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ORIGINAL ARTICLE

Placental Thickness: Its Correlation with Ultrasonographic Gestational Age in Normal and Intrauterine Growth-Retarded Pregnancies in the Late Second and Third Trimester

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Abstract

Objective The aim was to study the correlation of placental thickness, measured at the level of the umbilical cord insertion, with the ultrasonographic gestational age in normal and IUGR pregnancies in the late second and third trimester.

Materials and Methods A total of 498 patients were observed for correlation of the placental thickness with ultrasonographic gestational age and their outcomes by dividing them into Group A (outcome fetal weight $< 2{,}500$ g, $n = 122$) and Group B (fetal weight $\geq 2{,}500$ g, $n = 376$). The mean placental thickness was calculated at the umbilical cord insertion in both groups along with ultrasonographic fetal age and estimated fetal weight. The mean values of placental thickness along with respective standard deviation were calculated from the 24th to 39th week of gestational age.

Results A positive correlation was observed between placental thickness and ultrasonographic gestational age in both groups (p value of 0.01), with Pearson's correlation coefficient ("r") values of 0.325 in Group A and 0.135 in Group B. Regression analysis yielded linear equations of relationship with placental thickness and gestational age in both groups. The placental thickness was also found to be lower in Group A between 26 and 27 weeks and 30 and 31 weeks, having mean values of 2.48 ± 0.063 cm (p value of 0.042) and 2.76 ± 0.552 (p value of 0.05) in Group A as compared to 3.04 ± 0.25 and 3.13 ± 0.183 cm in Group B.

Conclusions Placental thickness measured at the level of umbilical cord insertion can be used as an accurate sonographic indicator in assessment of gestational age in singleton pregnancies because of its linear correlation.

Keywords Transabdominal ultrasonography · Placental thickness · Ultrasonographic gestational age · Intrauterine growth retardation · Late second and third trimester · Estimated fetal weight

Introduction

The role of ultrasonography in obstetric management has been immense. This has evolved over time from the basic 2-D imaging to Doppler imaging to assess the fetal and maternal circulation and to 3-D imaging of fetal anatomy [1]. Obstetrical ultrasound has proven invaluable in a variety of ways, two in particular being more accurate pregnancy dating and detection of fetal anomalies.

Several investigators have demonstrated that an estimated gestational age determined sonographically is more

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accurate than one based on the last menstrual period. Accurate dating may also alter the method of pregnancy termination. Various formulas and nomograms allow accurate assessment of gestational age and describe normal growth of fetal structures [2]. Estimates are typically most accurate when multiple parameters are used and when nomograms have been derived from fetuses of the same ethnic or racial background, living at a similar altitude [3].

The placenta is a fetal organ which provides the physiologic link between a pregnant woman and the fetus. The placenta develops from the chorionic villi at the implantation site at about the fifth week of gestation and by the ninth or tenth week, the diffuse granular echo texture of the placenta is clearly apparent at sonography [4, 5]. Placental thickness appears to be a promising parameter for estimation of gestational age of the fetus because of increase in placental thickness with gestational age. Studies by Mital et al. [6] and Jain et al. [6, 7] have reported the use of placental thickness as an indicator of gestational age. Despite careful antenatal surveillance involving scrupulous examination, an issue of considerable disappointment is that a majority of low birth weight infants are not diagnosed until delivery. Low birth weight infants are susceptible to hypoxia and fetal distress, long-term handicap, and fetal death. Therefore, an early detection of intrauterine growth retardation (IUGR) will be beneficial to obstetric and neonatal care [8]. Studies have shown that diminished placental size precedes fetal growth retardation as IUGR is associated with impoverished villous development and fetoplacental angiogenesis [9, 10].The present study was undertaken in our institution to study the correlation of placental thickness, measured at the level of the umbilical cord insertion, with the ultrasonographic gestational age in normal and IUGR pregnancies in the late second and third trimester (Fig. 1).

Methods

The study was carried out in the department of Radiodiagnosis for a period of 1 year. All pregnant patients ($\geq$24 weeks of gestation) attending the OPD and admitted as inpatients who were referred for routine antenatal ultrasound were included. Patients who had multiple gestations, diabetes, diagnosed cases of fetal hydrops, fetal congenital anomalies, and intrauterine fetal death were excluded from the study. Trans-abdominal sonographic measurements were performed on the GE medical system Logic 3 expert machine using a 3.5 MHz convex probe.

The placental thickness was taken at the level of the umbilical cord insertion in the longitudinal direction and a mean of three readings was taken, with the patient in supine position (Fig. 2). The ultrasonographic gestational age was determined by measuring the mean BPD, HC, AC, and FL. The placental thickness and gestational age were then correlated. The estimated fetal weight was determined by measurement of BPD, AC, and FL, adopting the formula devised by Hadlock. Subsequently, the fetal outcome was then assessed and correlated with the outcome variables of postpartum fetal weight (categorizing into groups of baby weights $< 2{,}500$ and $> 2{,}500$ g). An abnormal outcome of pregnancy was defined as birth weight below the tenth percentile of the Kloosterman birth weight chart or birth weight $< 2{,}500$ g. The mean values of the placental thickness along with the respective standard deviation were calculated for the different gestational ages from the 24th to 39th week. Mean and standard deviation were computed. "t"-test was applied to compare the difference between the mean of the two groups. To see the association between two attributes, χ^2 test was used. The correlation coefficient was computed and linear regression analysis was done. A "p" value ≤ 0.05 was considered significant.

Results

A prospective study of 523 antenatal singleton pregnancies of $\geq$24 weeks of gestation was conducted. 25 patients were lost to follow up. The remaining 498 patients were observed for the correlation of placental thickness with ultrasonographic gestational age and their outcomes by dividing them into Group A (outcome fetal weight $<$ 2,500 g, $n = 122$) and Group B (fetal weight $\geq$ 2,500 g, $n = 376$). The mean values of placental thickness along with the respective standard deviation were calculated from the 24th to 39th week of gestational age. A positive correlation was observed between placental thickness and ultrasonographic gestational age in both groups (p value of 0.01), with Pearson's correlation coefficient ("r") values of 0.325 in Group A and 0.135 in Group B. Regression analysis yielded linear equations of relationship in both groups with placental thickness (Y in cm) and gestational age (X in days) as follows:

$$Y = 1.643 + 0.007X \quad \text{in the Group A}$$

$$Y = 0.616 + 0.012X \quad \text{in the Group B.}$$

The placental thickness was also found to be lower in Group A between 26 and 27 weeks and 30 and 31 weeks, having mean values of 2.48 ± 0.063 cm (p value < 0.05) and 2.76 ± 0.552 (p value $= 0.05$) in Group A as compared to 3.04 ± 0.25 and 3.13 ± 0.183 cm in Group B (Table 1). In the rest of the gestational age groups in both Groups A and B, the mean placental thickness did not show any statistical significance with the ultrasonographic gestational age (p value > 0.05).

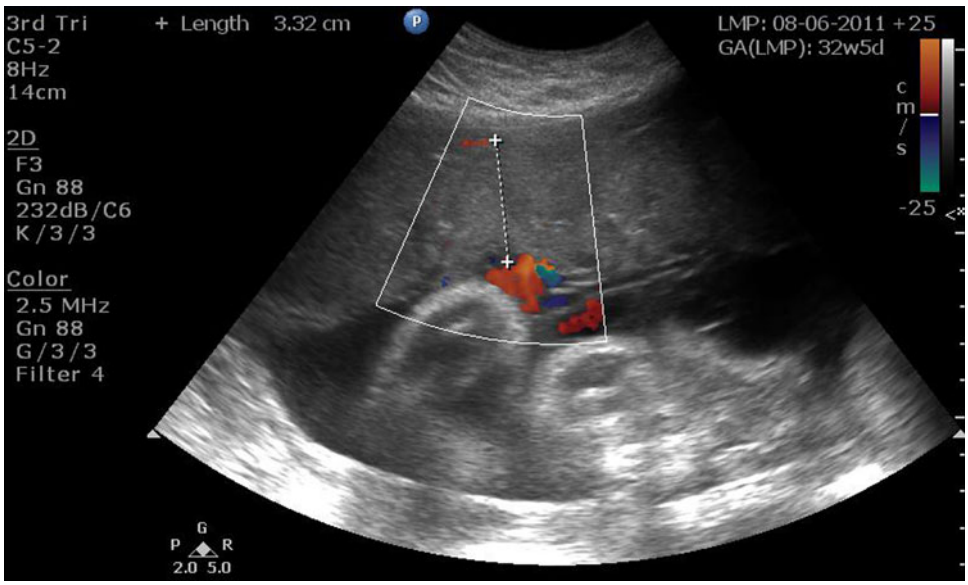

Fig. 1 Ultrasound with color image showing the umbilical cord insertion and the placental thickness

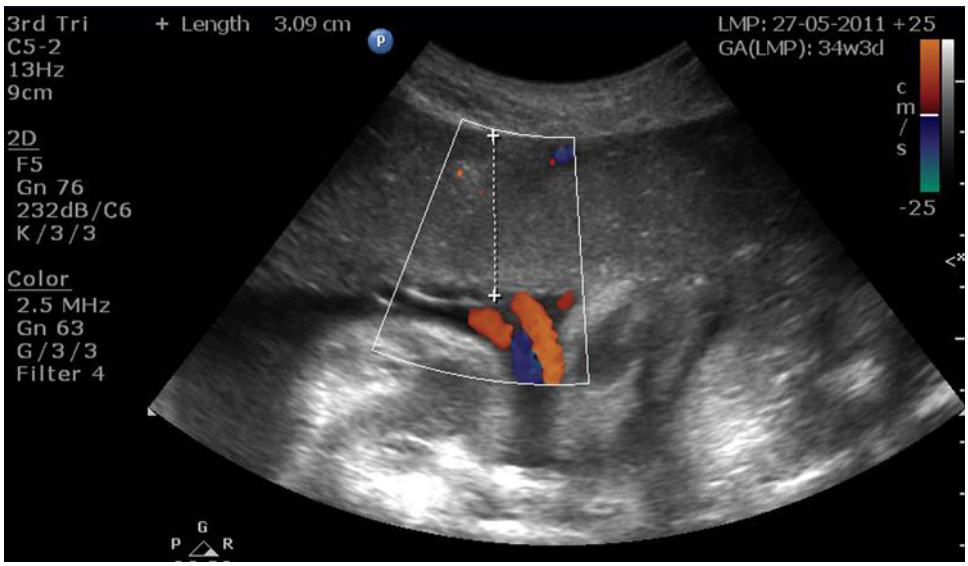

Fig. 2 Ultrasound image in another patient showing the placental thickness at the cord insertion site

Discussion

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 [4]. In addition to the routine fetal biometry parameters, various studies were done trying to deduce a relationship between the placental thickness and gestational age and the estimated fetal weight [6, 7, 11].

A fairly linear increase in mean placental thickness with gestational age was observed in correlation analysis studies conducted to determine the relationship between placental thickness and gestational age [12]. The value of the mean placental thickness increased with advancing gestational age, almost matching from the 22nd to the 35th week and 27 to 33 weeks in two separate studies conducted in India [6, 7]. Significant positive correlations between placental thickness and estimated fetal weight in the second and third trimesters ($p < 0.05$) in a non-IUGR group were also demonstrated [11]. A positive correlation, with increasing placental volume with increasing gestational age, was also observed, but it remained reduced in the growth-restricted fetuses [13]. The usefulness of this relationship between placental thickness and growth parameters is that subnormal placental thickness for a gestational age may be the earliest indication of fetal growth retardation [12]. In our study, a significant positive correlation is seen between placental thickness and the ultrasonographic gestational age in days in both groups (p value of 0.01).

Table 1 Showing the mean placental thickness according to the gestational age in both groups

USG gestational age (weeks group)	Group B $n = 376$	Mean placental thickness (cm)	Group A $n = 122$	Mean placental thickness (cm)
24–25	2	2.49 ± 0.12	0	–
25–26	5	2.47 ± 0.12	3	2.97 ± 0.71
26–27	4	3.04 ± 0.25	2	**2.48 ± 0.06**
27–28	6	3.17 ± 0.53	5	2.82 ± 0.73
28–29	4	2.80 ± 0.25	3	2.89 ± 0.38
29–30	3	2.88 ± 0.19	8	2.96 ± 0.45
30–31	11	3.13 ± 0.18	7	**2.76 ± 0.55**
31–32	21	3.19 ± 0.27	14	3.43 ± 0.77
32–33	46	3.29 ± 0.03	25	3.36 ± 0.59
33–34	59	3.40 ± 0.37	26	3.30 ± 0.34
34–35	74	3.53 ± 0.38	10	3.53 ± 0.27
35–36	73	3.58 ± 0.19	13	3.56 ± 0.18
36–37	46	4.41 ± 0.15	5	3.63 ± 0.11
37–38	19	3.83 ± 0.59	1	3.88 ± 0.00
38–39	2	4.35 ± 0.15	0	–
39–40	1	3.97 ± 0.00	0	–

Bold values indicate statistical significance between the placental thickness and the gestational age (p value ≤ 0.05)

A lower mean placental thickness at 36 weeks of gestation was observed in the < 2,500 g group as compared to the > 2,500 g group in a study conducted in Saudi Arabia [8]. In our study, the placental thickness was found to be lower in Group A between 26 and 27 weeks and 30 and31 weeks as compared to Group B. Thus, it is interesting to observe that mean placental thickness at these ultrasonographic gestational ages can be used as a cut-off point at these gestations in detecting IUGR infants as early as possible in our population.

Conclusions

Placental thickness measured at the level of umbilical cord insertion can be used as an accurate sonographic indicator in the assessment of gestational age in singleton pregnancies because of its linear correlation. Therefore, it can be used as an additional sonographic tool in correlating gestational age in cases where LMP is not known and in detecting patients developing IUGR.

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Conflict of interest There is no conflict of interest.

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