https://doi.org/10.22502/jlmc.v6i2.214

Original Research Article

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

Sumnima Acharya[a,d] Awadesh Tiwari[b,d] Rupesh Sharma[c,d]

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.

Submitted: 05 May, 2018
Accepted: 12 December, 2018
Published: 21 December, 2018

a - Assistant Professor, Department of Radiodiagnosis
b - Associate Professor and Head, Department of Radiodiagnosis
c - Lecturer, Department of Radiodiagnosis
d - Lumbini Medical College and Teaching Hospital, Pravas, Palpa

Corresponding Author:
Sumnima Archarya
e-mail: doctorsumnima@gmail.com
ORCID: https://orcid.org/0000-0001-8612-671X

How to cite this article:
Acharya S., Tiwari A., Sharma R. Placental Thickness and Its Correlation with Gestational Age and Fetal Growth Parameters: A Cross-sectional Ultrasonographic Study. Journal of Lumbini Medical College. 2018;6(2):5 pages. DOI: 10.22502/jlmc.v6i2.214. Epub: 2018 Dec 21.

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 90^0 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.

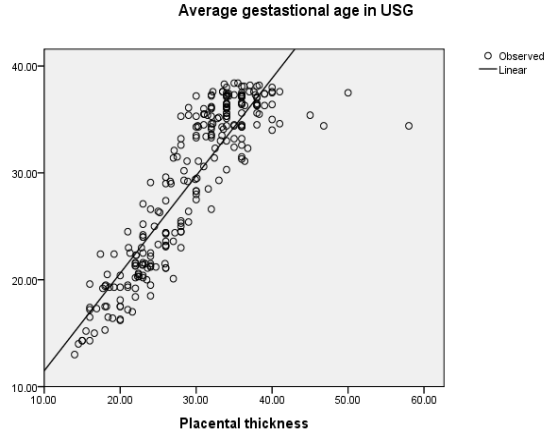

Fig. 1: Scatter plot diagram showing distribution between PT and GA (n=249)

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%, fundo-posterior 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.

Conflict of interest:
None Declared.

Financial Disclosure:
No funds were available.

REFERENCES:

1. Mathai BM, Singla SC, Nittala PP, Chakravarti RJ, Toppo JN. Placental thickness: its correlation with ultrasonographic gestational age in normal and intrauterine growth-retarded pregnancies in the late second and third trimester. The Journal of Obstetrics and Gynecology of India. 2013 Aug 1;63(4):230-3. PMID: 24431647 DOI: 10.1007%2Fs13224-012-0316-8 [Publisher Full Text]
2. Azpurua H, Funai EF, Coraluzzi LM, Doherty LF, Sasson IE, Kliman M, Kliman HJ. Determination of placental weight using two-dimensional sonography and volumetric mathematic modeling. American Journal of Perinatology. 2010 Feb 1;27(2):151-5. DOI: 10.1055/s-0029-1234034 [Publisher Full Text]
3. Jehan I, Zaidi S, Rizvi S, Mobeen N, McClure EM, Munoz B, Pasha O, Wright LL, Goldenberg RL. Dating gestational age by last menstrual period, symphysis-fundal height, and ultrasound in urban Pakistan. International Journal of Gynecology & Obstetrics. 2010 Sep 1;110(3):231-4. PMID: 20537328 DOI: 10.1016%2Fj.ijgo.2010.03.030 [Publisher Full Text]
4. Wolfson RN, Zador IE, Halvorsen P, Andrews B, Sokol RJ. Biparietal diameter in premature rupture of membranes: Errors in estimating gestational age. Journal of Clinical Ultrasound. 1983 Sep;11(7):371-4. PMID: 6415121 DOI: 10.1002/jcu.1870110705
5. Pant S, Dashottar S. A correlative study to evaluate the gestational age by sonological measurement of placental thickness in normal second and third trimester pregnancy. International Journal of Advances in Medicine. 2017 Nov 22;4(6):1638-44. DOI: DOI: 10.18203/2349-3933.ijam20175181 [Publisher Full Text]
6. Mital P, Hooja N, Mehndiratta K. Placental thickness: a sonographic parameter for estimating gestational age of the fetus. Indian journal of Radiology and Imaging. 2002 Nov 1;12(4):553-4. [Publisher Full Text]
7. Hanretty KP. Obstetrics Illustrated. 6th ed. Endiburgh: Churchill Livingstone; 2003. pp. 9–12.
8. Hadlock FP, Deter RL, Harrist RB, Park SK. Fetal biparietal diameter: rational choice of plane of section for sonographic measurement. American Journal of Roentgenology. 1982 May 1;138(5):871-4. PMID: 6979175 DOI: 10.2214/ajr.138.5.871
9. Chitty LS, Altman DG, Henderson A, Campbell S. Charts of fetal size: 2. Head measurements. BJOG: An International Journal of Obstetrics & Gynaecology. 1994 Jan 1;101(1):35-43. PMID: 8297866 DOI: 10.1111/j.1471-0528.1994.tb13007.x
10. Campbell S, Wilkin D. Ultrasonic measurement

of fetal abdomen circumference in the estimation of fetal weight. BJOG: An International Journal of Obstetrics & Gynaecology. 1975 Sep;82(9):689-97. PMID: 1101942

11. Chitty LS, Altman DG, Henderson A, Campbell S. Charts of fetal size: 4. Femur length. BJOG: An International Journal of Obstetrics & Gynaecology. 1994 Feb 1;101(2):132-5. PMID: 8305387 DOI: 10.1111/j.1471-0528.1994.tb13078.x
12. Agwuna KK, Eze CU, Ukoha PO, Umeh UA. Relationship between sonographic placental thickness and gestational age in normal singleton fetuses in Enugu, Southeast Nigeria. Annals of medical and health sciences research. 2016;6(6):335-40. PMID: 28540100 DOI: 10.4103/amhsr.amhsr_457_15 [Publisher Full Text]
13. Kakumanu PK, Kondragunta C, GandraNR,Yepuri H. Evaluation of placental thickness as an ultrasonographic parameter for estimating gestational age of the fetus in 2nd and 3rd trimesters. International Journal of Contemporary Medicine Surgery and Radiology. 2018;3(1):128-32. [Publisher Full Text]
14. Adhikari R, Deka PK, Tayal A, Chettri PK. Ultrasonographic Evaluation of Placental Thickness in Normal Singleton Pregnancies for Estimation of Gestation Age. International Journal of Medical Imaging. 2015;3(6):143-7. [Publisher Full Text]
15. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. World Health Organization; 2016. Available from: http://apps.who.int/iris/bitstream/handle/10665/250796/9789241549912-engpdf;jsessionid=DF8B7FEF544FD24F5A866DE6E82C0F5F?sequence=1
16. Saxena S, Rao.A , Nigam RK, Madan GS, Yadu N: Ultrasonographic Measurement Of Placental Thickness And Its Correlation With Gestational Age : A Cross-Sectional Study. International Journal of Current Medical and Applied Sciences. 2016;10(3):138-43
17. Hoddick WK, Mahony BS, Callen PW, Filly RA. Placental thickness. Journal of Ultrasound in Medicine. 1985 Sep;4(9):479-82. PMID: 3903201
18. Thurston M, Weerakkody Y. Placental thickness. Obstetrics Gynaecology Radiopaedia 2001;16:67-70
19. Benirschke K, Kaufmann P. Pathology of the Human Placenta.2nd ed. 2nd ed. New York: Spring-Verlag; 1990. pp. 234–42
20. Ohagwu CC, Abu PO, Ezeokeke UO, Ugwu AC. Relationship between placental thickness and growth parameters in normal Nigerian foetuses. African Journal of Biotechnology. 2009;8(2). [Publisher Full Text]
21. Karthikeyan T, Subramaniam RK, Johnson WM, Prabhu K. Placental thickness & its correlation to gestational age & foetal growth parameters-a cross sectional ultrasonographic study. Journal of Clinical and Diagnostic research. 2012 Dec;6(10):1732. PMID: 23373039 DOI: 10.7860%2FJCDR%2F2012%2F4867.2652 [Publisher Full Text]
22. Ahmed A, Alrashid Rahim HO, Elgyoum AA, Elzaki A. The correlation between placental thickness and fetal age among the pregnant in Sudan. Scholars Journal of Applied Medical Sciences. 2014;2:395-8. [Publisher Full Text]