

## Research Article

# Evaluation of placental thickness as a sonological indicator for estimation of gestational age of foetus in normal singleton pregnancy

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### ABSTRACT

**Background:** Gestational age is frequently over or under estimated, as the conventional gestational estimation is based on the last menstrual period and on ultrasonography. Many people are unaware of their last menstrual period and irregular menstruation and ultrasonography is bound to have a bias, thereby posing difficulties in the estimation gestational age. Placental thickness measured at the level of umbilical cord insertion appears to be a new promising parameter for estimation of gestational age of fetus as placenta is a maternal foetal organ and its size is a reflection of the health and size of the foetus. It provides the physiological link between a pregnant woman and the fetus. Measurement of placental thickness is relatively simple and very useful. In our present study we have tried to measure Placental thickness at the level of umbilical cord and determine its relationship with gestational age of foetus in normal singleton pregnancy.

**Methods:** The current crosssectional study was conducted at the department of radiodiagnosis, Gandhi medical college and Hamidia hospital, Bhopal from April 2012 to December 2014. This is a hospital based study with a sample size of 199 normal antenatal women. All the subjects were enrolled with detailed oral and written consents. All examinations were performed using GE logic 3 expert scanner with 3.5 MHz convex array transducer. Placental thickness in millimeters was measured at the level of insertion of the umbilical cord. Data was compiled in MS excel sheet and analyzed using online statistical calculator, chi square test and pearson correlation coefficient were applied with value of P <0.05 was considered statistically significant.

**Results:** In the total study group of 199 normal antenatal women, the age ranged between 18yrs to 34 years and the mean age was between 20 and 25 years of age. Anterior placenta was noted to be the most common location amongst the study sample. It is observed that placental thickness correlates with gestational age and gradually increases as gestational age increases. To prove that there was a correlation the between placental thickness and the gestational age, the Pearson correlation coefficient was found to be  $r = 0.98$  and the p value was <0.001, thereby establishing a positive correlation between the two variables, indicating placental thickness measured in millimeters increases with gestational age measured in weeks and were statistically significant.

**Conclusion:** A linear increase in mean placental thickness with gestational age was observed using correlation analysis in our present study conducted to determine the relationship between placental thickness and gestational age. Placental thickness measured in millimeters increases with gestational age from 11 weeks to 37 weeks. Placental thickness can be used as a predictor of the gestational age, in women in whom the last menstrual period is unreliable or is not known. In instances when femoral length was difficult to measure due to excessive foetal movements, Placental thickness was found to be a reliable alternative biometric measurement in calculating gestational age.

**Keywords:** Placental thickness, Gestational age of foetus, Placental grading, Foetal Biometry, Gray scale Ultrasonography

## INTRODUCTION

Placenta is a foetal organ with important metabolic, endocrine and immunological functions and provides the physiological link between a pregnant woman and foetus. The placenta develops from chorionic villi at the implantation site at about the fifth week of gestation and by the tenth week the granular echotexture of placenta is apparent on ultrasonography.<sup>1,2</sup>

Sonography has provided a safe and non-invasive means to evaluate the placenta. Its size and growth pattern have a bearing on the foetal outcome. Placental thickness also helps in differentiating normal from abnormal pregnancy. Small and thin placenta is associated with intrauterine growth retardation of the fetus.<sup>3</sup>

Thick placenta is associated with maternal diabetes mellitus, fetal hydrops and intrauterine fetal infections and adverse clinical outcome. Perinatal morbidity and neonatal conditions were worse in cases with thick placenta rather than without thick placenta.<sup>4,5</sup>

Gestational age is frequently improperly estimated. Many women do not recall the first day of their last menstrual period, hence necessitating the use of ultrasound in estimating the correct gestational age.

Wolfson et al. showed that the biparietal diameter was not reliable in the foetuses which had a premature rupture of the membranes. So, there is a need for another parameter for supplementing the gestational age estimation with minimal error.<sup>6</sup>

Gestational age assessment is useful in appropriate scheduling of invasive procedures such as chorionic villus sampling, amniocentesis and interpretation of biochemical tests such as the screening for maternal serum biomarkers such as alpha fetoprotein levels. Gestational age is of paramount importance in the evaluation of growth and development of the foetus as normal range of any foetal parameter changes with advancing age. Gestational age assessment allows the obstetrician to anticipate normal spontaneous delivery or to plan elective delivery at term. In case of anomalous foetus, the mode of management or intervention depends on the gestational age of foetus.

## METHODS

Present study was conducted at the department of radiodiagnosis and imaging, Gandhi medical college and Hamidia hospital, Bhopal. This is a hospital based cross sectional study with a sample size of 199 normal antenatal women. All the subjects were enrolled with detailed oral and written consents. This study was approved by ethical and scientific committee of the institute. Complete evaluation of all patients was performed using Clinical history and examination, laboratory data and ultrasonographic evaluation. All

examinations were performed using GE logic 3 expert scanner with 3.5 MHz convex array transducer.

Placental thickness in millimeters was measured at the level of insertion of the umbilical cord. The transducer must be oriented perpendicular to the chorionic plate and basal plate as tangential scans will distort the measurement of the thickness of the placenta. Placental thickness must be measured from the chorionic plate to the placental myometrial interface excluding the myometrium and subplacental veins. Placental thickness must be calculated by taking the average of three best measurements for each case. Data was compiled in MS excel sheet and analysed using online statistical calculator, chi square test and Pearson correlation coefficient were applied with value of  $P < 0.05$  was considered statistically significant.

### Exclusion criteria

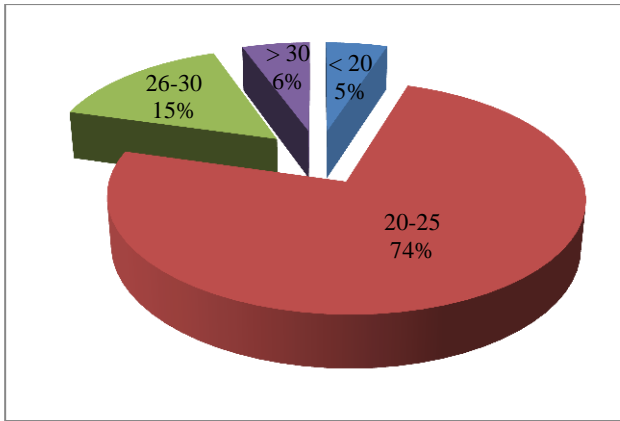
- Multiple gestation.
- Oligohydramnios.
- Polyhydramnios causes stretching of uterine contour there by causing thinning of placenta.
- Patients with medical diseases such as gestational diabetes mellitus, pregnancy induced hypertension, hydrops foetalis, congenital malformations and twins.
- Placentas with poor visualization of site of cord insertion.
- Placentas showing morphological variations such as succenturiate placenta, lobed placenta, membranous placenta.
- Placentas with variations in the insertions of the cord like marginal placenta and velamentous cord insertions were excluded.

## RESULTS

In the total study group of 199 normal antenatal women, the age ranged between 18yrs to 34 years (Table 1). The mean age was between 20 and 25 years of age (Figure 1).

**Table 1: Maternal age groups.**

Age	No. of cases	Percentage
<20	10	5.0
20-25	148	74.4
26-30	30	15.1
>30	11	5.5
<b>Total</b>	<b>199</b>	<b>100.0</b>

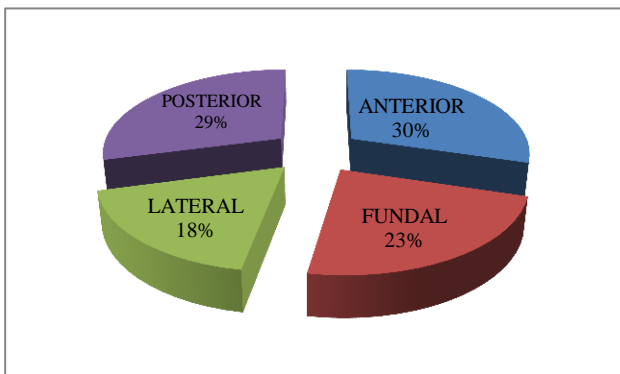


**Figure 1: Distribution according to age.**

Amongst the 199 cases under study, anterior placenta was noted in 59 cases (Table 2) fundal placenta was noted in 46 cases, lateral placenta in 36 cases and posterior placenta in 58 cases (Figure 2).

**Table 2: Placental location.**

Placental location	No. of cases	Percentage
Anterior	59	29.6
Fundal	46	23.1
Lateral	36	18.1
Posterior	58	29.1
<b>Total</b>	<b>199</b>	<b>100.0</b>



**Figure 2: Distribution according to placental location.**

Distribution of cases according to gestational age is depicted in Table 3 with pictographic representation in Figure 3.

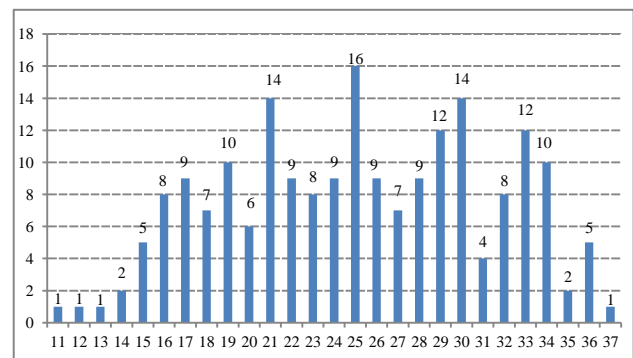
It is observed that placental thickness correlates with gestational age and gradually increases as gestational age increases. Placental thickness measured in millimeters matched gestational age in weeks and at no stage of pregnancy did placental thickness exceed 37 millimeters.

Placental thickness in millimeters is plotted against gestational age and it is observed that there is a linear

relationship between placental thickness measured in millimeters and gestational age measured in weeks.

**Table 3: Distribution of cases according to gestational age.**

Gestational age (weeks)	No. of cases	Percentage
11	1	0.5
12	1	0.5
13	1	0.5
14	2	1.0
15	5	2.5
16	8	4.0
17	9	4.5
18	7	3.5
19	10	5.0
20	6	3.0
21	14	7.0
22	9	4.5
23	8	4.0
24	9	4.5
25	16	8.0
26	9	4.5
27	7	3.5
28	9	4.5
29	12	6.0
30	14	7.0
31	4	2.0
32	8	4.0
33	12	6.0
34	10	5.0
35	2	1.0
36	5	2.5
37	1	0.5
<b>Total</b>	<b>199</b>	<b>100.0</b>

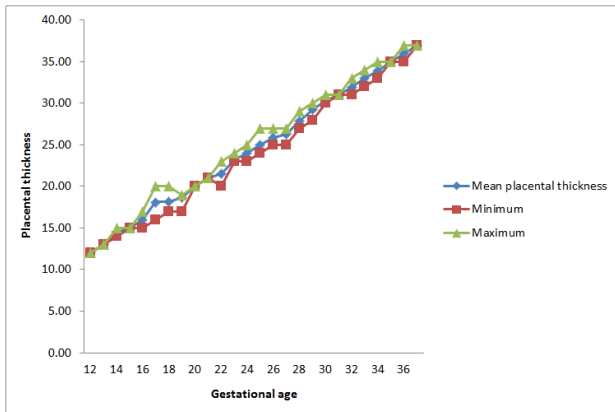


**Figure 3: Gestational age in weeks against total number of cases.**

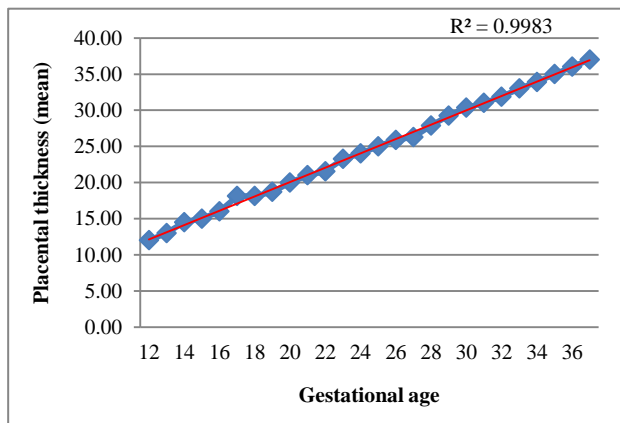
To prove that there was a correlation between placental thickness and the gestational age, the Pearson correlation coefficient was calculated and it was found to be  $r = 0.98$  and the "P" value was  $<0.001$ , thereby establishing a positive correlation between the two variables, indicating

placental thickness measured in millimeters increases with gestational age measured in weeks (statistically significant).

For every week of increase in gestational age, there is an average increase of placental thickness by 0.98 millimeters.



**Figure 4: Correlation between gestational age and placental thickness.**



**Figure 5: Correlation of mean placental thickness and gestational age.**

## DISCUSSION

Early reports of placental localization have been reported by Donald<sup>7</sup> and Kobayashi.<sup>8</sup> This method of ultrasound placentography was found to be accurate for localization of placenta.

Usually placenta was evaluated to determine its location or to determine its premature separation. Detailed ultrasonographic evaluation of the placenta has led to understanding of possible morphologic changes as the placenta matures.

Before the advent of antenatal ultrasonography, examination of the placenta was limited to retrospective evaluation and had little influence on pregnancy or management of its outcome. With the improvement of

ultrasound equipment it is now possible to examine the placenta in great detail from the beginning of first trimester.

For many years radiologists have approached placenta as a static structure in a dynamic environment. The present study confirms that placental thickness is related to gestational age and hence its measurement is significant.

Accurate determination of gestational age has become important for deciding the appropriate time for termination of the pregnancy as well as to monitor the fetal growth during the entire period of pregnancy.<sup>9,12</sup>

Early delivery may benefit a fetus that is small for dates. Such a fetus may be inadequately supplied by its placenta with oxygen and its nutrients, and may therefore do better in the care of neonatologists than in utero. When the fetus is large, caesarean section may be preferred route of delivery, particularly in pregnancies complicated by maternal diabetes. In view of these considerations fetal weight should be a component of every obstetric sonogram.

### Placental thickness and gestational age

The present study assessed the relationship of placental thickness (in mm) with sonographic gestational age (in weeks). The study showed the placental thickness (in mm) increases steadily with increasing gestational age (in weeks) in a linear fashion and almost matching the gestational age from 11-37 weeks of gestation (Figure 4, Figure 5).

The results of the present study are consistent with the observations made by authors of previous studies.

In contrast to previous studies a fall in placental thickness from 32 to 37 weeks was not observed. The relationship between the variables under study was linear amongst the study sample.

The measurement of placental thickness at the site of umbilical cord insertion site is relatively simple. Placental thickness normograms have been published and there is literature available about the use of placental thickness as a new parameter in the assessment of gestational age.

Nyberg and Finberg also reported that as a rule of thumb, placental thickness parallels gestational age in weeks.<sup>13</sup>

Hoddick et al. found average placental thickness in millimetres is equivalent to gestational age in weeks and found that in no stage of pregnancy should exceed 4 cm.<sup>14</sup>

Hadlock et al. suggested that one should avoid the tendency to place excessive emphasis arbitrarily on any one measurement because, in any given case, any measurement could provide the best estimate of age.<sup>15</sup>

With this idea in mind, they postulated that multiple foetal measurements should be used in combination to provide a composite age estimate.

The use of multiple measurements is especially important when one considers several points

- 1) If one is using only one parameter and makes an imaging or measurement error, the magnitude of the error in age prediction could be significantly greater than the reported variability for that parameter.
- 2) It is not uncommon for normal fetuses to have measurements that are above or below the expected mean value at a given age and these differences are not always in the same direction, for example foetus may have a 75 percentile head size and a 25 percentile abdominal size.
- 3) The process of plane selection of the foetal head, abdomen and femur allow a detailed look at important anatomic structure and therefore facilitates detection of abnormalities in these areas, including hydrocephalus, encephalocele, bowel obstruction, ascites, renal abnormalities and dwarfism.

Maximum placental thickness noted in our study was 37 mm and to the best of our knowledge only normal pregnant women were included in the study.

Jauniaux et al. and Hellman et al. have also established correlation between placental size and gestational age.<sup>16</sup>

Tanawattancharoen et al. reported less variation in placental thickness at gestational age between 18 weeks and 40 weeks.<sup>17</sup>

Mittal P and Hooja N found an increasing trend in the values of placental thickness in millimetre with increase in gestational age. The placental thickness corresponds to gestational age in weeks.<sup>18</sup>

Anupama Jain et al. reported that placental thickness almost matched gestational age from 27 weeks to 33 weeks of gestation.<sup>19</sup>

Placental thickness changes are an expression of normal growth of the fetoplacental unit amenable to measurement with ultrasonography and of value in describing normal physiology.

Some diseases or abnormalities of the fetus can be detected through the measurement of placental thickness. The measurements relative to gestational age should serve to facilitate recognition of altered placental thickness induced by pathological process.

Thin placenta is often a marker for a small for date fetus and a sign of growth restriction. Placental thinning is also

seen in patients in preeclampsia, chromosomal abnormalities and severe intrauterine infections.

Thick placentas are often associated with hydrops fetalis, diabetes mellitus and intrauterine infections. Sonographically thick placenta is associated with increased perinatal risk with increased mortality related to foetal anomalies and higher rates of both small for gestational age and large for gestational age infants at term.<sup>20</sup>

#### ***Accuracy of placental thickness measurements***

To obtain an accurate placental measurement, it is 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 of the fetus as possible.

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

Correct identification of placental myometrial interface should also preclude the illusion of placental thickening induced by focal myometrial thickening. 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 myomas. Attention to the placental-myometrial echogenicity difference should confirm that the placenta drapes over these regions of myometrial thickening. Thoughtful attention to technical details and correlation with gestational age should facilitate the detection of abnormal placental thickness and normal growth pattern in prenatal sonographic evaluation.

#### **CONCLUSIONS**

A linear increase in mean placental thickness with gestational age was observed using correlation analysis in our present study conducted to determine the relationship between placental thickness and gestational age. Placental thickness measured in millimeters increases with gestational age from 11 weeks to 37 weeks. Placental thickness can be used as a predictor of the gestational age, in women in whom the last menstrual period is unreliable or is not known. In instances when femoral length was difficult to measure due to excessive foetal movements, placental thickness was found to be a reliable alternative biometric measurement in calculating gestational age. It is a useful adjunct to other biometric parameters in estimation of gestational age. The substitution of abnormal foetal parameters like biparietal diameter in hydrocephalus with placental thickness in the gestational age estimation can be looked into.

Placental thickness measurement can be used as a screening indicator to differentiate normal from abnormal pregnancies warranting further evaluation.

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