

The accuracy of placental thickness in estimation of gestational age during late third trimester — A single centre cross sectional study

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Abstract

Objective: To determine the validity of the placental thickness for calculating the gestational age during the third trimester.

Methods: A cross-section prospective study was carried out from March 2019 to January 2020 at the Obstetrics and Gynaecology Department in Al Yarmouk Teaching Hospital, Baghdad, Iraq on 90 women with low risk pregnancy and gestational age between 34 to 37 completed weeks, recruited from the antenatal clinic. The foetal gestational age was estimated by the accurate date of the last menstrual period and early ultrasound at 11-14 weeks of gestation. Placental thickness was determined at the umbilical cord implantation site. The association between placental thickness and gestational age was established.

Results: There was no meaningful association amongst placental thickness and age, gravida, para, and placental location. The mean placental thickness in this analysis was 34.17mm at 34th week of gestation to 34+6 days, and its steadily (and significantly) increased through 35th to 35+6 days, and from 36week to 36+6days, and 37th weeks of gestation, (35.06, 36.11, and 36.81 millimeters; respectively). Placental thickness in millimeters had a linear relationship and a statistically significant positive correlation with gestational age (in weeks) in the third trimester. A cut off placental thickness more than 36.3 mm can be used to differentiate between term and preterm pregnancy.

Conclusion: Mean placental thickness was steadily and significantly increased through third trimester of pregnancy, and can be used as a parameter for accurate estimation of gestational age during third trimester of pregnancy. A more than 36.3 mm placental thickness can be used as cut off point between term and preterm pregnancy.

Keywords: Estimation of gestational age, placental thickness. (JPMA 71: S-93 [Suppl. 8]; 2021)

Introduction

The placenta is a temporary structure that connects the foetus to the wall of the uterus to deliver oxygen and nutrients, waste elimination via the mother's blood supply; and to produce hormones which support pregnancy.^{1,2} For maintenance of a healthy pregnancy the placenta development should be highly regulated that is essential for normal foetal growth and development.² Any deviation from the norm such as incomplete invasion of trophoblast can alter placental angiogenesis which is considered as a cause of many disorders during pregnancy as preeclampsia.⁴ The placenta usually has a disc shape, averages 22 cm in length, with the center being thicker than the edges, It weighs approximately 500 grams, it is hypotrophic if less than 300 g and hypertrophic if more than 700gram.^{5,6} Its location is classified into posterior, anterior, fundal and lateral.⁷ As a part of physiological aging process placentas develop some degree of calcification at term. But if calcification occurs before 36th week, it could cause

complications as foetal growth restriction and foetal distress.⁸

Accurate estimation of gestational age is essential in obstetric care and is important in different clinical situations.⁹ The usual method to calculate the gestational age is by calculating the days since the first day of the last menstrual period.⁹ The other method is by using ultrasound to measure the mean diameter of the gestational sac and crown rump length (CRL) during first trimester¹⁰ and biparietal diameter (BPD),¹¹ head circumference (HC),¹² abdominal circumference (AC) and femoral length (FL) during 2nd and 3rd trimester of pregnancy.¹³ As placental thickness gradually increases with gestational age by approximately 1 mm per week, although there is some difficulty in measuring placental thickness when placenta is placed posteriorly or in cases of a lateral placenta with big baby or in case of unequal amniotic fluid distribution.¹⁴ Placental thickness varies according to the clinical situation so abnormally increased placental thickness develops in association with foetal macrosomia, foetal hydrops and maternal diabetes while decreased placental thickness can be seen with pre-eclampsia and Intrauterine growth restriction (IUGR).¹⁴ As placental thickness increases with rise in gestational age in absence of any medical or obstetrical

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complication, so it can be used to approximate gestational age in low risk pregnancy.

Patients and Methods

A total of 90 pregnant women with low risk pregnancy between 34 to 37 completed weeks of gestation were included in this hospital-based cross-sectional study conducted at Al Yarmouk teaching Hospital, Baghdad, Iraq between March 2019 - January 2020. The sample size was calculated based on the correlation coefficient $R=0.01$ and using alpha 0.01 Beta 0.01 with reference to the Nigerian study.¹⁵ The figure calculated for the sample size was 63 and in order to increase the accuracy of our findings the figure was increased to 90. It was approved by the Scientific council of obstetric and gynaecology/the Iraqi board for Medical Specialization, The gestational age was estimated depending on accurate dates of the last menstrual period (LMP) and early ultrasound (US) between 11-14 weeks of gestation (using crown rump length). Any woman with unsure LMP, lactation amenorrhoea, irregular cycle and women on contraceptive pills for the last 3 months prior to pregnancy were excluded. Pregnancy complicated by amniotic fluid abnormality, medical disorder, intrauterine growth restriction, foetal anomalies, multiple pregnancy, placental abnormalities, poor visualization of the placenta and site of cord insertion and women who had started labour, were also excluded. Informed verbal consent was obtained from all participants who met the inclusion criteria. A detailed history and clinical examination and investigations were sent. US scan was done with sector probe 3.5MHZ logic p5 TOSHIBIA ultrasound convex array transducers . The foetus were examined for any anomaly, amount of liquor and GA was estimated by measurements of foetal biometry (femoral length, parietal diameter and head circumference). For placental position, morphology was determined and thickness in millimeters was measured with patient in supine position with a moderately distended urinary bladder, and with no uterine contraction. The measurement should be at the level of cord insertion and averaging the three measurements for each patient.

For statistical analysis, the chi square test was used to

evaluate the discrete variable. T-test and one way ANOVA was used to evaluate differences in mean among 2 groups and more than two groups, the post Hoc Tukey test was used to assess which pair was meaningful with r being the correlation coefficient and representative of the magnitude and direction of a relationship. The receiver operator curve was used to validate various parameters when distinguishing active cases from the control (negative cases) and the area under the curve, i.e. The AUC and its p value recommended this validity (if $AUC \geq 0.9$ means excellent test, 0.8 - 0.89 means good test, 0.7 - 0.79 fair test and otherwise unacceptable). Trapezoidal method was used to estimate the curve. SPSS 22.0.0 (Chicago, IL) software package was used for statistical analysis, $p < 0.05$ was considered significant.

Results

A total of 90 pregnant women with low risk pregnancy their mean age was 28.1 ± 8.2 years. in terms of gestational age they had almost similar distribution (from 34 to 37 weeks) and distribution as follow 34-34+6day 18 (20%), 35-35+6 days ,24 (26.7%), 36- 36+6 days, 26 (28.9%) , 37 compeletd weeks, 22 (24.4%). The mean of the gravida of the patients \pm standard error mean (SEM) was 3.9 ± 0.2 , the mean of their parity \pm SEM was 2.1 ± 0.2 , about 44 (48.9%) had history of abortion, while 62(68.9%) had anterior placental position and 28 (31.1%) had posterior position. Mean placental thickness increased as gestational age increased from the 34th week to 34+6 days of gestation, additionally the increase from 35th to 35+6 days; from 36th to 36 week+6 days, and 37th weeks was significant, as illustrated in Table-1.

There was direct strong significant positive correlation between gestational age and placental thickness (correlation coefficient (r) = 0.961) and there was no significant correlation between placental thickness with age, gravida, para, and placental position. Placental thickness cut-off of >36.6 showed excellent ability as area under the curve >0.983 to predict the 37th week of gestation compared to 34 - 36 weeks, with very high sensitivity 100 and specificity 94.1 positive predictive value 84.6 negative predictive value 100.

Table-1: Association between gestational age and placental thickness.

GA (weeks)	34 -34+6	35- 35+6	36- 36+6	37	Overall
Number	18	24	26	22	-
PT (mm)	34.17 ± 0.25	35.06 ± 0.19	36.11 ± 0.37	36.94 ± 0.29	35.64 ± 1.04
95%CI	34.04 - 34.29	34.98 - 35.14	35.96 - 36.26	36.81 - 37.06	35.42 - 35.86
	34 vs. 35	35 vs. 36	36 vs. 37	-	-
p-value	<0.001	<0.001	<0.001	-	-

GA: gestational age, PT: placental thickness, CI:confindnice interval.

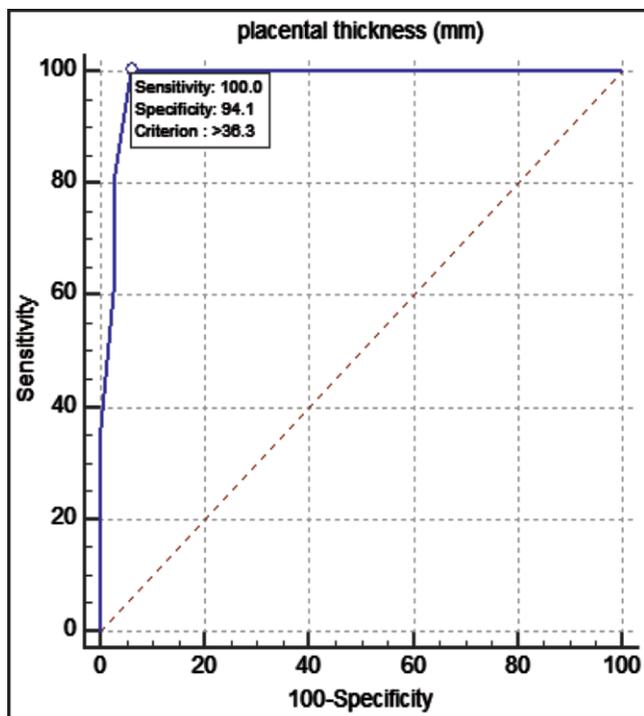


Figure-1: ROC curve placental thickness as predictor of 37th week compared to 34th - 36th weeks of GA.

Discussion

In the present study, mean placental thickness was 34.17 mm at 34th week of GA to 34+6 days, and its steadily (and significantly) increased through 35th to 35+6 days, and from 36 week to 36+6 days (35.06, 36.11, and 36.81 mm; respectively). Our findings were in agreement with other studies as that of Karthikeyan et al's study carried out in India. In this study they reported an increase in placental thickness from 34th to 37th week (35.55, 34.99, 37.6, and 39.33 mm; respectively) which is similar to our findings.¹⁶ Similar to Agwuna et al's study done in Nigeria, in which they assessed the relationship between GA and placental thickness from 14th to 40th weeks and found an increase in placental thickness from (36.8, 37.3, 38.3, and 39.4 mm; from 34th to 37th weeks of gestation).¹⁷ In Zaidi et al's study from Pakistan, placental thickness increased from 34th to 37th weeks of gestation (37.3, 41.1, 39.3, and 43.5 mm, respectively) which was in agreement with our findings.¹⁸ In Balakrishnan and Virudachalam's study from India they found an increase in placental thickness from (34.0, 35.2, 35.6, and 36.5 mm; from 34th to 37th weeks of gestation).¹⁹ In Mathai et al's study from India, they observed an increase in placental thickness from (35.3, 35.8, 44.1, and 38.3 mm; from 34th to 37th weeks of gestation).²⁰ All these studies were in agreement with our findings. In the present study there was direct significant correlation between placental thickness with GA ($r = 0.961$,

p -value < 0.001), this was in agreement with other studies like, Kakumanu et al with ($r = 0.899$, p -value < 0.001)²¹ and with Agwuna et al's study done in the 3rd trimester ($r = 0.706$, p -value $= 0.01$).¹⁷ In the present study, there was no significant difference in placental thickness according to placental position, which was in agreement with Kakumanu et al,²¹ which indicated that placental position is an independent factor. This observation is similar to other studies like the study by Suganya et al.²² The diagnostic performance of placental thickness appears to be excellent (since the AUC is above 0.9), which predicts high sensitivity (100%) and specificity (94.1%) in women with 37 weeks of GA. Interestingly, since the negative predictive value is higher than its positive predictive value (100% vs. 84.6%), this could indicate that it is of more value as a screening method rather than a method for confirming GA. In this study the placental thickness of more than 36.3mm was considered as a cut off value to differentiate between term and preterm gestation. Similar results were observed by Balakrishnan et al¹⁹ which were 36.5 ± 1.4 mm representing the placental thickness in pregnant women with 37 weeks of gestation. Higher level was observed by Agwuna K et al¹⁷ and Ohagwu. et al¹⁵ as they reported placental thickness of 39.4 ± 3.8 mm, 43.5 ± 5.6 mm respectively. In the present study 68.9% of the participants had anterior placental position, and 31.1% had posterior placental position. This was in agreement with Kakumanu et al's study in which anterior placenta was observed in 36.7%, 22.0% in posterior position, 23.3% in fundal position and 18.0% in the lateral position.²¹

Conclusion

Mean placental thickness increases steadily and significantly through gestation during third trimester of the uncomplicated pregnancy. Placental thickness greater than 36.3 mm can be used as a cut off point to differentiate between term and preterm pregnancy. Placental thickness can be used as an additional parameter for accurate estimation of gestational age during third trimester of pregnancy.

Disclaimer: None.

Conflict of Interest: None.

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