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PLACENTAL THICKNESS IN THIRD TRIMESTER PREGNANCY AND ITS CORRELATION WITH ESTIMATED FETAL WEIGHT ON ULTRASONOGRAPHY

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ABSTRACT

Background: Placental disease has been shown to be the most clinically relevant of all potential underlying processes that may result in intrauterine growth retardation. Studies have shown that diminished placental size precedes to fetal growth restriction. Knowledge of normal placental size and estimation of accurate fetal weight is always rewarding. In this study we aimed to evaluate placental size and fetal birth weight and to analyse weather placental size is important factor that determine fetal birth weight. **Methods:** The hospital-based cross-sectional study was be carried out for 6 months in the Department of Radiodiagnosis and Imaging of BPKIHS among singleton normal pregnancy in third trimester (27-40 weeks). The subjects undergone obstetric USG and findings (placental thickness and fetal weight) were noted in a structured proforma. The Pearson's Correlation (r value) was carried out to show the relation between the placental thickness in mm and weight of foetus in grams. **Results:** The mean placental thickness among enrolled subjects was 38.9±0.8 mm. The mean fetal weight among study subjects using fetal parameters on USG was 2674.4±482.5 grams. The Pearson correlation analysis of subjects at 31-40 weeks of gestational age showed a very strong relationship between fetus weight and thickness of placenta (r=0.774). Percentage of variability in the fetal weight (in grams) estimation (R^2) by Placental thickness (mm) was 60.0%. β1 was 2.4E-3, which indicates that change in 1 mm of Placental thickness will lead to 60.0 gm change in fetal weight. **Conclusion:** Placental thickness measured at the level of umbilical cord insertion can be used as a sonographic indicator in the assessment of fetal weight in singleton pregnancies.

KEYWORDS: Fetal growth, fetal weight, Placental thickness, third trimester pregnancy, ultrasonography.

INTRODUCTION

Large portion of perinatal mortality is related to low birth weight. Thus, birth weight is important parameter that determines neonatal survival. Fetal weight depends upon various maternal and fetal factor and placental play a vital role in it. The placenta links mother and fetus by indirect interaction with maternal blood to allow the exchange of gases and nutrients. Adequate fetal growth and subsequent normal birth weight depend on the efficient delivery of nutrients from the mother to the fetus. Therefore, evaluation of placental thickness in third trimester could help to determine normal development, function of placenta and can be a good predictor of fetal growth and birth weight.[1,2]

Medical imaging modalities used for fetal weight estimation include magnetic resonance imaging (MRI) and ultrasonography, the latter being the more popular and cost-effective modality. Obstetric USG offers the tool to assess placental size and estimate fetal weight. USG derived fetal parameters used for fetal weight include fetal crown - rump length (CRL), biparietal diameter (BPD), head circumference (HC), femur length (FL), and abdominal circumference (AC). Placental thickness measured at the level of the umbilical cord insertion can be used as a new parameter.[3,4]

In a very few past studies, the relationship between placenta and fetal weight has been investigated. By finding the correlation between the thickness of the placenta and fetal weight in the third trimester of pregnancy, a simple, inexpensive and available method can be introduced. Many problems of childhood and adolescence are related to birth weight, which variably depends on the birth weight of the new born. Therefore, estimation of fetal weight is essential in our daily practice, especially in the third trimester. It guides obstetricians to make up their decisions as regard time and mode of delivery to guard against complications of low birth weight.[5,6]

Placental disease has been shown to be the most clinically relevant of all potential underlying processes that may result in intrauterine growth retardation. Studies have shown that diminished placental size precedes to fetal growth restriction. Knowledge of normal placental

size and estimation of accurate fetal weight is always rewarding.[7] In this study we aimed to evaluate placental size and fetal birth weight and to analyse weather placental size is important factor that determine fetal birth weight.

AIM

To measure the placental thickness and correlate it with estimated fetal weight in third trimester of pregnancy.

OBJECTIVES

1) To measure placental thickness at the level of umbilical cord insertion on ultrasonography.
2) To correlate placental thickness with EFW obtained by ultrasonographic fetal biometry.

MATERIALS AND METHODS

The hospital-based cross-sectional study was be carried out for 6 months (March 2021 to September 2022) in the Department of Radiodiagnosis and Imaging of BPKIHS. The study subjects were all mothers with singleton normal pregnancy in third trimester (27-40 weeks) visited the Department of Radiodiagnosis and Imaging, BPKIHS for Obstetric scan after obtaining ethical clearance from IRC (reference no. 121/078/079).

The sample size was calculated as 134 using formula: N (sample size) = $[(Z_\alpha+Z_\beta)/C(r)]^2$ +3, where: Z_α = 1.96 at 95% CI, Z_β= 0.842 at 80% and C (r) =24% that was 0.24, which was based on a study by Rao et al.,[8] The hospital records suggested that during previous year (2021) approximately 140 mothers were for obstetric scan in third trimester of pregnancy, so using purposive sampling technique 140 subjects were included in the study. Women with abnormally situated placenta and with placental abnormality, women with multiple gestations, women with previous history of congenital malformation/intrauterine growth restriction, and women with pregnancy induced hypertension/diabetes mellitus were excluded from the study.

At first all the subjects were requested to read the consent form and sign it. Informed consent was obtained and questionnaire filled by the investigators which captured details about their demographic background including gestational age (by LMP). Then subjects undergone obstetric USG and subsequently advised to follow up in OPD as recommended by referring doctor and the findings of Obstetric USG (placental thickness and fetal weight [by biometry i.e. HC, BPD, AC and FL]) were noted in a structured proforma. Measurement of placental thickness was done at the level of umbilical cord insertion.

Statistical analysis

The data was analysed using latest version of SPSS. Univariate and bivariate tables were used to present the data. The Pearson's Correlation (r value) was carried out to show the relation between the placental thickness in mm and weight of foetus in grams. The respective data was plotted on the scattered diagrams and the best fit/trend was shown with a straight line. P value < 0.05 was considered as statistically significant.

RESULTS

In present study, 47.9% of subjects belonged to the 21-25 years of age group and 42.1% of subjects belonged to 26-30 years of age group. Only 4.3% of subjects were below the age of 21 years and 5.7% of subjects were above the 30 years of age (Table 1).

Table 1: Age distribution of study subjects (N=140).

Age	Number	%
< 21 years	6	4.3
21-25 years	67	47.9
26-30 years	59	42.1
>30 years	8	5.7

In our study, among enrolled subjects 27.1% of subjects were primigravida, 42.9% of subjects were gravida 2 as and 30.0% of subjects were gravida 3 or more (Table 2).

Table 2: Distribution of study subjects according to the parity (N=140).

Parity	Number	%
Primigravida	38	27.1
Gravida 2	60	42.9
Gravida 3 or more	42	30.0

The mean gestational age of study subjects was 34.3±2.2 weeks. Only 0.7% of subjects were having gestational age of 40 weeks and 1.4% of subjects were having gestational age of 28 weeks. The most of the study subjects were in the 32 weeks (12.1%), 33 weeks (10.0%), 34 weeks (15.0%), 35 weeks (10.8%), 36 weeks (14.4%), and 37 weeks (10.7%) of gestational period (Table 3).

Table 3: Distribution of study subjects according to the gestational age in weeks (N=140).

Gestational age	Number	%
28 weeks	2	1.4
29 weeks	3	2.1
30 weeks	10	7.1
31 weeks	6	4.3
32 weeks	17	12.1
33 weeks	14	10.0
34 weeks	21	15.0
35 weeks	15	10.8
36 weeks	20	14.4
37 weeks	15	10.7
38 weeks	8	5.7
39 weeks	8	5.7
40 weeks	1	0.7
Mean gestational age (in weeks)	34.3±2.2	

The mean placental thickness among enrolled subjects was 38.9±0.8 mm. Table 4. shows that the mean

placental thickness increased with the increase in the gestational age. The mean placental thickness at 40 weeks of gestation was 43.5±0.1 mm. The mean fetal weight among study subjects using fetal parameters on USG was 2674.4±482.5 grams.

Table 4: Placental thickness at various gestational week among study subjects (N=140).

Gestational age	Placental thickness (in mm)	
	Mean	SD
28 weeks	34.1	0.9
29 weeks	35.3	2.1
30 weeks	36.1	1.1
31 weeks	36.7	0.1
32 weeks	37.6	0.9
33 weeks	38.3	0.7
34 weeks	38.9	0.5
35 weeks	39.3	0.7
36 weeks	39.7	0.5
37 weeks	40.5	1.0
38 weeks	41.6	1.2
39 weeks	42.9	1.4
40 weeks	43.5	0.1
Overall	38.9	0.8

The Pearson correlation analysis of subjects at 31-40 weeks of gestational age showed a very strong relationship between fetus weight and thickness of placenta (r=0.774) (Table 5).

Table 5: Pearson correlation analysis between placental thickness and fetal weight among study subjects (N=140).

Gestational age (28-40 weeks)	Fetal weight	
Placental thickness	Pearson Correlation	0.774**
	Sig. (2-tailed)	0.000
	N	140

**Correlation is significant at the 0.01 level (2-tailed).

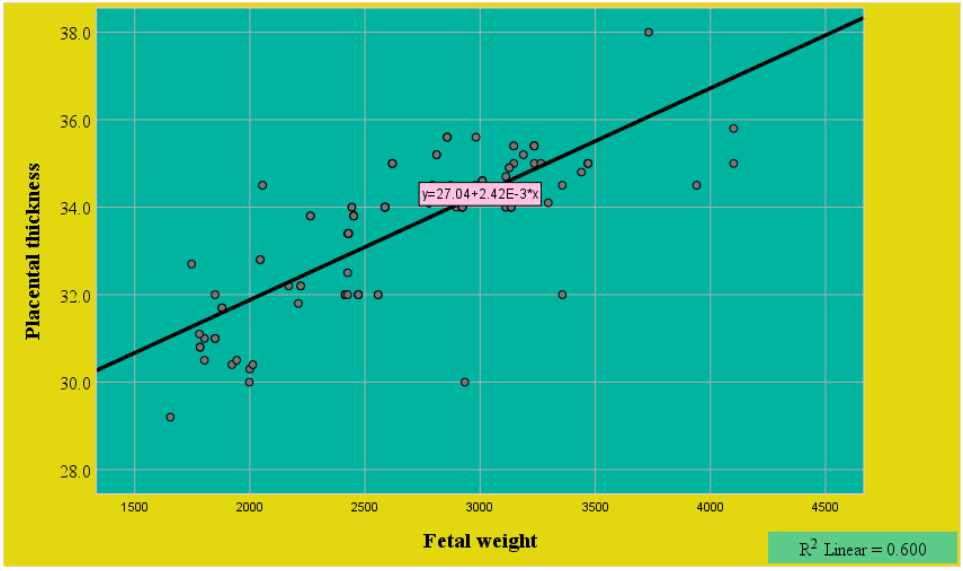

Figure 1: Scatter plot between placental thickness on Y-axis and fetus weight on X -axis at 28-40 weeks of gestation among study subjects (N=140).

Percentage of variability in the fetal weight (in grams) estimation (R^2) by Placental thickness (mm) was 60.0%. β1 was 2.4E-3, which indicates that change in 1 mm of Placental thickness will lead to 60.0 gm change in fetal weight (Figure 1).

DISCUSSION

In present study, the Pearson correlation analysis of subjects at 31-40 weeks of gestational age showed a very strong relationship between fetus weight and thickness of placenta (r=0.774). Study by Abu et al., also investigated

the relationship between placental thickness and estimated fetal weight in 645 normal singletons pregnant (2^{nd} and 3^{rd} trimester) in Nigeria in using transabdominal ultrasound and it was found that there were significant positive correlations between placental thickness and estimated fetal weight ($p< 0.05$).[9] A study by Afrakhteh et al., investigated relationship the between placental thickness and birth weight during third trimesters on 250 singleton pregnant women using Pearson's correlation analysis and it showed a significant positive correlation between placental thickness and birth weight in third trimesters ($r=0.140$, $p=0.04$).[10]

A study by Adeyekun et al., aimed to establish a relationship between ultrasound estimated placental thickness and fetal weight in 420 apparently healthy pregnant women at gestational age 15-40 weeks and it showed that there was a significant correlation between placenta thickness and fetal weight ($r = 0.668$; $P = 0.000$). This study established a fairly linear relationship between placental thickness and EFW and similar pattern was observed in our study.[11] Study results of Rasoul et al., showed a significant correlation between the placental thickness in the third trimester of pregnancy with fetal weight at these times ($r=0.541$,$p=0.005$).[12]

Study by Badu et al., among 111 primigravida in third trimester with normal singleton using Pearson's correlation analysis showed Placental thickness was correlated well with fetal weight ($r=0.598$, $p<0.001$).[7] Also, Rao et al., carried a cross-sectional descriptive study in 99 normal antenatal women of all gestational ages from 11 weeks to 40 weeks of gestation and it was observed that, there was a statistically significant positive correlation between sonographic placenta thickness and foetal weight yielding a Pearson's correlation coefficient (r) of 0.856 for the third trimester within a P value of 0.001.[8] [7(1), 8(2), 9(3), 10(7), 11(6), 12(5)

In our study the mean placental thickness among enrolled subjects during third trimester (31-40 weeks) was 38.9±0.8 mm, which was greater than the studies done by Afrakhteh et al., and Adeyekun et al., where ultrasonographic measures of placental thickness in third trimester was 36.26±6.46 mm and 35.5±7.0 mm respectively.[10,11] Also, in a prospective descriptive by Ismail et al., among 207 pregnant ladies in third trimester showed mean placental thickness as 3.1±0.64 cm which was lower than our study.[13]

In our study, percentage of variability in the fetal weight (in grams) estimation (R^2) by Placental thickness (mm) was 60.0%. β1 was 2.4E-3, which indicates that change in 1 mm of Placental thickness will lead to 60.0 gm change in fetal weight, which was lower than the study conducted by Ismail et al., where with the increase in every 1 mm of placental thickness there was increase in fetal weight by 88.0 gm.[13] Also, in a study by Rasoul et al., it was shown that per 250 gms in third trimester of pregnancy, the placental thickness increased 0.4 mm in the third trimester of pregnancy.[12] So, it can be concluded that fetal weight can be determined by measuring placental thickness.

A study by Gupta et al. among 450 pregnant females in late second and third trimester of pregnancy (24th to 39th weeks) found that placental thickness was found to be lower in newborns having birth weight less than 2500gms. They concluded placental thickness can be used as a predictor of the gestational age and fetal weight outcome and it acts like a mirror, reflecting the statuses of both the mother and the fetus.[14]

A study conducted by Ghosh et al., evaluated the role of placental thickness in estimation of fetal outcome in terms of birth weight, meconium-stained liquor, APGAR score and NICU admission and it was shown that the thin placenta was associated with increased morbidity, poor APGAR score and higher incidence of NICU admission.[15]

LIMITATIONS OF THE STUDY

This was a cross-sectional study, single centre study with small sample size where single reading of placental thickness was take in each patient. Same patient was no followed up at different stage of pregnancy and other factors such as maternal height and weight which are known to affect placental thickness were also not taken into consideration.

CONCLUSION

Placental thickness measured at the level of umbilical cord insertion can be used as a sonographic indicator in the assessment of fetal weight in singleton pregnancies. Therefore, it can be used as an additional sonographic parameter in correlating gestational age in cases where last menstrual period is not known and in detecting patients developing intrauterine growth retardation.

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