



## Placental Thickness as an Ultrasonographic indicator for estimating gestational Age of the Fetus

### KEYWORDS

1. Placental thickness 2. Chorionic villous sampling 3. Genetic amniocentesis

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**ABSTRACT** Placental thickness evaluation by sonography has been used to characterize Placental position and Morphologic changes as it matures. Sonographic measurement of Placental thickness at the level of cord insertion site is simple. Placental thickness (in mm) increases in linear fashion with advancing gestational age (in weeks) and almost matching it with from 11 to 35 weeks of gestation

### Aims and objectives:

“Placental thickness as an ultrasonographic indicator for estimating gestational age of the fetus” was conducted with the aim of evaluating placental thickness, measured at the level of insertion of umbilical cord

- As a parameter for estimating gestational age of the fetus.
- To assess the growth pattern of placenta with advancing gestational age.

### Patients And Methods:

The study included **300** normal antenatal women attending antenatal clinic at the department of Obstetrics and gynecology, Alluri Sita Rama Raju Academy of Medical Sciences, Eluru. This study is to determine the correlation between Placental thickness and gestational age as determined by the last menstrual period.

### Conclusion:

- The relationship between the placental thickness and gestational age is linear and direct.
- Placental thickness (in mm) increases with increasing gestational age (in weeks) and almost matching it from 11 to 35 weeks of gestation.
- The relationship of Placental thickness with gestational age falls marginally and the rate of growth of Placental thickness decreased after 36 weeks of gestation and was lower by 1-3 mm.
- The thickness of the placenta and growth pattern did not vary relative to the placental location.
- Normal Placental thickness nomograms have been established in the present study to determine whether a given Placental thickness is normal or abnormal for a particular gestational age.
- Thoughtful attention to technical detail and correlation of placental thickness with gestational age should facilitate the detection of abnormal placental thickness associated with IUGR, hydrops fetalis and diabetes mellitus in early stages.

### INTRODUCTION

The placenta is a maternal-fetal organ with important metabolic, endocrine and immunological functions and also it has a role in protecting the fetus from noxious agents.. Sonography has provided a safe and non-invasive means to evaluate the placenta whose normal and

abnormal size, appearance and growth pattern can have significant antenatal implications.

The role of sonography in the evaluation of morphology and detection of placental abnormalities in entities such as non-immune hydrops, gestational diabetes and intrauterine growth restriction has been well established. Placenta is primarily a fetal organ and its size is a reflection of the health and size of the fetus. Total placental volume is probably the most accurate estimate of placental size, but volumetric measurement is too complicated and cumbersome for routine use.

The measurement of placental thickness is relatively simple and clinically useful. Abnormal thickness of placenta is well recognized as a diagnostic harbinger in a wide spectrum of pathologic events. Placental thickness can contribute to the management of fetus at risk.<sup>2</sup> Few authors have studied the role of placental thickness as a new parameter for estimating gestational age and placental thickness nomograms in relation to gestational age have been published. Placental thickness measurement can differentiate normal from abnormal pregnancy.<sup>3</sup>

Accurate assessment of gestational age is an important part of any obstetric examination and presently the most effective way to date pregnancy is by the use of ultrasound. Several sonographically derived fetal parameters are used to date pregnancy. They are fetal crown-rump length (CRL), biparietal diameter (BPD), head circumference (HC), femur length (FL) and abdominal circumference (AC). Placental thickness measurement can be used as a new parameter to estimate gestational age.

Single most useful piece of information that obstetric sonography provides is the accurate determination of menstrual age.<sup>4</sup> Knowledge of menstrual age is important to obstetrician because it affects clinical management in a number of important ways.

Knowledge of menstrual age is used in early pregnancy for the scheduling of invasive procedures such as chorionic villous sampling and genetic amniocentesis and in the interpretation of biochemical tests such as expanded maternal serum alpha-fetoprotein screening in which the normal range of values changes over time.

- Knowledge of menstrual age allows the obstetrician to anticipate normal spontaneous delivery or to plan elective delivery at term.
- Gestational age is important in evaluating fetal growth.
- Virtually all important clinical decisions require knowledge of menstrual age.
- Menstrual history could be misleading for a number of reasons.
- Many women may not accurately recall the first day of last menstrual period, particularly if they are not trying to conceive
- Ovulating very early (< day 11) or very late (> day 21) in the menstrual cycle. Matsumoto et al reported that early or late ovulation occurs in approximately 20% of the population.

Most common indications for obstetric sonograms are related to uncertainty regarding the gestational age.

The purpose of the present study of measuring placental thickness at the level of umbilical cord insertion site was to assess the relationship of placental thickness with gestational age and also to assess the growth pattern of placenta with advancing gestational age.

#### Aims and objectives:

The aim of evaluating placental thickness measured at the level of insertion of umbilical cord for estimating gestational age of the fetus.

As a parameter for estimating gestational age of the fetus.

To assess the growth pattern of placenta with advancing gestational age.

#### Patients And Methods:

- The study included **300** normal antenatal women attending antenatal clinic at the department of Obstetrics and gynecology, Alluri Sita Rama Raju Academy of Medical Sciences , Eluru.

#### The inclusion criteria were:

The normal antenatal women of all gestational ages from 11 weeks to 40 weeks of gestation referred to department of radiology, Alluri Sita Rama Raju Academy of Medical Sciences , Eluru for routine antenatal ultrasound.

#### The exclusion criteria were:

- Patients with PIH, diabetes mellitus, intrauterine growth restriction, hydrops fetalis, congenital malformations and twins.
- Polyhydramnios: Large amounts of amniotic fluid can greatly increase the uterine volume and thus the surface area of placenta resulting in thinning of placenta.
- Oligohydramnios. Placenta with morphological variations in size and shape like lobed placenta, succenturiate lobe, placenta membranacea and circumvalate placentas.
- Placentas with variations in insertions of umbilical cord like marginal or battledore placentas and velamentous cord insertions were excluded from study.
- Placentas with poor visualization of cord insertion site were also excluded.

## OBSERVATION AND RESULTS

1. Age distribution of antenatal women studied:

In the total study group of 300 normal antenatal women, the age ranged between 17 yrs to 39 yrs. The mean age was 25 years. The distribution of cases with respect to maternal age groups is given in table.

#### Maternal Age distribution

Age in years	Number of cases	Percentage
<20	26	8.7
20-25	144	48.0
26-30	119	39.7
>30	11	3.7
Total	300	100.0

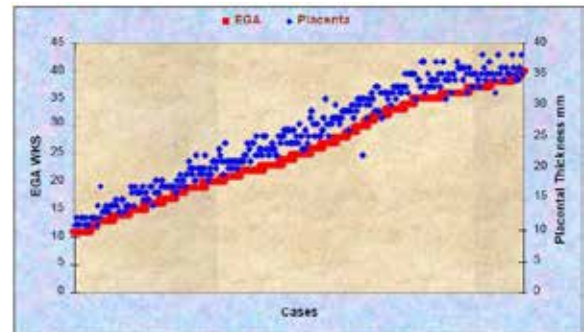
Majority of antenatal women were in the age group between 20 and 30 years

#### Effect of Advancing Gestational age on Placental thickness:

Placental thickness in individuals from 11-40 weeks of gestation is plotted with gestational age and it is observed that there is a linear relationship between Placental thickness (in mm) and gestational age (in weeks). The mean values of Placental thickness show a perfect increasing linear trend with increasing gestational age and almost matching it.

It is observed from 95% confidence interval that gestational age can be accurately predicted from the placental thickness measurements. Slight increased variations were observed in 30 and 31 weeks of gestation as seen from relatively wide 95% confidence interval limits.

#### Plot of Placental thickness (in mm) with gestational age (in weeks) of all cases



Placental thickness (in mm) increases with increasing gestational age (in weeks) ( $r = 0.8993$ ,  $p < 0.01$ ). It is observed that the relationship of Placental thickness with gestational age falls marginally and the rate of growth of Placental thickness decreased after 36 weeks of gestation.

For every week of increase in gestational age, there is an average increase of Placental thickness by 0.8993 mm.

The data show that the placental thickness was directly related to gestational age, with linear regression modeling yielding the following equation: (11-40 weeks)

Placental thickness (in mm) =  $0.8993 \times$  gestational age (in weeks) + 2.1647 ( $r=0.9947$ ),  $r$  = Pearson correlation coefficient.

The values of mean Placental thickness were also correlated with gestational ages between 11 and 35 weeks with linear regression modeling yielding the following equation:

Placental thickness (in mm) =  $0.9612 \times \text{gestational age (in weeks)} + 0.9443$  ( $r=0.9975$ ),  $r$  = Pearson correlation coefficient

## DISCUSSION

Donald introduced placental localization by ultrasound in 1965. This method of ultrasound placentography was found to be highly accurate for localization of placenta. Until recently, the placenta was evaluated purely to determine its position or to ascertain premature separation. A more detailed USG evaluation of the placenta has led to the understanding of possible morphologic changes as the placenta matures.

For many years ultrasonologists have approached the placenta as a 'static' feature in a dynamic system. While all measurements of fetus were related to menstrual age, the placental thickness was judged as normal or abnormal based on a single "cut off" point. The present study data confirm that placental thickness is a function of age. Abnormal thickening or thinning must be correlated with other estimates of pregnancy duration.

The present study assessed the relationship of placental thickness (in mm) with sonographic gestational age (in weeks) and also the growth pattern with advancing gestational age. The study showed that the placental thickness (in mm) increases steadily with increasing gestational age (in weeks) in a linear fashion and almost matching the gestational age from 11-35 weeks of gestation. The rate of increase of placental thickness gradually diminished from 36-40 weeks and was less by 1-4 mm compared to gestational age (in weeks).

### Accuracy of placental thickness measurements

To obtain an accurate placental measurement, it's important to identify the placental-myometrial interface. When placenta is posterior, identification of this region is facilitated by the acquisition of images as free from acoustic shadowing from the fetus as possible.

When the placenta is anterior, proper transducer position and gain settings are important to minimize near field and reverberation artifacts.

Since the placenta is a passive structure lacking the capacity to expand focally, measurements of placental thickness at any point yields similar results. Placental thickness may appear focally increased over uterine contractions or myomata, attention to the placental-myometrial echogenicity difference should confirm that the placenta drapes over these regions of myometrial thickening.

### Limitations of the study

The present study is a cross-sectional study design, which is made up of observations on different individuals. It is not a true placental growth curve as these can only be obtained from serial measurements taken on the same patient throughout gestation. So, it may not provide a clear understanding in individual growth patterns. However, it is a reasonable approximation of a true placental growth curve. Longitudinal placental growth curves can be constructed from serial measurements taken on the same patient throughout pregnancy.

Accuracy of placental measurements depends on making a perpendicular scan of the placenta and care should be taken in acquisition and interpretation of the images

to prevent spurious measurements. For e.g., imaging obliquely through the placenta leads to images incorrectly suggesting placental thickening. Images were always acquired at the level of cord insertion as images obtained too near the periphery of the placenta may spuriously suggest thinning.

A method to estimate the thickness of the in-situ placenta from USG images in a single dimension has its own limitations. Placental volume measurement using 3-D USG may more accurately assess placental size than placental thickness measurements.

The parameter of placental thickness may vary among different population groups. Population specific nomograms may be needed derived from large sample sizes. The placental growth curves may be different for different population groups.

Short placental insertion site may spuriously suggest placental thickening in a normal placenta.

Cord insertion site on the placenta was difficult to image in normal term pregnancies, especially in posterior locations.

## CONCLUSIONS

The relationship between the placental thickness and gestational age is linear and direct.

Placental thickness (in mm) measurement can be an important additional parameter for estimating gestational age along with other parameters especially from 11 to 35 weeks of gestation.

Placental thickness (in mm) increases with increasing gestational age (in weeks) and almost matching it from 11 to 35 weeks of gestation.

The relationship of Placental thickness with gestational age falls marginally and the rate of growth of Placental thickness decreased after 36 weeks of gestation and was lower by 1-3 mm.

The thickness of the placenta and growth pattern did not vary relative to the placental location.

Normal Placental thickness nomograms have been established in the present study to determine whether a given Placental thickness is normal or abnormal for a particular gestational age.

## SUMMARY

Sonographic measurement of placental thickness, at the level of cord insertion site, is relatively simple and is clinically useful. It enables the evaluation and detection of placental abnormalities that can significantly affect the management and outcome of pregnancy.

Placental thickness (in mm) increases in a linear fashion with advancing gestational age (in weeks) and almost matching it from 11 – 35 weeks of gestation. It can be an additional indicator of estimating gestational age especially where the duration of pregnancy is unknown or uncertain.

It was observed that the relationship of Placental thickness with gestational age falls marginally and the rate of growth of Placental thickness decreased after 36 weeks of gestation.

Determining the Placental thickness may be helpful in the diagnosis of some abnormalities; a thin placenta may be seen in cases of IUGR and thick placentas are noted in hydros fetalis of varied causes.

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## CORD INSERTION SITE



## Placental myometrial interface

Correct identification of placental myometrial interface is important for proper measurements of placenta. Focal myometrial thickening due to contractions or myomata may spuriously suggest placental thickening but attention to the placental myometrial echogenicity difference should confirm that the placenta drapes over these regions of myometrial thickening.<sup>37</sup>

