

Ultrasonographic Measurement of Placental Thickness During Pregnancy as a Parameter For Estimating Gestational Age of The Foetus

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ABSTRACT

Introduction: Routine ultrasonography in pregnancy has the role in identifying the position, parenchyma echo pattern, variability of thickness of placenta which is associated with increased perinatal risk to both the foetus and mother. This study was carried out to establish the value of placental thickness measurement during normal pregnancy as a reliable parameter for estimating gestational age of the foetus.

Methods: This was a prospective cross sectional study done in the department of Radiology and Imaging at Tribhuvan University Teaching Hospital from September 2004 to April 2005. Total 350 normal pregnant women of more than 15 weeks of gestation were included. Ultrasonographic measurement of placental thickness and foetal biometric measurements were obtained. Correlation co-efficient tests were performed between the gestational age in weeks and placental thickness using Karl Pearson formula in SPSS 10 package.

Results: Mean placental thickness measured at the cord insertion site increased from 15.28 mm at 15 weeks of gestational age to 39.57 mm at 39 weeks of gestational age correlated almost exact with a standard mean of deviation of ± 1.8 mm ($r > 0.851$, $p < 0.001$).

Conclusion: Ultrasonographic measurement of placental thickness during normal pregnancy can predict the gestational age of the foetus with high confidence level and can be included as one of the biometric measurements of foetus to estimate its gestational age.

Key words: Gestational age, Placental thickness, Ultrasonography

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INTRODUCTION

The term placenta originated from Greek word plakuos meaning 'Flat cake'. The placenta is a materno-foetal organ which begins



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developing at implantation of the blastocyst and is delivered with the foetus after birth.

The placenta has the general form of a disc-like flattened cake moulded with the endometrial lining of the uterus. The mature has diameter of approximately 20 cm and about 3-4 cm thick centrally tapering towards edges. It weighs 500 grams when all blood is taken out.

The placenta is a foetal organ with important metabolic, endocrine and immunological functions besides being responsible for nutrition, respiration and excretion for the foetus. Acting as a barrier, it has a role in protecting foetus from noxious agents. Placental formation begins in the latter half of second month of pregnancy and usually completed by the fourth month. It reaches its maximum growth at term.

With new advances in the gray scale and Doppler sonography, we are able to study placental sonographic appearance and its relation to the uteroplacental blood flow measurement and intrauterine growth. Presently the most effective way to date the pregnancy is by the use of ultrasound.¹⁻⁸

Several sonographically derived parameters used to date pregnancy include Crown rump length (CRL), Biparietal diameter (BPD), Head circumference (HC), Femoral length (FL) and Abdominal circumference (AC). Routine ultrasonography in pregnancy has the role in identifying the position, parenchyma echo pattern, variability of thickness of placenta which is associated with increased perinatal risk to both the foetus and mother.⁹ Placental thickness measured at the level of umbilical cord insertion can be used as a new parameter to estimate the gestational age of the foetus. The present study was undertaken to evaluate the relationship between placental thickness and gestational age of the foetus and compare the results obtained with the other studies carried out elsewhere.

METHODS

This was a prospective cross sectional study conducted in the Department of Radiology and Imaging with the help of the Department of Obstetrics and Gynecology at tertiary hospital in Kathmandu, Nepal. Study was conducted from the month of September 2004 to April 2005. The study comprised of 350 pregnant women at or above 15 weeks of pregnancy who attended the Obstetrics and Gynecology outpatient department for antenatal checkup. The participants of the study were explained in detail regarding the nature of the study and its benefits and only those who agreed to participate in the study were included.

Multiple pregnancies, pregnancy with intrauterine growth retardation of the foetus, foetus with congenital malformations identified during the time of scan, hydrops fetalis, patients with pregnancy induced hypertension and diabetes mellitus were excluded from the study.

Study was conducted using curvilinear array, real time, B-mode ultrasound equipped with a 3.5 and 5 MHz frequency probes with Doppler facility in SONOACE 8800 MEDISONS Co. Patient was kept in supine position and trans abdominal ultrasonography was performed. The site of insertion of umbilical artery was identified by color Doppler study.

Ultrasonographic examination of placenta included the site localization, parenchymal echopattern and thickness. The placental thickness was obtained at the maximum vertical length at the level of cord insertion. Placental thickness was measured in millimeters.

Foetal biometric parameters were measured with screen calipers on the freeze pictures. Biparietal diameter (BPD), Head circumference (HC), Abdominal circumference (AC) and Femoral length (FL)

were measured in millimeters using standard techniques (HADLOCK formula).

Permission was obtained from head of departments of Radiology and Imaging as well as Obstetrics and Gynecology of TUTH and protocol was approved by ethical board of the institution. Informed consent was obtained from all the participants after explaining the procedure.

Numerical data obtained was analyzed using statistical methods with the use of computer software, SPSS 10 package. The mean placental thickness for every week of gestation from 15 weeks till 39 weeks were obtained along with standard deviation and standard error of mean was calculated in each measurement. Co-relations of the gestational age with placental thickness were obtained by Pearson co-relation formula. Graph of the co-relation was obtained and studied.

RESULTS

Table 1: Placental thickness at different gestational age

Week of Gestation	N	Placental thickness (mm)			
		Minimum	Maximum	Mean	Std. Deviation
15	6	14.00	17.00	15.2833	1.1321
16	7	16.00	19.00	17.0286	0.9499
17	12	16.80	18.80	17.6417	0.6360
18	15	17.00	19.80	18.5533	0.8991
19	18	15.00	25.00	19.2444	2.1840
20	14	16.00	25.00	19.8143	2.2305
21	17	16.00	28.00	21.7941	2.6102
22	15	21.00	27.00	23.0533	1.6155
23	12	21.00	29.00	23.7330	2.0042
24	10	21.00	25.00	23.9000	1.4491
25	10	24.00	28.00	25.5800	1.3011
26	10	23.00	29.00	25.7200	1.7242
27	19	25.00	31.00	28.0000	1.7692
28	14	25.50	31.00	28.6929	1.3691
29	18	26.00	30.00	28.7389	1.1330
30	16	29.00	31.80	30.1750	0.8250
31	15	27.00	40.00	31.5800	2.8411
32	11	30.50	37.00	32.4273	1.7333
33	16	27.00	37.00	33.4500	2.0163
34	19	30.40	35.00	33.9158	1.3074
35	20	30.80	39.00	34.7500	1.8509
36	14	31.00	40.50	36.8357	2.5239
37	16	32.00	48.00	37.5375	3.6628
38	14	34.80	45.00	39.1500	2.6958
39	12	35.00	45.00	39.5750	2.9588
Total No of cases =	350				

In this prospective cross sectional study, sonographic measurement of placental thickness was compared with Gestational age of the foetus in each week of gestation from 15th weeks to 39th weeks. A total of 350 normal pregnant women were included.

The age of the subjects ranged from 17 years to 35 years with a mean age of 25.0 ± 4 years.

Placental thickness at various gestational ages were measured (Table 1, Fig. 1).

The maximum placental thickness measured was 48.5 mm and minimum was 14.0 mm. mean placental thickness increased steadily from 15.28 mm at 15 weeks of gestation to 39.5 mm at 39 weeks of gestation. The standard deviation in placental thickness measurement also varied from ± 0.825 mm ($p < 0.001$) at 30 weeks to ± 2.958 mm ($p < 0.001$) at 39 weeks of gestation. The placental thickness of the foetus of 15th week till 39 weeks of gestational age correlated almost exact with a standard deviation of 1.8 mm ($r > 0.851$, $p < 0.001$).

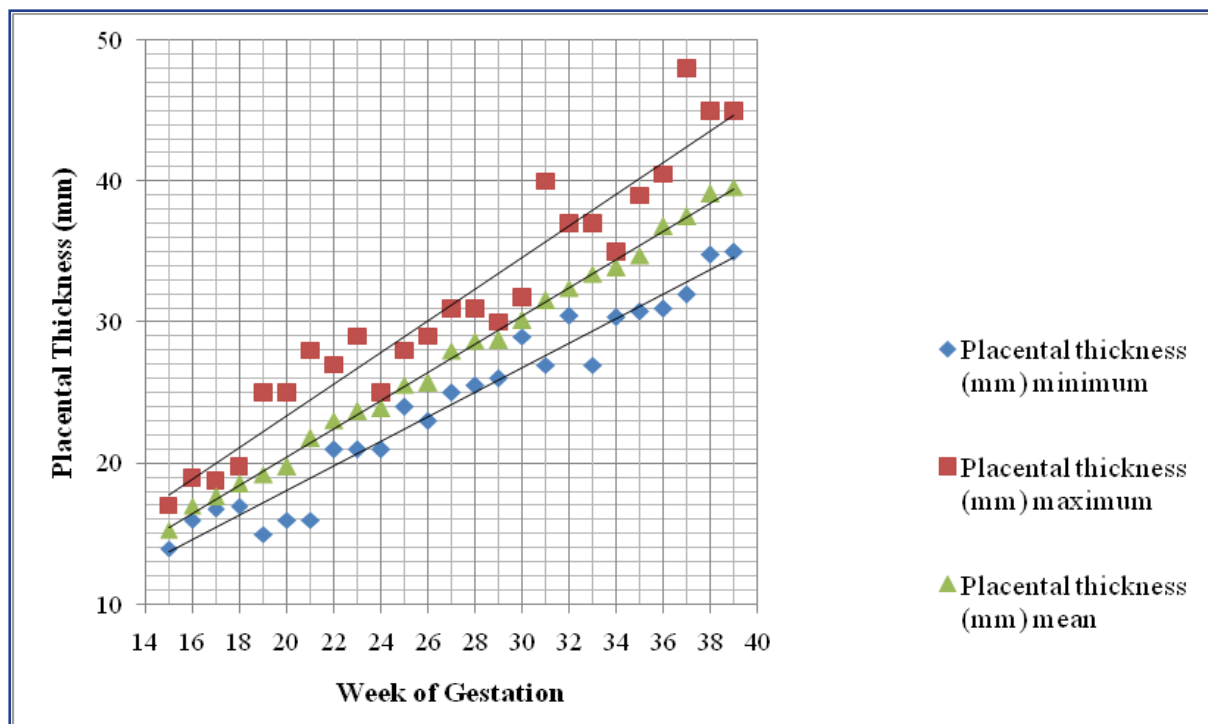


Figure 1: Mean placental thickness at different weeks of gestational .

DISCUSSION

It is well known that gestational age of the foetus can be estimated by measurement of various parts of the foetus. It has been in practice since 1970s when Robinson started using Ultrasonography for this purpose. The CRL, BPD, HC, AC and FL are routinely measured in obstetric sonography along with the morphology of various structures of the foetus to exclude any eventuality that may crop up during pregnancy. This has significantly reduced both morbidity and mortality of the foetus as well as the mother.⁹

The crown rump length (CRL) between 7 to 12 weeks is the most accurate parameter for first trimester dating. In the second trimester, the Biparietal diameter (BPD), head circumference (HC), transcerebellar diameter (TCD), abdominal circumference (AC), femoral length (FL) and long bones can be measured to estimate gestational age. HC is considered to be the better indicator than BPD as it takes account of various shapes of growing skull.

After 32 weeks the composite factors (HC, AC and FL) are accurate. However, the best

assessment of foetal gestational age should be corrected with previous ultrasound findings.

The other parameters to date pregnancy include embryonic trunk circumference, orbital diameter, scapular length, thigh circumference and foot length. Serial study of all these give fairly approximate foetal gestational age.

In this prospective study the thickness of placenta was measured for each gestational week by ultrasound starting from 15th week. The gestational week of the foetus was determined by BPD, FL, AC & HC using the HADLOCK formula. There was strong positive correlation between placental thickness and gestational age in all weeks of gestation ($p < 0.001$).

Similar study done by Mital P et al at SMS Medical College, Jaipur, India in 2002 on 600 antenatal women of all gestational age more than 10 weeks of gestation had revealed similar findings. From 22nd weeks to the 35th weeks of gestation, the placental thickness coincide almost exactly with gestational age in the weeks.¹⁰

In addition to gestational age assessment, placental thickness can be used in predicting intrauterine growth retardation. As demonstrated by Habib A Fawzia at department of obstetrics and gynecology, King Khalid University Hospital, Riyadh, Saudi Arabia in 2002, measurement of placental diameter and thickness in all sonographic assessment of pregnancy in addition to the routine use of uterine artery Doppler in the second trimester helps in predicting low birth weight infants.¹⁰

CONCLUSIONS

There was strong positive correlation between the placental thickness at each week of gestational age of foetus to the gestational age of the foetus calculated by

other parameters. The ultrasonographic measurement of placental thickness during normal pregnancy can predict the gestational age of the foetus with high confidence level (>95% at all gestational age). In cases where the exact duration of pregnancy is not known measuring the placental thickness alone could give important clue about it. Thus placental thickness at the insertion of umbilical cord as measured by ultrasonography is one of the biometric measurements of the foetus to estimate its gestational age.

We feel that further study involving larger number of normal pregnancies would be valuable.

CONFLICT OF INTEREST

None

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None

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