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ORIGINAL ARTICLE

Placental Thickness - an alternative to Biparietal Diameter for assessment of Gestational Age in cases of Unknown Last Menstrual Period: A cross-sectional observational study

Short title: Placental thickness and gestational age

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ABSTRACT

Objective. The objective of this study was to evaluate the relationship of placental thickness with biparietal diameter (BPD) which can be used for assessment of gestational age in women with unknown last menstrual period.

Materials and Methods. This was a cross-sectional observational study conducted at antenatal outpatient department of a tertiary center hospital among second and third trimester pregnant women of age 18-35 years with singleton live fetus. All women were subjected to ultrasonography for measurement of placental thickness (measured at the level of umbilical cord insertion) and BPD of fetus.

Results. 200 pregnant women were recruited (Mean age – 24.5 years). Both biparietal diameter and placental thickness increases with gestational age. Mean placental thickness show strong positive correlation with BPD ($r=0.930$ and $p\text{-value} < 0.0001$). Further, subgroup analysis showed BPD and placental thickness to have significant correlation at all gestational age groups with significantly strong positive correlation from 13-33 week of gestation.

Conclusions. Placental thickness is positively correlated with BPD and can be used as a marker for gestational age in pregnant women.

Keywords: Gestational age; Prenatal diagnosis; Ultrasonography.

INTRODUCTION

Gestational age is usually estimated by the last menstrual period (LMP). However, many women are unaware or unsure of their LMP due to irregular menses, conception in lactation amenorrhea and illiteracy [1]. Accurate knowledge of gestational age determination is important for the evaluation of growth and development of the fetus. It is also an essential component of prenatal diagnosis for appropriate scheduling of invasive procedures and interpretation of biochemical tests [2].

Ultrasonography (USG) determines gestational age from various fetal dimensions like biparietal diameter (BPD), femur length (FL), head circumference etc. out of which BPD is considered a good parameter for measurement of gestational age in second trimester [3]. However, BPD is an unreliable marker in some cases such as intrauterine growth retardation (IUGR), hydrocephalus [4].

Placental thickness measured at the level of umbilical cord insertion may help in such cases. Placenta develops from chorionic villi at about fifth week of intra-uterine life. It grows in size with the advancement of gestational age and plays an important role for delivery of nutrients from mother to fetus [5]. However, there is less information about placental thickness. On USG, it has been seen to increase linearly at rate of about 1 mm per week [6].

The aim of this study was to evaluate the relationship of placental thickness with biparietal diameter which can be used for assessment of gestational age in women with unknown last menstrual period.

MATERIAL AND METHODS:

This was a cross-sectional observational study conducted in the department of Obstetrics and Gynaecology, S.M.S. medical college, Jaipur. 200 pregnant women of age group 18-35 years who spontaneously conceived with singleton live pregnancy of ≥ 13 weeks of gestation having known LMP, regular menstrual cycle, normal BMI (18.5-24.9) and attending antenatal outpatient department were recruited for the study. Pregnant women with hypertensive disorders, diabetes mellitus (both overt and gestational diabetes diagnosed by 75 gm 2-hour OGTT) or having history of alcohol, tobacco or other toxic substance use, or other medical disorders were excluded. Similarly, patients having coexisting uterine or adnexal mass, hydramnios, fetal or placental anomalies, placenta previa or accreta, immune or non-immune hydrops in current pregnancy or past history of adverse fetal outcome were excluded from the study.

After recruitment, detailed history and physical examination including obstetric examination were done. Routine laboratory investigations were done to rule out other medical comorbidities. All women were then subjected to detailed USG for fetal well-being and BPD measurement. Thickness of placenta was measured at the level of umbilical cord insertion. USG parameters were measured by the same observer and on the same machine.

Statistical Analysis

Data was collected using Microsoft Excel software and analyzed statistically using SPSS software. Descriptive statistics, including absolute frequency distribution, percentage distribution, mean and standard deviation, were calculated as appropriate. To determine the strength of the relationship between BPD and placental thickness, Pearson's correlation coefficient was used. Statistical significance was set at a p-value < 0.05 . Finally, linear

regression analysis was done and plotted with scatter-plot graph. The current study has been reported according to internationally recognized guidelines: Strengthening the Reporting of Observational Studies in Epidemiology (STROBE).

RESULTS:

Baseline data of participants is given in Table 1. Mean age of the participants was 24.5 years. Majority of the women were from urban background and literate. Most common location of the placenta was anterior (33%) followed by posterior (24%), fundal (23%) and lateral (20%). The difference between placental thicknesses at various locations of placenta was not statistically significant (p-value = 0.08).

Table no. 2 shows correlation between placental thickness and BPD. BPD and placental thickness linearly increase with gestational age. BPD and placental thickness show strong positive correlation from 13-33 week of gestation with average correlation coefficient of 0.669 (p-value <0.001). 34-40 weeks of gestation showed less strong (r=0.291) but statistically significant positive correlation (p=0.023). The scattered correlation graph between BPD and placental thickness of patients (Figure 1) shows maximum number of patients fall along with linear regression line indicating strong correlation.

DISCUSSION

In our study, placental thickness increases with the increase in gestational age and showed a positive linear correlation with biparietal diameter.

Similar results have been reported in other studies. Ohagwu CC et al [7] concluded that placental thickness and BPD have positive correlation. Similarly, Karthikeyan T et al [8] observed a linear relationship of placental thickness and biparietal diameter. They concluded that placental thickness is an important parameter where there is abnormal BPD like hydrocephalus.

Few studies have tried to quantify the relationship between the two parameters. A study done by Sandesh Ganjoo et al [9] on relation between placental thickness and BPD showed linear correlation for 14-24 week of gestation. They further developed a linear equation between the two parameters.

Maya Menon et al [10] also observed positive correlation between both parameters. Correlation coefficient was r=0.93 and p value was <0.0001. Regression analysis yielded following mathematical relationship between BPD and Placental thickness.

$$y (\text{BPD}) = 2.8262 x (\text{Placental Thickness}) - 10.208.$$

However, certain factors including maternal (diabetes, pre-eclampsia, TORCH infections), fetal (intrauterine growth restriction, congenital anomalies) and placenta (abruption, accreta) are associated with abnormal placental thickness [11,12]. Hence, in these patients, placental thickness should be used carefully for estimating gestational age.

This study has its limitations too. The sample size of the study is limited, and a larger sample size is required for further validation. Additionally, in patients with abnormal placental thickness for the corresponding gestational age, the underlying disease leading to increase or decrease of placental thickness should be taken into account and rectified.

CONCLUSION

In pregnant women, placental thickness can be an important additional parameter for the estimation of gestational age estimation. Future studies with large sample are required to identify high risk cases based on placental thickness.

DATA SHARING: Data are available under reasonable request to the corresponding author.

COMPLIANCE WITH ETHICAL STANDARDS

Authors contribution:

M.S. Visualization, Writing – original draft;

S.M. Conceptualizing, Methodology;

R.S.C. Investigation, Formal analysis;

N.S. Data Curation, Supervision.

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Ethical approval: The study protocol was approved from Institutional Ethics Committee, SMS Medical College and attached hospitals, Jaipur.

Informed consent: Informed written consent form signed by women participating in study.

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Table 1: Demographic distribution of study population

1. Mean age(yrs)	24.5±3.18
2. Mean gravidity	1.68±0.899
3. Residence	
Rural	45.5%
Urban	54.5%
4. Religion	
Hindu	72%
Muslim	28%
5. Literacy	
Literate	71.5%
Illiterate	28.5%

Table 2: Correlation of placental thickness and biparietal diameter

Gestational age (weeks)	N (%)	Placental thickness (mm)		Biparietal diameter (mm)		Correlation coefficient (r)	p-value
		Mean	Standard deviation	Mean	Standard deviation		
13-19	39 (19.5)	17.18	2.543	35.31	7.780	0.691	<0.0001
20-26	58 (29)	23.14	2.358	55.88	6.470	0.695	<0.0001
27-33	42 (21)	29.98	2.590	76.79	5.612	0.622	<0.0001
34-40	61 (30.5)	34.69	1.996	87.54	11.232	0.291	0.0230
Overall (13-40)	200	26.94	6.975	65.92	21.197	0.930	<0.0001

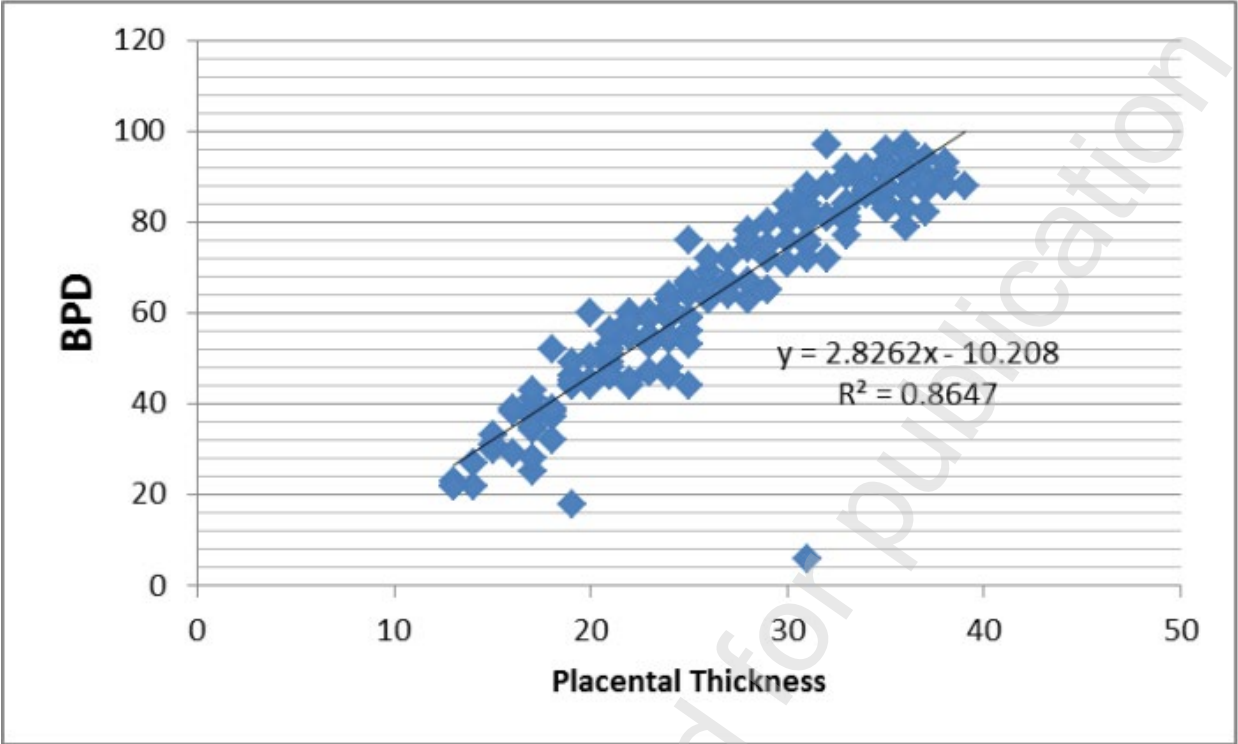


Figure 1: Correlation Graph between Placental Thickness and Biparietal diameter (BPD)