

Placental Thickness and Its Correlation with Gestational Age: A Cross-sectional Ultrasonographic Study

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ABSTRACT:

Introduction: Placenta grows in size with the advancement of gestational age (GA) and plays an important role for delivery of nutrients from mother to fetus. Ultrasonography (USG) is implicated for the estimation of GA by using fetal growth parameters like Femur Length (FL), Bi-parietal Diameter (BPD), Head Circumference (HC), and Abdominal Circumference (AC). This study intends to observe the correlation between Placental Thickness (PT) and GA. **Methods:** It was an observational, cross-sectional, and analytical study conducted over a period of six months from November 2017 to April 2018. All trans-abdominal USG were done in supine position using 3.5 MHz curvilinear probe by the principal investigator. Fetal growth parameters i.e. FL, BPD, HC, and AC were measured to estimate GA. PT was also measured at the same time. **Results:** There was a positive correlation between PT and GA ($r = 0.89$, $n=249$, $p < 0.001$). Pearson correlation coefficient between the two variables at second and third trimesters were 0.81 and 0.49 respectively. Fisher r-to-z transformation was used to analyze the difference between those two coefficients and was found to be statistically significant ($z = 4.6$, $p < 0.001$). This indicates that there was a significant overall relationship between PT and GA. As GA increases, PT also increases. **Conclusion:** Our study observed a positive correlation between the PT and GA in second and third trimesters. Thickness of placenta can thus be used as a reliable parameter for the estimation of GA during the second and third trimesters, and can be used as a supplementary USG parameter along with FL, BPD, HC and AC.

Keywords: Gestational Age, Placental Thickness, Ultrasonography

INTRODUCTION:

Placenta develops from chorionic villi at about fifth week of intra-uterine life and is visible by transabdominal ultrasonography (TAS) at around tenth week of gestation.[1] It grows in size with the advancement of gestational age (GA) and plays an important role for delivery of nutrients from mother to fetus.[2]

Last menstrual period (LMP) and clinical methods such as first fetal movements and uterine

fundal height measurement were initially used for the evaluation of gestational age. But these methods do have drawbacks. LMP may be difficult to ascertain when there are irregular menstrual cycles or conception occurs in lactational amenorrhea. Clinical methods are flawed with observer's bias. [3] These days ultrasonography (USG) is used for the estimation or confirmation of gestational age. USG determines gestational age from various fetal dimensions like femoral length (FL), bi-parietal diameter (BPD), head circumference (HC), and abdominal circumference (AC). But these conventional methods of measuring fetal dimensions too are associated with some short comings as in the case of hydrocephalus.[4]

Hence, there should be alternative method which can reliably estimate the gestational age.

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Placental thickness correlates with gestational age in the second and third trimesters and may be used as an alternative method for the evaluation of latter.[5] We conducted this study to evaluate the correlation between placental thickness and gestational age.

METHODS:

This was an observational, cross-sectional, and analytical study carried out in the Department of Radiodiagnosis, Lumbini Medical College Teaching Hospital (LMCTH), Palpa, Nepal. The study was conducted after the ethical approval from Institutional Review Committee of the institute. It was conducted over a period of six months from November 2017 to April 2018. During the study period, consecutive singleton pregnant women who underwent obstetric USG in second or third trimester were included in the study. Pregnant women with diabetes, hypertension or anemia were excluded. Those with fetal anomalies, placental anomalies or poor visualization of placenta were also excluded.

AcusonX300 from Siemens with a 3.5 MHz convex array transducer was used for obstetric evaluation. Each woman underwent USG only once during the study.

Scanning Technique:

All trans-abdominal obstetric USG were done in supine position using 3.5MHz curvilinear probe by the principal investigator. Fetal growth parameters i.e. FL, BPD, HC, and AC were measured to estimate GA. Placental thickness (PT) was also measured at the same time.

The antero-posterior diameter of placenta was measured at the level of insertion of umbilical cord.[6,7] The uterine myometrium and retro placental veins were excluded. BPD was estimated as the distance between the outer edge of the cranium nearest to the USG probe and inner edge of the cranium distal to the transducer at the level of paired hypoechoic thalami and cavum septum pellucidum.[8] Using the elliptical calipers, HC was estimated over the four points; two points of BPD and other two points of occipital frontal diameter in the same plane as BPD.[9] AC was estimated as the circumference of fetal abdomen in a transverse plane 90° to the fetal spine at the level of umbilical vein junction with the portal vein.[10] FL was estimated as the length of fetal femur from the greater trochanter to the femoral condyles.[11]

The data was collected using Microsoft Excel 2007 and imported it to Statistical Package for the Social Sciences (SPSS™), version 16, for statistical analysis.

RESULTS:

A total of 249 pregnant ladies in their second and third trimesters were studied. 39.8% of the patients were of 21-25 years followed by 15-20 years (23.3%) and 26-30 years (22.5%). Out of all cases, 103 women were in the second trimester (14-27 weeks) and 146 were in the third trimester (28-40 weeks).

The most common location of placenta was anterior (55%) followed by posterior in 35%, fundo-posterior in 6% and fundo-anterior in 4%. The maximum PT was 50 mm at 37 weeks and minimum (14.5 mm) at 14 weeks. The mean PT of ladies in the second trimester was found to be 22.3±3.7 mm, and 39±4.4 mm in the third trimester. Cumulative mean of PT in both trimesters was 29±7.2 mm. There was a positive correlation between PT and GA ($r = 0.89$, $n=249$, $p < 0.001$) as shown in fig. 1. Pearson correlation coefficient between the two variables at second and third trimesters were 0.81 and 0.49 respectively. Fisher r-to-z transformation was used to analyze the difference between those two coefficients and was found to be statistically significant ($z = 4.6$, $p < 0.001$). This indicates that there was a significant overall relationship between PT and GA. As GA increases, PT also increases.

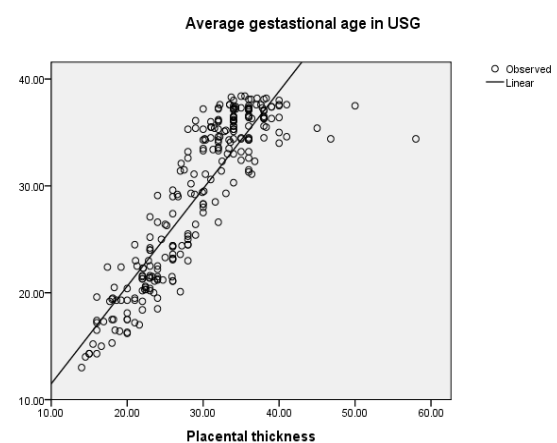


Fig. 1: Scatter plot diagram showing distribution between PT and GA ($n=249$)

This strength of relationship was however different in second and third trimester. It was much stronger in the second trimester as compared to the third.

DISCUSSION:

Our study evaluated relationship between PT

and GA. A total of 249 patients in second and third trimesters were included in the study. Evaluation of GA is essential to assess the wellbeing of the fetus and to plan an appropriate obstetric management of the pregnant ladies.[12] GA can be precisely determined by USG and can be more reliable than one calculated by LMP, provided multiple parameters are used in the USG for GA estimation.[1]

It was observed that most of the patients in our study were in the age group of 21-25 years (39.8%), followed by 15-20 years (23.3%) and 26-30 years (22.5 %). In the study of Kakumanu PK et al.[13] 48% patients were in the age group of 20-25 years. Similarly, study of Adhikari R. et al.[14] also found that 20-30 years was the predominant age group with 73% antenatal women, and 27.3% were below 20 years of age. Findings from these studies are comparable to ours. In our study 12% of patients presented at 37th week of gestation (WOG), followed by 34th WOG (8.8%), and 36th WOG (8.4%). This might be explained by the lack of knowledge regarding Antenatal Care (ANC) in Nepalese women in the sub-urban or rural areas, and their hesitancy to seek medical advice during pregnancy. WHO recommends a minimum of 8 ANC visits, with the first visit in the first trimester, two visits in the second trimester (20 and 26 WOG), and five visits in the third trimester (30, 34, 36, 38 and 40 WOG).[15]

In our study, most common placental location was anterior (55%) followed by posterior in 35%, fundoposterior in 6% and fundo-anterior in 4% of the women. Similar to the finding of our study, Saxena S. et al.[16] also witnessed anterior located placenta in most of the women (50.1%). In contrary, Adhikari R. et al.[14] reported most of the placenta (46%) were in the posterior location. Possibly, placental location may vary among population according to the geography.

The maximum PT observed in this study was during 38th WOG with mean PT of 36.3±1.9 mm. Previous studies of Hoddick WK et al.[17], Weerakkody Y. et al.[18], and Benirschke K. et al.[19] also suggested that PT was not more than 40 mm at any time of gestation. This shows that PT in Nepalese women is comparable to that of Indian, Nigerian and Caucasian women. According to Agwuna KK et al.,[12] PT can be a reflection of any abnormalities in the fetus. Diabetes mellitus, fetal hydrops and intra-uterine fetal infections are associated with increased PT for corresponding GA, whereas decreased PT is associated with intrauterine fetal growth retardation. Thus, assessment of PT can be helpful in assessing the fetal condition and to plan a proper medical care for the fetus.

The mean PT in the second, third and both trimesters were 22.3 mm, 33.9 mm and 29.2 mm respectively. The mean PT was higher in the third trimester as compared to the second trimester. There was a linear increase in PT with GA and the maximum PT was seen in the 38th WOG. However, the mean PT was decreased during the 35-36th WOG by less than 1 mm. The increase in size of the placenta correspond to the increasing age of fetus, as suggested by other similar studies by Ohagwu CC[20] and Agwuna KK.[12] In the current study, a positive correlation was noted between PT and GA ($r=0.89$, $n=249$, $p<0.001$). These findings of our study are comparable to the observations made by authors in previous studies [13,14,16, 21, 22] as depicted in table 1.

In our study, serial measurement of the placental growth was not carried out over a different period of time, thus were not plotted into a longitudinal growth curve. Estimating PT by USG at a single point of time and its correlation with GA has its own shortcomings. Besides this, placental volume would have been better in assessing the

Table 1. Correlation of placental thickness (PT) and gestational age (GA) in various studies

Studied By	Published In	Correlation of PT with GA (r value)			P-value
		Trimester			
		1st	2nd	3rd	
Karthikeyan et al.(21)	J Clin Diagn Res. 2012	0.609	0.812	0.814	<0.01
Ahmed et al.(22)	J.App.Med.Sci.2014	Not studied	Not done	0.85	<0.01
Adhikari R et al.(14)	Int. J of Med Imaging, 2015	Not studied	0.914	0.946	<0.001
Saxena S et al.(16)	IJCMAAS, 2016	0.859	0.993	Not studied	<0.001
Kakumanu PK et al. (13)	IJCMSR,2018	Not studied	0.99	0.99	<0.01
Present Study		Not studied	0.811	0.487	<0.001

placental growth rather than PT, but it requires a three dimensional USG, which is expensive and time consuming to perform. Moreover, PT differs among different population group. A large sample is essential to derive a population specific nomogram.

CONCLUSION:

Our study observed a positive correlation between the PT and GA in second and third trimesters. Thickness of placenta can thus be used as a reliable parameter for the estimation of GA during the second and third trimesters, and can be used as a supplementary USG parameter along with FL, BPD, HC and AC.

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Conflict of interest:

None Declared.

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