness is helpful in determining the gestational age as placental thickness measurement is reliable in all three trimesters unlike BPD, AC, FL etc. The mean maternal age was 24.93±3.99 years (range 19-36years) and maximum numbers of antenatal women were from age group of 21-30years (87%). Similar age distribution was seen in study conducted by Ahmed *et al* [7] and Jauniaux *et al* [8]. Most of the antenatal women were primipara i.e. 53% whereas parity ranged from 0-3 which is comparable with the other studies [9, 10]. The mean placental thickness had no correlation with age group (p value 0.487 non-significant). It is comparable to study conducted by Adhikari *et al* [11]. It was observed that mean placental thickness at a particular gestation had no correlation with parity and the p value was non-significant (0.258). Pant *et al* [9] also found no correlation between parity and placental thickness.

The maximum (37%) study populations were above 30 weeks of gestation. 36% were between 20 to 30 weeks of gestation and 27% were less than 20 weeks of gestation. This finding correlated with the study done by Noor *et al* [12]. In the present study mean placental thickness is directly proportional to the advancing gestational age and had linear correlation with gestational age from 11 to 40 weeks. The mean placental thickness gradually increased with gestational age, from 14mm at 12 weeks to 35mm at 40 weeks of gestation. These results are supported by the previous studies [7, 8, 13, 14].

When variability of placental thickness is accessed categorically, we found that from 12 to 20 weeks, the mean placental thickness was2-3mm more than the gestational age and showed strong positive correlation. From 20 to 30 weeks the mean placental thickness almost coincided with gestational age and showed very strong positive correlation. From 30-40weeks the mean placental thickness was 2-3mm less than the gestational age and showed a moderate positive correlation. Overall from 12 to 40 weeks mean placental thickness and gestational age had a very strong positive correlation. Similar findings are reported in earlier studies [11, 14-17]. Lee et at in 2011 determined that placental position needs to be considered when determining placental thickness and study limits for clinical use at the routine second trimester scan. The association of gestational age and the mean placental thickness between 18 and 23 weeks is uncertain and requires further investigation [10]. Reports of studies done for placental localization by ultrasound examination were published by Donald and Abdulla [18], Kobayashi *et al* [19] and Gottesfield *et al* [20]. Nyberg and Finberg [21] also reported that placental thickness (in mm) parallels gestational age (in weeks).

The mean placental thickness is directly proportional to estimated fetal weight and had linear correlation with estimated fetal weight. This finding is supported by study conducted by Noor *et al* [12] and Kiran *et al* [22]. However, the present study demonstrated that the significant positive correlations between placental thickness and estimated fetal weight in the second and third trimesters on a non-IUGR group. A positive correlation, between increasing placental volume with increasing gestational

age was observed but not in case of growth restricted foetuses. The usefulness of this relationship between placental thickness and growth parameters is that subnormal placental thickness for a gestational age may be the earliest indication of fetal growth retardation.

There is an association found by Dombrowski *et al* [23] in 1992 and Jauniaux *et al* [8] between an increase in placental thickness and subsequent slow fetal growth and hypertensive disorders of pregnancy. It has been suggested by Ko *et al* [24] that an increased placental thickness in the second trimester a highly sensitive marker of the subsequent development of fetal hydrops related to alpha-thalessemia in high risk populations. These studies emphasize the importance of measuring placental thickness at routine ultrasonography to follow fetalwell being and to identify at the earliest the developing pathology. Once the fetal pathology is developed, timely intervention and termination is decided considering fetal maturity. For that exact knowledge of gestational age and assessment of maturity provides guidance for management and to ensure safe motherhood.

Placental thickness being an important feto-maternal component and easily measurable serves as a marker for identification of both maternal and fetal complications at the earliest before they become clinically evident. The study derives a nomogram for placental thickness as a reference. It will act as a screening tool as deviation in thickness at any gestation will serve as a clue to subject the women for further investigations and color dopplers. With evolution of placentography, other placental parameters and their patterns with increasing gestational age will serve to both obstetric and fetal care and aid in safe maternal and neonatal outcomes.

Conclusion

The linear correlation and statistical compatibility of placental thickness in estimation of gestational age makes it an alternate parameter for gestational age and fetal weight estimation. Determination of placental thickness can be a screening tool as deviation from normal value can give a clue to developing pathology. This rests on the fact that placenta is a key organ and pathological changes can be seen here much before they appear clinically or biochemically.

To conclude, placental thickness can give an estimation of gestational age. Knowledge of correct gestational age is important in delivering proper antenatal care, assessing fetalwell being, identifying pathology at the earliest and timely decision of termination and providing safe motherhood.

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