ORIGINAL RESEARCH ARTICLE

Evaluation of Placental Thickness as an Ultrasonographic Parameter for Estimating Gestational Age of the Fetus in 2nd and 3rd Trimesters

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ABSTRACT

Introduction: Accurate estimation of Gestational age (GA) is important in assessing the growth of fetus and plan for delivery. We assessed the role of placental thickness (PT) in estimating the GA and the growth pattern of placenta.

Material and Methods: This observational, study measured PT ultrasonographically in pregnant women with GA of 13-40 weeks. Patients were grouped into Group I (Anterior and lateral placentas combined) and Group II (Posterior and fundal placentas combined).

Result: Pregnant women (150), mean age of 24.2 years (range 18-33yrs) were included. Sixteen (10.66%) patients were in 21 weeks, 12 in 20 weeks and 32 weeks each and 10 in 22 weeks of pregnancy.

Anterior placenta was noted in 36.7%, followed by fundal (23.3%) and posterior (22.0%) placement. PT gradually increased from 13.2mm (13 weeks) to 36.5mm at 40 weeks of gestation, almost matched GA from 13-35 weeks, lowered by 1-4mm from 36-40 weeks of gestation. At no stage of pregnancy was the normal placenta > 38mm. There was a linear relationship between PT and GA, with slight increased variations in 30-31 weeks of gestation.

Conclusion: There is a linear and direct relationship between PT and GA. PT can be an important additional parameter for estimating GA, especially from 13-35 weeks of gestation and when the duration of the pregnancy is unknown or uncertain.

Key words: Estimation of Gestational Age, Linear Growth, Placental Growth Pattern, Placental Location, Placental Thickness

INTRODUCTION

Accurate assessment of gestational age (GA) is important in assessing the growth of fetus and to plan for delivery. Placenta is not only a source of nutrition for the developing foetus, but also can throw light on its health and growth status. Studies have shown that changes in the placenta during mid pregnancy particularly during 17-20 weeks, correlate well with the development of the foetus and can predict foetal abnormality.[1,2,3] Presently the most effective way to date pregnancy is by the use of ultrasound parameters.[4] Several sonographically derived fetal parameters are used to date the pregnancy.[5] Campbell S opne that placental parameters are useful in assessing small for GA and intra uterine growth retardation (IUGR) that needs early intervention.[6] Measuring Placental thickness (PT) can be used as a new additional parameter to estimate gestational age. Single most useful piece of information that obstetric sonography provides is the accurate determination of gestational age. [7]Mounting evidences on the prediction of placental thickness in estimating GA are directing the obstetricians to measure PT as a routine in pregnant woman.[8-13]

Advances in imaging techniques have enabled to identify abnormality in various placental parameters to group high risk pregnancies. With maternal complication such as severe pre-eclampsia, there is a significant reduction in assessed placental parameters compared to control.[14] Abnormal thickness of placenta is well recognized as a diagnostic tool in a wide spectrum of pathologic events. Placental thickness can contribute to the management of fetus at risk[15] and can differentiate normal from abnormal pregnancy.[16] Placental thickness is reduced significantly in IUGR and in those with pre eclampsia. Available evidences have shown the importance of various placental parameters measured using ultrasonography in assessing high risk pregnancies. Ultrasound still remains the choice in detecting placental abnormalities for the advantages it offers for it is easy to use, good safety profile[17] and most importantly its contribution in real time diagnosis.[18]

Gestational age is important in evaluating fetal growth. The purpose of the present study was to measure placental thickness at the level of umbilical cord insertion site to assess the relationship of placental thickness with the gestational age and also assessing the growth pattern of placenta with advancing gestational age.

MATERIAL AND METHODS

This observational, cross sectional, prospective study was conducted by the department of Radiodiagnosis, of a tertiary care hospital after obtaining Institutional Ethics committee's clearance. Prospective patients were screened after obtaining the written informed consent.

Placental thickness was measured ultrasonographically in the pregnant women with GA of 13-40 weeks; Patients with pregnancy induced hypertension (PIH), Diabetes mellitus, IUGR, hydrops fetalis, congenital malformations, placental abnormalities and twins were excluded.

Included patients underwent ultrasonographic evaluation. The grey scale real time ultrasonographic examinations were performed using a TOSHIBHA Xario, PHILIPS HD15 ultrasound machines with 3.5 and 5.2 MHz convex array transducers. Hard copy images of the cases were acquired using thermal printer and photographs.

Placental thickness in millimeters, was measured at the level of cord insertion site. 32.The transducer was oriented to scan perpendicular to both the chorionic and basal plates, as tangential scan distorts the measurement of the thickness of placenta 40. Placental thickness was calculated from the echogenic chorionic plate to placental myometrial interface. The myometrium and sub placental veins were excluded in the measurements.

All placental measurements were taken during the relaxed phase of the uterus as contractions can spuriously increase the placental thickness. Placental thickness (mm) was calculated by averaging the three best measurements for each case.

The relationship of PT measured at the level of insertion of umbilical cord with advancing GA in weeks. We obtained correlation of mean PT with calculated GA from 13 weeks-40 weeks.

Cases are categorized into two groups based on placental location.

- Group I: Anterior and lateral placentas combined.
- Group II: Posterior and fundal placentas combined.

Correlation of mean placental thickness with calculated gestational age from 13-40 weeks was obtained in each group separately.

STATISTICAL ANALYSIS

The mean values of PT (in mm) along with respective standard deviation (SD) were computed for each Gestational age from 13-40 weeks. The 95% Confidence Interval was also calculated. The Correlation and regression analysis was carried out to quantify the relationship between the gestational age in weeks and Placental thickness in mm. The Slopes were also compared for various placental positions and different GA groups (13-40 and 13-35 GA). Analysis was carried out using EPI INFO 3.5.3 software package. Microsoft word and Excel have been used to generate graphs.

RESULTS

We included 150 normal pregnant women, with a 24.2 years and range of 18-33 yrs. Greater number of patients were in 20-25 yrs of age (n=72, 48.0%), followed by 26-30 yrs (n=59, 39.30%) (Fig 1).

The number of measurements ranged from 2 - 16 for each week of gestational age. Sixteen (10.66%) patients were in 21 weeks of gestation, 12 (8.0%) in 20 weeks and 32 weeks, each and 10 (6.66%) in 22 weeks of pregnancy (Fig 2).

Position of placenta was assessed in all patients. Anterior placenta was noted in 55 (36.7%), posterior in 33 (22.0%), fundal (n=35, 23.3%) and lateral (n=27, 18.0%) cases respectively

In our patients, PT gradually increased from 13.2mm at 13 weeks to 36.5mm at 40 weeks of gestation. From 13 to 35 weeks of gestation, PT almost matched GA in weeks, thereafter from 36 to 40 weeks, it was lowered by 1-4 mm. At no stage of pregnancy was the normal placenta greater than 38 mm.

There was a linear relationship between PT and gestational age. Slight increased variations were observed in 30 and 31 weeks of gestation.

For every week of increase in GA, there was an average increase of PT by 0.8993 mm. Placental thickness was directly related to GA, with linear regression modeling yielding the following equation: (13-40 weeks) Placental thickness (in mm) = 0.8993 x gestational age (in weeks) + 2.1647 (r=0.9947), r= Pearson correlation coefficient.

The values of mean PT were also correlated with GA between 13 and 35 weeks with linear regression modeling yielding the following equation:

Placental thickness (in mm) = 0.9612 x gestational age (in weeks) + 0.9443

(r=0.9975), r= Pearson correlation coefficient

Relationship between gestational age and placental thickness for different placental locations

Cases were categorized into two groups based on placental

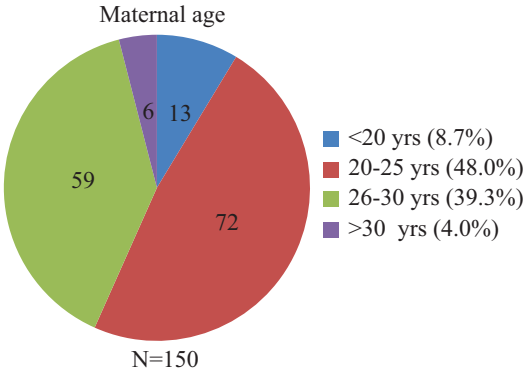

Figure-1: Maternal age range

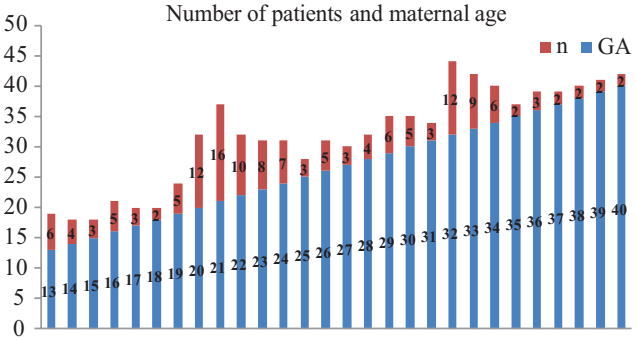

Figure-2: Patient distribution in different period of gestational age

location. Placental thickness was directly related to gestational age for both groups, with linear regression modeling yielding the following equations:

Group I: Placental thickness (in mm) = 0.9187 x gestational age (in weeks) +
1.6126 (r=0.9931), where r= Pearson correlation coefficient.

Group II: Placental thickness (in mm) = 0.9030 x gestational age (in weeks) +
2.3401 (r=0.9919), where r= Pearson correlation coefficient.
The relationship between Placental thickness and gestational age in both groups were similar in terms of Pearson correlation coefficient and also similar in terms of regression coefficient i.e., b= 0.9187 for group I and b= 0.903 for group II.
The thickness of the placenta did not vary relative to the placental location.

DISCUSSION

Estimating the gestaional age is a challenge faced by the obstetrician treating the less educated population with less awareness of importance of keeping track of last menstrual period. Menstrual history could be misleading for a number of reasons: many women may not accurately recall the first day of last menstrual period (LMP), particularly if they were not trying to conceive. LMP is often unreliable and misleading because of oligomenorrhea, bleeding events, use of oral contraceptives, becoming pregnant in the first ovulatory cycle after a recent delivery. Ovulating very early (< day 11) or very late (> day 21) in the menstrual cycle. Moreover, it has been proved that accuracy of expected data of delivery by LMP is accurate only 30% as even in women with regular 28 day menstrual cycle; though clinical estimation of gestationa age is often considered near accurate, but not 100%.[19]
Matsumoto et al (1962) reported that early or late ovulation occurs in approximately 20% of the population.[20] Most common indications for obstetric sonograms are related to uncertainty regarding the gestational age.
With the advent of ultrasonography, many parameters were considered to be effective in assesing accurate GA; but these parameters were not found to be accurate as the pregnancy progresses to third trimester.[21] Hence, apart from clinical estimation, laboratory and clinical investigations are often sought to estimate the correct gestational age for a safe delivery.
Placental thickness changes are an expression of normal growth of the feto placental unit amenable to measurement with ultrasonography and of value in describing normal physiology. With the advent of ultrasonography, estimation of PT has gained momentum as a noninvasive technique. It is a well proven and most accepted due to the accuracy in estimating the gestational age.[22,23] It is also useful in detecting intrauterine growth retardation, small for gestational age babies, thus, guiding the obstetrician to decide the further mode of action.
While most of these studies have reported positive correlation, there are reports that deny this association. No relation between placental thickness and gestational age has been documented by Appiah.[24]
We noted a linear relationship between PT and GA as reported by previous studies.[12, 22-23, 25-27] Placental thickness (in mm) corresponded to GA (in weeks) between 13-35 weeks of pregnancy. Slight increased variations were observed in 30 and 31 weeks of gestation as seen from relatively wide 95% confidence interval limits. We report increasing PT with advancing pregnancy. Similar observations were reported by Adhikari R et al.[28] Strong positive correlation between placental PT and GA have been shown by previous studies.[21-23,29-31] Hamid et al[29] reports that maximum thickness is seen around 32 weeks, while others reported it to be around 38-39 weeks.[31-33] Ganjoo S et al report that during GA 10 - 13 weeks, PT was higher than GA by 1-2 mm. PT accurately correlates with GA between 14-21 weeks, after which a reduction of 1-4mm is expected.[9] Suresh KK et al too observed linear correlation between PT and GA between 12-24 weeks, thereafter variations were seen.[34] Tiwari A et al too concluded that up to 21 weeks of gestation the mean PT was slightly higher than the GA (1-4 mm). From the 22nd week to the 35th week of gestation, PT almost matched GA in weeks, thereafter PT was lower by 1-2 mm.[35]
We observed that PT increased with increasing GA ($r = 0.8993$, $p < 0.01$). The relationship of PT with GA fell marginally and the rate of growth of PT decreased from 36 weeks of gestation. Similar observations were reported by Baghel et al.[36]
We did not find any difference in the PT in different location of placenta, indicating that it is an independent factor. This is in line with observations of Suganya B et al[21] and Hoddick et al.[37] In contrast, Durnwald C et al observed reduced thickness of placenta in anterior position compared to posterior and fundal.[38]
Anterior placenta (36.7%),was common in our patients followed by fundal (23.3%). Similar observations were reported by Arifa et al.[31]
We did not construct longitudinal placental growth curves from serial measurements taken on the same patient throughout pregnancy which would have been more accurate. Estimating the thickness of the in-situ placenta from ultrasonographic images in a single dimension has its own limitations. Placental volume measurement using 3-D USG may more accurately assess placental size than PT measurements. However, 3-D sonography is expensive, time consuming and not widely available. Placental thickness may vary among different population groups. Population specific nomograms may be needed which can be 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. All observations in our study was done by a single observer; views of a blinded observer would have removed observer bias.
Even with these limitations, we conclude that GA can be accurately predicted by measuring placental thickness. 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 free from acoustic shadowing from the fetus.

CONCLUSION

Sonographic measurement of PT at the level of cord insertion site is relatively simple and clinically useful. It enables the evaluation and detection of placental abnormalities that can significantly affect the management and outcome of pregnancy. The relationship between PT and GA is linear and direct. Placental thickness measurement can be an important additional parameter for estimating GA along with other parameters, especially from 13 to 35 weeks of gestation and when the duration of the pregnancy is unknown or uncertain.

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