REVIEW ARTICLE

Sonographic Placental Thickness as a Determinant of Fetal Gestational Age: A Review

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Abstract

Accurate estimation of fetal gestational age is important for the appropriate management of pregnancy. Gestational age is usually calculated from the last menstrual period or fetal biometrics like crown-rump length and femur length. Both these methods are relatively inaccurate. Placental thickness has long been looked at as a maternofetal parameter for estimating gestational age primarily because it does not rely on either menstrual history or fetal measurements affected by anomalies or inconsistent measurements as the gestational advances. The purpose of this study was to review the role of placental thickness in estimating fetal gestational age. It was found that placental thickness increased linearly with the increase in gestational age and thus is a function of gestational age. Most of the studies agreed that this relationship can be exploited to predict gestational age when it is unknown. Along with other already established parameters, the placental thickness may help to give a more accurate estimate of gestational age and consequently help to identify premature babies that require specialized care. This would go a long way in reducing perinatal mortality rates due to prematurity and better fetal outcomes.

Keywords: Antenatal care, Gestational age, Placental thickness, Pregnancy dating, Ultrasound.

Key Message: Placental thickness correlates well with fetal gestational age and can be used as a potential new parameter for estimating fetal gestational age to guide appropriate pregnancy management. This will result in better fetal outcomes with decreased mortality statistics.

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Introduction

The placenta is a temporary but highly specialized, fetomaternal organ essential for fetal metabolic, nutritional, endocrine, and immunological needs. It forms the physical and functional connection between the developing fetus and mother.[1] As such, proper fetal growth and subsequent timely development depend upon the efficient functioning of the placenta. As the fetus grows, the size of placenta increases to support fetal growth needs. Hence, placental size is a marker of fetal growth.[2]

Sonography is a safe and noninvasive tool to evaluate placental position, morphology, and growth throughout the pregnancy. Placental evaluation has an established role in the detection of pathologies, like nonimmune hydrops, intrauterine growth restriction, and gestational diabetes.[3] Total placental volume is probably the most accurate estimate of placental size, but the volumetric measurement is too complicated and cumbersome for routine use.[4]

Instead, ultrasonographic placental thickness is an easily measurable and reliable parameter. It has been proposed as a new biometric parameter to overcome the inherent limitations of other sonographic parameters in estimating fetal gestational age.[5] This review article aims at studying the accuracy of correlation between placental thickness and gestational age and whether placental thickness can be used to estimate gestational age.

Materials and Methods

A comprehensive computer-aided search for relevant articles published from January 2000 till December 2020 investigating the correlation between placental thickness and gestational age was made from PubMed/Medline and Google Scholar databases using keywords like placental thickness and gestational age. The search retrieved 34 studies out of which only the studies conducted using ultrasonography and 2D measurement of placental thickness at the site of cord insertion were included. Bibliographies of relevant articles were screened for other potential articles that could be included. Thus, 11 studies most of which were conducted in the Indian subcontinent were selected after evaluating each study independently based on the sample size, correlation coefficient, and statistical significance for feasibility of using placental thickness as a parameter for estimating fetal gestational age.

Discussion

India has a high burden of both perinatal (36/1,000 pregnancies) and neonatal mortality rates (30/1,000) as reported by the national representative of the National Family Health Survey-4 .[6] In light of the reinforced attempts of the Indian Radiological and Imaging Association to reduce perinatal mortality in India by initiating a nationwide program (Samrakshan), it becomes all the more

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important for radiologists to focus our attention back on what once was a hot topic—accurate estimation of fetal gestational age to avoid premature deliveries.[7] Recalls of the last menstrual period (LMP) may be incorrect and this method suffers from the inherent flaw in that it assumes all women to have a 28-day cycle. Recently, a paper published by Sharma et al. emphasized further on the lack of agreement in dating pregnancy using LMP.[8]

Presently, the most effective way to assess fetal gestational age is by ultrasonography. Fetal crown-rump length is used for estimating gestational age in the first trimester whereas in the second and third trimesters femur length, head circumference, biparietal diameter, and abdominal circumference are used. The parameters may be altered by fetal anomalies. Even the combined accuracy of these parameters decreases as pregnancy advances. The search for a parameter that is independent of fetal biometrics that allows a more accurate estimation of gestational age might end at placental thickness.

Placental thickness at the site of cord insertion is easily measurable during the routine antenatal scan and does not add much to the scan time. Additionally, altered placental thickness has been implicated in a wide spectrum of pathologies.

This article reviews the role of placental thickness as an additional parameter for estimating gestation age, which can go a long way in reducing the perinatal mortality in a largely resource-poor setting like rural India.

In a study conducted on 600 normal antenatal women of all gestational ages from Rajasthan, Mital et al. reported a gradual increase in placental size during pregnancy with placental thickness (millimeter) from 22nd–35th week coinciding with gestational age (weeks). They also concluded that placental thickness was an important parameter for estimating fetal age along with other parameters, especially in the late midtrimester and early third trimester, when the exact duration of pregnancy is unknown.[9]

Karthikeyan et al. studied 211 pregnant women in the South Indian state of Tamil Nadu to conclude that placental thickness can be used as a predictor of the gestational age between the gestational ages of 11–40 weeks and the two were correlated linearly with a Pearson's correlation coefficient of $r = 0.968$. A maximum mean placental thickness of 42.2 mm at 38 weeks was noted with an average placental thickness of 28.4924 mm ± (1.03) for all the trimesters. Furthermore, they observed that subnormal thickness of the placenta corresponding to a gestational age should raise suspicion of underlying abnormality.[10]

In a Nigerian study on 730 women conducted by Ohagwu et al. to investigate the relationship between placental thickness and fetal growth parameters in normal singleton Nigerian fetuses, a fairly linear increase in placental thickness with gestational age was noted with a Pearson's correlation coefficient of 0.872. They also recorded a maximum mean placental thickness of 45.09 ± 6.37 mm corresponding to 39 weeks. However, they were unable to conclude whether this relationship can be exploited for determining the gestational age of the fetus.[11]

In a study on 100 patients more than 26 weeks of gestation, a maximum mean placental thickness was noted to be 40.5 ± 13 mm. The study by Nagwani et al. conducted in Uttar Pradesh concluded that placental thickness could not be reliably used as a predictor of gestational age as the correlation between the two had a Pearson's coefficient of 0.09.[12]

Four-hundred healthy pregnant women in their third trimester were studied by Ngozi et al. The study showed a maximum mean thickness of 46.00 ± 2.8 cm at 39 weeks of gestation and concluded that placental thickness could be used to predict gestational age.[13]

Muhammad et al. concluded in their study that placental thickness could be used for gestational age estimation. However, they did not elucidate the Pearson's correlation coefficient.[14]

The study conducted by Azagidi et al. on 400 women observed a mean placental thickness of 29.6 ± 7.1 mm with a statistically significant positive correlation (Pearson's coefficient of 0.943) between placental thickness and fetal gestational age suffice to use placental thickness as a marker for predicting gestational age. They recorded a maximum thickness of 40.9 mm at 38 weeks gestation.[15]

The study by Kaushal et al. in Madhya Pradesh on 199 normal antenatal women between 11 and 37 gestational weeks noted that $r = 0.98$, thereby establishing a significant correlation between the placental thickness and gestational age. The study concluded that placental thickness could be used for estimating gestational age. The study also noted a maximum mean thickness of 37 mm.[16]

Another study conducted by Ali et al. on 100 women in their third trimester showed a Pearson's correlation coefficient of 0.974 between placental thickness and fetal gestational age. It concluded that placental thickness was a reliable marker for estimating gestational age. Mean placental thickness in their study was 31.1 ± 2.8 mm with a maximum of 33.4 mm at 39 weeks.[17]

The study conducted in Uttar Pradesh by Verma et al. concluded that the linear relationship between placental thickness and gestational age was sufficient to predict gestational age (18–40 weeks) based on placental thickness. Pearson's correlation coefficient was 0.745 for this study. Average thickness in their study was 31 mm with a maximum mean of 33 ± 5.1 mm at 36 weeks.[18]

In the study conducted by Adeyekun on 420 pregnant women, the maximum average placental thickness was 39.2 + 5.69 mm at 40 weeks gestation with a Pearson's correlation coefficient of 0.632. The study concluded that placental thickness and estimated fetal gestational age were linearly related and placental thickness could be used for gestational age estimation.[19]

Kakumanu et al. studied 150 pregnant women in Telangana and observed a maximum average thickness of 36.5 mm at 40 weeks. There was a linear relationship between placental thickness and gestational age with Pearson's coefficient of 0.9975.[20]

All of the above studies concluded that there is a linear positive correlation between placental thickness at the site of cord insertion and gestational age with no significant discordance with respect to placental location, fetal gender, advancement of pregnancy, and geographical location of study. The degree of correlation with the exception of one study ranged from Pearson's coefficient $r = 0.997$ to $r = 0.632$. The outlier study with $r = 0.09$ can be explained by a relatively smaller sample size of 100 subjects and methodological choices. While a single study observed that placental thickness cannot be used as a reliable marker for estimating fetal gestational age, another study remained unsure and a majority of nine studies concluded that the placental thickness can be used as an adjunct for estimating fetal gestational age when unknown.

Most of the studies agreed that a maximum and minimum value of placental thickness exists for corresponding gestational age but this value varies between studies. This variation may be due to demographic variation, including, but not limited to genetics, food habits and body habitus of women. It is, therefore, necessary

to construct population-specific nomograms from large sample sizes for accurate correlation and comparison.

Conclusion

In conclusion, there exists a significant positive correlation between the placental thickness and fetal gestational age. This correlation can be used to reliably estimate fetal gestational age. Population-specific nomograms tailor-made for different demographics should be constructed to better cater to the needs of antenatal women. Implementing simple measurement of placental thickness for gestational age may hugely reduce premature deliveries and consequent Indian perinatal mortality rates.

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