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Research Article

Placental thickness: an additional sonographic parameter to estimate the foetal gestational age.

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Abstract

Background: Accurate estimation of gestational age is a highly influential component of antenatal care. Therefore, searching for other parameters supplementing well-known biometric parameters for calculating gestational age is necessary. Hence, we evaluated the placental thickness by ultrasonography at the level of insertion of the umbilical cord to estimate and correlate with the gestational age. **Methods:** 200 antenatal women were included in a cross-sectional observational study with a normal singleton pregnancy between 11 and 40 weeks. Routine antenatal ultrasonography was done, along with regular biometric parameters, and the placental thickness was also measured for calculating the gestational age. **Results:** From 11 to 40 weeks, there is a progressive increase in placental thickness with gestational age. There was a more significant positive correlation (r=0.983) at 11 to 35 weeks of gestational age; however, the correlation was not between 36 and 40 weeks. **Conclusions:** Ultrasonographic measurement of placental thickness can be considered for estimating the gestational age from 11 to 35 weeks.

Keywords: placental thickness, measurement, correlation, gestational age.

Introduction

The placenta is a fetal organ with a maternal component accountable for the growth of the fetus. It is responsible for the foetus's nutrition, respiratory, and excretory functions and is associated with metabolic, endocrine, and immunological systems. It shields the fetus from noxious agents. By the 9th or 10th week, the diffuse granular echotexture of the placenta is seen on sonography. (1)

Ultrasonography's role in obstetrics has been immense. Advances in sonography made it possible to study the placenta's sonographic appearance and its relation to uteroplacental blood flow measurement and intrauterine growth.(2) Sonography is a safe, non-invasive means to assess fetal growth. Placenta position, size, appearance, and growth pattern influence maternal and fetal outcomes. The greatest possible antepartum care and a successful labour result necessitate accurate gestational age assessment, a crucial component of prenatal care. Gestational age is frequently either over or underestimated, as the conventional gestational age estimation is based on the last menstruation and ultrasonography (USG). Many women are either unaware of their previous menstruation or have irregular menses, and ultrasonography is bound to

have a bias, posing difficulties in estimating gestational age.

Sometimes, even regular menstruation cannot exact the gestational age as there may be early or delayed ovulation. Ultrasonography is used to estimate the gestational age by measuring the fetal dimensions like crown-rump length (CRL), biparietal diameter (BPD), head circum-ference (HC), abdominal circum-ference (AC), and femur length (FL).[3] Ultra-sonography is prone to observer bias since it depends on the observer's technical skills.[4] Also, the fetal parameters, different measurement techniques, and positional problems may diminish the accuracy of the gestational age estimation. Hence, another additional parameter is needed to supplement the gestational age estimation with less error. Placental thickness (PT) gauged at the level of umbilical cord insertion is a new promising parameter for assessing the foetus's gestational age. The present study evaluated the relationship between PT and the foetus's gestational age in a normal singleton pregnancy.

Methods

A cross-sectional observational study was conducted on 200 normal pregnant women attending the antenatal clinic of the obstetrics and gynaecology department, in association with the radiology department, in our institute from August 2018 to September 2019. Approval from the Institutional Ethics Committee was obtained.

After obtaining written consent and a detailed history, the pregnant woman was sent for ultrasonography and fetal biometric parameters, and the PT was also measured. Normal antenatal women with a singleton pregnancy of all gestational ages from 11 weeks to 40 weeks were included. Patients with medical illness, obstetric complications, and any other associated fetal, placental, and cord anomalies were excluded from the study. The grayscale real-time ultrasonographic examinations were performed using a Siemens Acuson X-300 ultrasound scanner, and the probe used for the study was a 3.5-megahertz convex array transducer.

The patient was scanned transabdominal with a moderately distended bladder in the supine position. The PT in millimetres (mm) was measured at the level of the cord insertion site. The transducer was oriented perpendicular to both the chorionic and basal plates. PT was calculated from the echogenic chorionic plate to the placental myometrial interface during the relaxed phase of the uterus. The three best average measurements were taken. The gestational age in the first trimester of pregnancy was determined by measuring CRL and calculations using Hadlock tables. Com-posite foetal measurements of BPD, HC, AC, and FL determined the gestational age in the second and third trimesters of pregnancy.

Statistical analysis:
Data were entered using Microsoft Excel 2010 and analysed using SPSS 17th version. Categorical data were presented in percentages and proportions, and numerical data in mean and standard deviation. The student 't' test was used for numerical data to determine associations. Pearson's correlation was used to find the correlation between gestational age and PT, with r-value ranging from -1 to +1. The significance level was kept at 5%.

Results

In the total study group of 200 normal antenatal women, the age ranged from 18 to 38 years. The mean age was 22.96±4.06 years. We observed that PT gradually increased from 11.57 mm at 11 weeks to 36.50 mm at 40 weeks gestation. Between 11 and 35 weeks of gestation, the PT (mm) almost matched the gestational age in weeks (Table 1). After that, from 36 to 40 weeks, the PT decreased by 1 to 4 mm (Table 1). The present study observed that the gestational age (weeks) by USG is 27.76±8.59, ranging from 11 to 40 weeks. The PT is 27.19±7.88 mm, with a range of 11-38mm (Table 1).

The PT based on placental location is described in Table 2. The present study

observed a high positive correlation between gestational age and PT between 11 - 35 weeks (r-0.983, P-0.001), which is statistically significant (Table 3 and Figure 1). From 36-40 weeks of gestation, there is a low correlation between gestational age and PT (r-0.16, P-0.2). Every week of increase in gestational age, there is an average increase in PT by 0.876 mm (table 3 and Figure 2).

Table 1: Comparison between mean gestational age and placental thickness

Gestational age	Mean of gestational age	Placental thickness	P-value
11-35 weeks (n=150)	24.59 ± 7.57	24.58 ± 7.37	0.98
36-40 weeks (n=50)	37.28 ± 1.13	35.02 ± 1.51	0.2
11-40 weeks (n=200)	27.76 ± 8.59	27.19 ± 7.88	0.48

Table 2: Placental thickness based on position

	Number	Thickness	p-value
Anterior	82 (44%)	26.23±7.60	-
Posterior	43 (21.5%)	23.65±7.44	0.069
Fundal	46(23%)	29.83±7.66	0.01
Lateral	29 (14.5%)	30.97±6.98	0.04

Table 3: Correlation between gestational age and placental thickness

Gestational age	Pearson's correlation	P-value
11-35 weeks (n=150)	0.983	0.001
36- 40 weeks (n=50)	0.16	0.24
11-40 weeks (n=200)	0.98	0.001

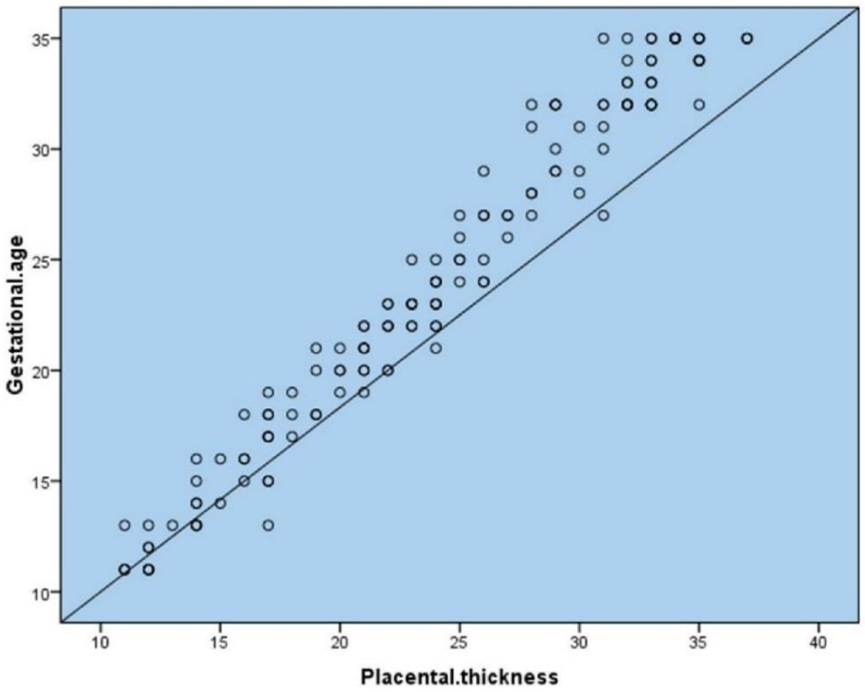

Figure (1): Correlation between gestational age (11 to 35 weeks) and placental thickness.

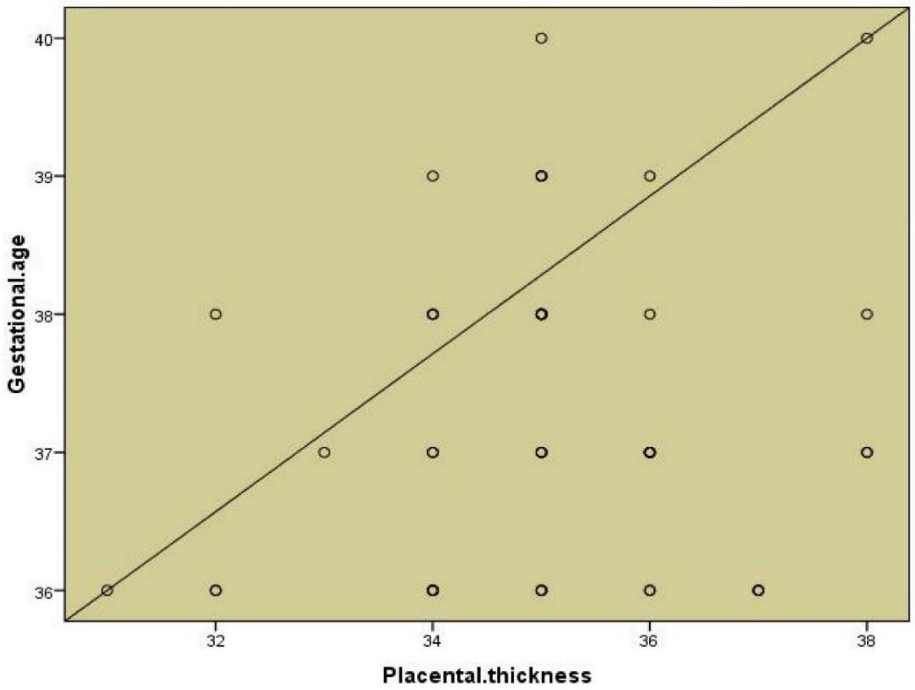

Figure (2): Correlation between gestational age (36 to 40 weeks) and placental thickness.

Discussion

Evaluation of our study revealed a positive correlation between gestational age and placental thickness from 11 to 35 weeks. Before the advent of prenatal investigation techniques, morphological examination of the placenta was limited to retrospective information and had little influence on pregnancy management. With the improvement of ultrasound equipment, it is now possible to examine the placenta in detail from the beginning of the first trimester. Placenta evaluation by ultrasonography was used to characterise placental position and morphological changes as it matures. Placental size is said in terms of thickness in the mid-portion of the organ. Total placental volume is probably the most accurate estimate of placental size, but the volumetric measurement is too complicated and cumbersome for routine use. PT calculation is relatively simple and clinically useful. [5]

The placenta has been seen as a 'static' feature in a dynamic system for many years. While all measurements of the fetus were related to menstrual age, the PT was judged as normal or abnormal based on a single "cut-off" point. The present study data confirm that PT is a function of gestational age. Abnormal thickening or thinning must be correlated with other estimates of pregnancy duration. To determine whether a given PT is normal or abnormal, the normal PT must be defined for each week of gestational age throughout pregnancy. The present study assessed the relationship of the PT (in mm) with sonographic gestational age (in weeks) and advancing gestational age.

Our study showed that the PT (in mm) increases progressively with gestational age (in weeks) linearly and almost matches the gestational age from 11-35 weeks of gestation. The present study was similar to the study by Mathai et al.,[6]. They also found an increasing trend in the values of the mean PT (in mm) with an increase in gestational age (in weeks) and the PT (in mm) coincides almost precisely with the gestational age in weeks. The increase of PT gradually diminished from 36-40 weeks and was less by 1-4mm compared to gestational age from 11-35 weeks. Our findings were in concordance with the study published by Noor et al.,[7]; they reported that at 18-37

weeks of gestational age, there is no statistical significance between the mean difference of gestational age (29.8±5.5) and PT (29.5±4.9). After 37 weeks of gestational age, there is a high mean difference between gestational age (38.07±1.42) and placental thickness (34.36±2.86).

Few authors have studied the role of PT as an additional parameter for estimating gestational age, and PT nomograms have been published. [6,8] It is the only factor independent of the fetus for predicting gestational age.

In the present study, PT's growth rate did not vary relative to the placental position. In contrast, Lee et al., showed that PT in the posterior and fundal placenta was 5-7 mm thicker than in the anterior placenta. [5]

PT changes express the growth of the fetoplacental unit amenable to measurement with USG and its role in describing physiology. Some diseases or abnormalities of the fetus can be detected by measuring PT. The values relative to gestational age should facilitate recognising altered PT induced by pathologic processes. The average PT (in mm) was roughly equivalent to gestational age (in weeks), and at no stage of pregnancy was the normal placenta greater than 4 cm thick.[9]

In the present study, PT's growth rate did not vary relative to the placental position. According to Lee et al., an anterior placenta >33 mm and a posterior placenta >40 mm in the second trimester would be regarded as unusually thick.[5] Although there is no agreed definition of a thicker placenta, poor perinatal outcome is possible if the PT is larger than 40 mm. The abnormal thickness of the placenta is seen in a broad spectrum of pathologic events. Thick placentas are associated with hydrops fetalis, diabetes mellitus, and intrauterine infection.[9,10] Sonographically, a thick placenta is associated with greater perinatal risk of morbidity and mortality, associated fetal anomalies, and higher rates of both small for dates and large for gestational age infants at term. [11,12] The thin placenta is often a marker for a small for dates fetus and a sign of growth restriction. Placental thinning is also seen in patients with pre-eclampsia, chromosomal abnormalities, and severe intrauterine infection. PT measured in the late second and third trimesters can predict fetal growth restriction. The mean placental thickness was directly proportional and had a linear correlation with estimated fetal weight.[13] Another study suggested that PT could help detect intrauterine growth restriction babies with a positive predictive value of 75%.[14] Hence, including PT in routine ultrasono-graphic parameters may help evolve safe maternal and neonatal outcomes.

Limitations of the study include the cross-sectional design, which prevented us from obtaining a proper placental growth curve based on serial measurements from a single patient. As the sample size was small, further studies on large numbers and from different ethnicities are needed to validate PT incorporated into a routine sonographic parameter.

Conclusions

PT has a linear and direct relationship with gestational age and can be an essential additional sonographic parameter for estimating gestational age and other fetal biometric parameters, especially from 11 to 35 weeks. Subnormal placental thickness may be the earliest indicator of fetal growth restriction, and hyperplacentosis may be seen with diabetes mellitus, intrauterine infections, hydrops fetalis, and hemoglobinopathies. Hence, it is suggested that PT can be adopted as an additional sonographic parameter to be measured during routine obstetric ultrasound scans, as it not only aids in estimating the gestational age but also the growth of the fetus.

Declarations

Statements

Statement of Ethics: Approval from the Institutional Ethics Committee was obtained.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: Study design: Dr Aparna Jarathi, Dr B. Jyothirmayee Biostatistics: Dr Aparna Jarathi, Dr B. Jyothirmayee Collection of Data: Dr Parveen Sultana D, Dr Aparna Jarathi Writing the manuscript: Dr Aparna Jarathi, Dr Parveen Sultana D

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