Original Article

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A Sonographic Study on Estimating of Gestational Age by Placental Thickness

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Abstract

Background: Knowledge of gestational age (GA) is important because it affects clinical management in many ways. Ultrasonography has provided a safe and noninvasive means of dating a pregnancy. The purpose of the present study is to assess the relationship of placental thickness with gestational age and to compare it with other sonographic parameters used to estimate gestational age. **Subjects and Methods:** The study included 242 normal pregnant women who knew their last menstrual period (LMP). After taking consent, all the women underwent an ultrasound examination. During the scan, besides measuring routine biometric parameters, Placental thickness at the cord insertion was also measured. A retrospective study was designated to test the hypothesis that placental thickness in an age dependant variable and hence can predict gestational age. In the end, the predicted gestational age by placental thickness was compared with gestational age as determined by other sonographic parameters. **Results:** Placental thickness showed a linear progression in relation to the menstrual age. The correlation coefficient was found to be 0.86($p<0.001$). The regression equation was formulated by regressing gestational age on the measured placental thickness. The correlation coefficient between GA-LMP and GA-USG was 0.92 as compared to 0.86 between GA-LMP and GA-PT. The standard error for other USG parameters was +2.32 compared to +2.96 for placental thickness. **Conclusion:** Placental thickness being a fusion of menstrual age, can be used to predict the gestational age by using the regression formula. Gestational age calculated by other USG parameters is closer to menstrual age as compared to that by placental thickness. The prediction interval was slightly more when the placental thickness was used instead of other USG parameters. Placental thickness is a good alternative parameter for predicting gestational age in the second and third trimester.

Keywords: Gestational age, Ultrasonography, Prenatal, Placenta, Pregnancy, Biometry

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Introduction

Knowledge of gestational age is important because it affects clinical management in a number of ways. Firstly knowledge of gestational age is used in early pregnancy for scheduling invasive procedures such as chronic villus sampling and amniocentesis and in the interpretation of biochemical tests such as triple marking testing, in which the normal range of values changes over time. Secondly, knowledge of the gestational age allows the obstetrician to anticipate normal spontaneous delivery or to plan elective delivery. Lastly, knowledge of the gestational age is important in evaluating fetal growth because the normal range of the size of any fetal parameter changes with advancing age. When an anomaly is discovered sonographically, the mother's choice is heavily influenced by gestational age. Virtually all important clinical decisions require knowledge of the menstrual age. Fetal age actually begins at conception and is equivalent to conceptional age. Menstrual age is an age in weeks beginning from the first day of the last menstrual period. Ideally, gestational age would be synonymous with conceptional age. However, the age of conception is unknown, whereas the related date, the first day of the last menstrual period, is known in most cases. For this reason, gestational age has long been used synonymously with menstrual age. Before the advent of sonography, menstrual age was established by the patient's menstrual history corroborated by physical examination of uterine size and confirmed in the postnatal period by physical examination of the neonate. If all pregnant women knew their last menstrual period and had regular 28 days cycle, menstrual age would always be 2 weeks more than the conceptional age. If this was the case, it would be reasonable to continue to use menstrual age to measure progression through pregnancy and ultrasound would play no role in dating pregnancies. However, in practice, dating

using the last menstrual period has many limitations. Many women misremember their last menstrual period, especially if they were not trying to conceive or when questioned late in pregnancy. Cycle lengths vary so that the time interval between the LMP and conception may be greater or less than 2 weeks. It may be unreliable or misleading because of implantation bleeding, use of oral contraceptives, or becoming pregnant in the first ovulatory cycle following recent delivery. In women without objective data about the conception, the last menstrual period and ultrasound play a complementary role in establishing gestational age based on the last menstrual period. When an obstetrician is confronted with pregnant women who are uncertain of her dates and has already reached the third trimester, biometric data are unreliable at this time. There is no foolproof means of determining menstrual age at this juncture. The present study was conducted to study placental thickness by sonography and assess the relationship of placental thickness with gestational age and to estimate gestational age by placental thickness. [1–3]

Subjects and Methods

The antenatal scan was done by a single observer to eliminate inter-observer variations. The ultrasound machine used had 3.5 MHz curvilinear probes (Sonoline Adara (Siemens), Flexus SSD1100 (Aloka) and Larson & Toubro SONALISA). In this cross-sectional study, the study group consisted of the last menstrual period determined gestational age of fetuses ranging from 18 weeks to 40 weeks. Each patient was examined only once during the study period. All the scans were done by using a transabdominal approach. The patients were explained in detail before the examination. During the scan, various parameters such as MSD and CRL (early pregnancies) BPD, HC, FL and AC were measured accurately. Effective fetal weight, gestational age, and estimated date of delivery were then calculated by the machine and recorded. The amniotic fluid index estimated to rule out oligohydramnios. The placenta was then localized. Placental thickness in millimeters at the level of cord insertion was measured. The measurements were obtained taking care, not include the retroplacental complex or the myometrium. After obtaining the readings, a retrospective study was designed to test the hypothesis that placental thickness is an age-dependent variable and hence can be used to predict the gestational age. In the end the predicted gestational age using placental thickness was compared with gestational age as determined by other USG parameters. Descriptive data were presented as mean +SD and 95% confidence interval. Correlation and regression analysis were performed to assess the relationship between placental thickness and gestational age and to predict gestational for any given placental thickness by prediction equation and graphical representation. Data were analyzed by appropriate statistical analysis. A p-value of <0.05 considered significant.

Results

In the present study, 242 pregnant women were selected who had known LMP and a singleton gestation. The gestational age of fetuses ranged from 18-40 weeks, as determined by the LMP. All these pregnant women were subjected to routine ultrasound parameters. The placental thickness was also measured. The placental measurements were then used to prepare a nomogram for gestational ages ranging from 18 to 40 weeks and predict gestational age by formulating a regression equation. It was observed that there is an increase in the mean placental thickness relative to the progress of the gestational age. At 20 weeks mean placental thickness was 21.4mm, at 30 weeks was 29.6mm and at 40 weeks was 36.8mm. Hence, a relationship was observed between the placental thickness measured and the gestational age. Based on the analysis, a correlation coefficient was calculated which was found to be 0.86, which showed that there is a significant positive correlation between the two variables. The overall observation that the gestational age increased, there was a simultaneous increase in the placental thickness and placental thickness is a dependent variable of the gestational age as determined by the LMP. An ultrasound examination performed on the fetus determines the fetal age based on BPD, Fetal length AC measurements of the fetus. It has been inferred that placental thickness is a gestational age dependable variable; hence an effort was made to know whether placental thickness could be a dependent variable of USG determined gestational age too. A regression equation was then formulated by regressing gestational age as determined by LMP and ultrasound on the placental thickness using the regression coefficient [Table 1].

Table 1: Relationship between PT & GA

Gest age	Correl betwee	No. of	Ra	Mea +SD	Cori Coef	Reg. Coef	Prediction for PT		GA
							Regi Eqn	R2	SE
18-	PT	242	14 40	27.7	–	–	–	–	–
	GA-LMP	242	18 40	28.1	+0.8	+0.9	GA = 0.61	74.5	2.9
	GA-USG	242	14 40	27.2	+0.9	+0.9	GA = 1.22	80.5	2.3

In this study the Pearsons correlation coefficient between placental thickness and gestational age by LMP was found to be +0.86 and that between placental thickness and gestational age by USG was +0.90, which is statistically significant (P <0.001). It was therefore inferred that placental thickness is the dependent variable of gestational age determined either

Table 2: Relationship between GA-USG and GA-LMP

Pearson's correlation coefficient (r)	Coefficient of Determination (R2 : % Dependency)	The standard error (S.E)
0.92	84%	+2.32

from LMP or ultrasound. It was observed that the correlation coefficient between gestation ages as calculated by LMP and other USG parameters is 0.92 as compared to that between gestational ages calculated by LMP and placental thickness, which is 0.86. Hence correlation between gestational age calculated by LMP and other USG parameters is better than that between gestational age calculated by LMP and placental thickness [Table 2].

The standard error for other USG parameters is +2.32 as compared to a placental thickness which is +2.96. Thus, the prediction interval was slightly more when the placental thickness is used instead of other USG parameters. Hence gestational age calculated by other USG parameters is closer to menstrual age as compared to the predicted gestational age by placental thickness. Placental thickness is useful in determining the gestational age in cases of women presenting late in the third trimester where the LMP is not known or is unreliable. It is also a good alternative parameter to use when a single fetal parameter is disproportionately large or small.

Discussion

In the present study 242 normal pregnant women with known LMP and gestational age ranging from 18 -40 weeks were subjected to routine antenatal scans. The study did not include pregnant women with multiple gestations, pregnancy-related complications such as pre-eclampsia, diabetes mellitus which can affect the placenta and cases with severe oligohydramnios where the placenta is compressed. Besides noting the usual biometric measurements that are BPD, FL and AC, placental thickness at the cord insertion was measured in all cases. The measurement of placental thickness was done in its long axis at the level of cord insertion. The transducer was correctly aligned and care was taken not to include the retroplacental complex or the myometrium. The technique was practiced initially before the actual study and a single observer performed the measurements in all the cases to minimize the error.

The studies were done by Jain et al. and Mital et al. have compared USG determined gestational age into consideration.[4,5] None of them have formulated any equation by using regression analysis. They have shown that the placental thickness shows a linear relationship with the gestational age determined by other parameters. Tsong and Boonyanurak established normal values of placental thickness during the first half of pregnancy.[6] Regression analysis yielded a linear equation of the relationship. However they measured placental thickness perpendicularly through the thickest part of the placental. In the present study, after obtaining all the measurements, a nomogram was constructed using the placental thickness measured for the specific gestational age as calculated by LMP. It was found that as the gestational age progressed, there was a linear in the placental thickness too. Pearson's correlation coefficient between placental thickness and gestational age was found to be 0.86. Depending upon the correlation coefficient, the regression equation was formulated. Equation GA = 0.61+0.99 (PT), R2 74.5% and Standard error was found to be +2.9 weeks. The estimated gestational age was calculated for each case using the regression formula. In the second phase of the study, a correlation between the age as calculated by LMP and gestational age as calculated by other USG parameters and placental thickness was studied. Pearson's correlation coefficient (r) between GA-LMP and GA (other USG parameters) was found to be 0.92. GA- LMP and Estimated GA (Placental Thickness) was found to be 0.86. Coefficient determination (R2: Dependency) and standard error (S.E) as calculated by regression analysis were as follows: GA (LMP) and GA (USG). R2 was 84% with standard error +2.32 and GA (LMP) and Est GA (PT): R2 was 75 % with standard error +2.96. Here it was seen that the correlation between gestational age calculated by LMP and other USG parameters was better than that between gestational age calculated by LMP and placental thickness. The prediction interval was slightly more when the placental thickness was used instead of other USG parameters. Placental thickness being a function of menstrual age can be used to predict the gestation age of the fetus in second and third trimesters by using the regression formula. However, gestational age calculated by other USG parameters is closer to menstrual age as compared to the predicted gestational age by placental thickness. Placental thickness is useful in determining the gestational age in cases of women presenting late in the third trimester where the LMP is not known or is unreliable. It is also a good alternative parameter to use when a single fetal parameter is disproportionately large or small.

Conclusion

Placental thickness being a fusion of menstrual age, can be used to predict the gestational age by using the regression formula. Gestational age calculated by other USG parameters is closer to menstrual age as compared to that by placental thickness. The prediction interval was slightly more when the placental thickness was used instead of other USG parameters. Placental thickness is a good alternative parameter for predicting gestational age in the second and third trimester.

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