



ULTRASONOGRAPHIC MEASUREMENT OF PLACENTAL THICKNESS AND ITS CORRELATION WITH ESTIMATED FETAL WEIGHT

Radiodiagnosis

Chirtrarasan P	Professor, Department of Radiodiagnosis, Stanley medical college, Chennai.
Amarnath Chellathurai	Professor and Head of Department, Department of Radiodiagnosis, Stanley medical college, Chennai
Sathyan G	Professor, Department of Radiodiagnosis, Stanley medical college, Chennai.
Subramaniam Amirthalingam*	Assistant Professor, Department of Radiodiagnosis, Stanley medical college, Chennai. *Corresponding Author
Kharat Pandit Jeeja	Junior Resident, Department of Radiodiagnosis, Stanley medical college, Chennai.
V Sudhakar	Associate Professor, Department of Radiodiagnosis, Stanley medical college, Chennai.

ABSTRACT

OBJECTIVE : The objective of our study is to Correlate the relationship between placental thickness with estimated fetal weight in south Indian population .To propose placental thickness as simple additional parameter that can be used for assessment of foetal wellbeing during pregnancy period.

BACKGROUND: The placenta is a fetal organ with important metabolic, endocrine and immunological functions and also it has a role in protecting the foetus from noxious agents. Placental evaluation by ultrasonography has been used to characterize placental position and morphologic changes as the placenta matures. The measurement of placental thickness is relatively simple and clinically useful

METHODS : The present study was a prospective observational study and included 135 pregnant women with known last menstrual period, history of regular menstruation, singleton pregnancy and aged between 20-35 years. After Institutional Ethics committee approval, all pregnant women underwent ultrasound examination. The placental thickness was measured trans-abdominally by placing the ultrasound transducer perpendicularly to the plane of the placenta, in the area of the cord insertion at second and third trimester. Pearson's correlation analysis was used to establish the degree of relationship between placental thickness and estimated foetal weight.

RESULTS: Correlation of estimated fetal weight (g) with Placental thickness(mm) by Pearson's Correlation (r -value=0.903 , p =0.0005<0.01) shows highly statistical significant positive linear relationship between Estimated fetal weight (g) and Placental thickness(mm).

CONCLUSION: The placental thickness correlated well with the estimated fetal weight which is equivalent to that of standard biometric variables assessed in routine antenatal sonographic survey. Thus Placental thickness can be used as a potential predictor of estimated fetal weight and can be useful in early detection of abnormal fetal growth as placental changes precede the fetal morphological changes.

KEYWORDS

Estimated foetal weight, Placental thickness, Umbilical cord insertion

INTRODUCTION :

The human placenta develops with the principal function of providing nutrients and oxygen to the foetus.⁽¹⁾ The role of sonography in the evaluation of morphology and detection of placental abnormalities in entities such as non-immune hydrops, gestational diabetes and intrauterine growth restriction has been well established. Placenta is primarily a fetal organ and its size is a reflection of the health and size of the fetus. One additional ultrasonographic parameter frequently used to assess the placenta is placental size. Total placental volume is probably the most accurate estimate of placental size, but volumetric measurement is too complicated and Cumbersome for routine use.⁽²⁾ It is clear that normal development of placenta during gestation is necessary for supporting of a healthy foetus.⁽³⁾

Historically, a placenta of greater than 4 cm in thickness has been regarded as abnormal and associated with various poor outcomes.^(4,5) Large placentas are associated with haemolytic disease of newborn, maternal diabetes mellitus, severe anaemia and intrauterine fetal infections^(6,7) Fetal weight estimates are very important because a large proportion of perinatal mortality is related to birth-weight. Thus, birth-weight is the single most important parameter that determines neonatal survival. The purpose of the present study is to measure placental thickness at the level of umbilical cord insertion site and to assess the relationship between placental thickness with estimated fetal weight.

MATERIALS AND METHODS

After getting institutional ethical committee approval a prospective observational study was conducted at Department of Radio Diagnosis, Government Stanley Medical College, Chennai among 135 pregnant females with known last menstrual period, history of regular menstruation, singleton pregnancy and aged between 20-35 years coming to Radiology Department for routine Ultrasound examinations, second trimester anatomy scan, and third trimester growth scan between 18-40 weeks of gestation after obtaining written

and informed consent from participant during the study period of June 2019 to June 2020. Pregnancies with gestational hypertension, Diabetes mellitus , multiple pregnancy, Oligohydramnios & Severe Polyhydramnios, Hydrops fetalis ,Congenital malformations, Last menstrual period not known, Irregular menstrual period, Abnormal Placenta and poor visualization of placenta, Placentas with variations in insertions umbilical cord are excluded from the study.

All examinations were performed on the Mindray DC-60 ultrasound equipment using a convex 3.5 MHz transducer. Conventional sonographic measurements BPD(mm),HC(mm),AC(mm) ,FL(mm) and the estimated fetal weight(EFW) in grams by Hadlock's model are obtained followed by placental thickness.

PLACENTAL THICKNESS is measured in supine position with moderately distended bladder. After applying the couple agent the probe was placed at skin surface and placental thickness measured at level of umbilical cord insertion site. As the tangential scan will distort the measurement of the thickness of the placenta, the transducer was oriented to scan perpendicular to both the chorionic and basal plates. To avoid false increase in placental thickness during uterine contraction due to distension of intervillous spaces ,all the placental measurements were taken in uterine relaxation phase . Accurately recognition of placental myometrial interface is very essential for appropriate placental measurement (Fig 1)

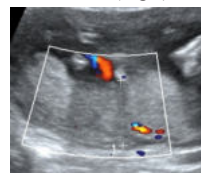


Figure 1. Measurement technique of placental thickness at the umbilical cord insertion site.

STATISTICAL ANALYSIS & RESULTS:

The collected data were analysed with IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To fit regression model to find the influencing factors which predict the fetal weight the Linear regression and the Multiple regression with enter method was used. To assess the relationship between the variables Pearson's Correlation with the Scatter diagrams was used. In all the above statistical tools the probability value .05 is considered as significant level.

Table 1: Age distribution:

Age distribution		
	Frequency	Percent
< 20 years	10	7.4
20 - 25 years	71	52.6
26 - 30 years	40	29.6
31 - 35 years	14	10.4
Total	135	100.0

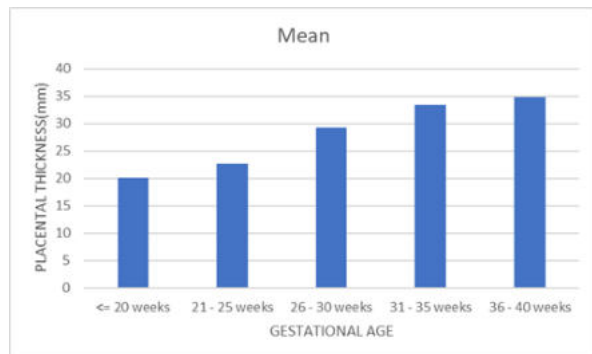
Table 2: Gestational age distribution:

Gestational age		
	Frequency	Percent
<= 20 weeks	17	12.6
21 - 25 weeks	20	14.8
26 - 30 weeks	21	15.6
31 - 35 weeks	54	40.0
36 - 40 weeks	23	17.0
Total	135	100.0

Table 3: Comparison of Placental Thickness (mm) with Gestational age (weeks) by One-way ANOVA:

	N	Mean	S.D	F-value	p-value
<= 20 weeks	17	20.08	1.51	347.512	0.0005 **
21 - 25 weeks	20	22.63	0.97		
26 - 30 weeks	21	29.30	2.52		
31 - 35 weeks	54	33.38	1.59		
36 - 40 weeks	23	34.79	1.49		

** Highly Statistical Significant at $p < 0.01$ level

**Figure.2 Relation between placental thickness and gestational age****Table 4: Regression Analysis of Fetal weight with Placental thickness**

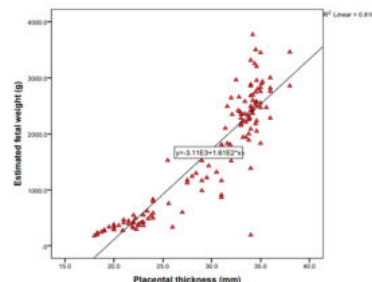
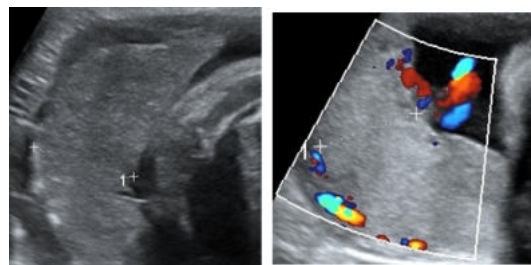
	Unstandardized Coefficients		Standardized Coefficients	t	p-value	95% C.I.	
	B	Std. Error	Beta			LB	UB
(Constan)	-3106.833	200.687		-15.481	0.0005 **	-3503.784	-2709.881
Placental thickness (mm)	160.994	6.635	.903	24.265	0.0005 **	147.871	174.117

** Highly Statistical Significant at $p < 0.01$ level

PROPOSED MODEL: Fetal weight = Placental thickness * 160.9 - 3106.8 which is significant at $p = 0.0005 < 0.01$ and R square 0.816

Table 5: Correlation Between Estimated Fetal Weight (g) With Placental Thickness(mm), Efw Hadlock By Pearson's Correlation

		Using Placental thickness(mm)	EFW Hadlock
Estimated fetal weight (g)	r-value	0.903	0.762
	p-value	0.0005 **	0.0005 **
	N	135	135

**Figure.3 Scatter Plot Between Estimated Fetal Weight And Placental Thickness****Figure. 4(a,b) A: Gray Scale Image With Placental Thickness:3cm, Estimated Fetal Weight:1308gms. B: Colour Doppler Image With Placental Thickness:21.8cm ,estimated Fetal Weight: 438gms.****DISCUSSION**

A prospective observational study on 135 pregnant women was performed to determine the correlation between Placental thickness and Estimated foetal weight .In our study ,we assessed the correlation between placental thickness ,so that it can be used in routine antenatal survey for early detection of pathologies. Our study population includes 135 gravida with gestational age ranging from 18 to 40 weeks ,calculated as per last menstrual period . patients with wrong dates were excluded from the study. Similar observations were made by Hadlock et al (1985).

All the standard biometric variables used in Hadlock model had statistically significant positive linear correlation with estimated fetal weight. Among the parameters tested AC had the highest level of positive correlation in value of 0.961 and FL, BPD had the second best positive correlation in value of 0.933. HC also had statistically significant positive correlation but lesser than that of other standard biometrics.

In our study ,there is a positive linear correlation between the placental thickness and the estimated fetal weight with r value 0.903 and p value < 0.0005 . The correlation between estimated fetal weight and placental thickness is high statistically significant . *Afrakhteh M et al*⁽⁸⁾ observed a significant positive correlation between placental thickness and fetal weight in second and third trimester which is coherent with our study results. *Abu et al.*⁽⁹⁾ in a study among Nigerian women also noted significant positive correlation between placental thickness and EFW in the second and third trimesters.

The level of correlation between the placental thickness and the estimated fetal weight is similar on comparison with the correlation of standard biometric variables used in Hadlock model with estimated fetal weight. This gives us the inference that placental thickness can be utilised as an alternative or adjunct to the standard variables in predicting the estimated fetal weight. Ultrasonographic measurement of placental diameter and thickness is of prognostic value in identifying the subsequent occurrence of fetal growth restriction⁽¹⁰⁾. *Adhikari Ret al*⁽¹¹⁾ observed that the estimated fetal birth weight which is calculated based on a formula having FL, BPD and AC as variables is dependent on placental thickness which is similar to our observations.) Regression Analysis of Fetal weight with Placental thickness was done which gave us the following predictive equation which is statistically

significant with R2 value of 0.816. Proposed new Model is **Fetal weight=Placental thickness * 160.9 - 3106.8** which is significant at $p=0.0005 < 0.01$ and R square 0.816.

Parameter of the placental thickness may vary among the different population group. Population specific normogram may be needed. Short placental insertion site may falsely suggest the placental thickening in normal placenta. Cord insertion site on placenta was difficult to image in normal term pregnancies in especially posterior location these are few limitations of the study

CONCLUSION:

The placental thickness increases steadily with fetal weight during second and third trimester. The placental thickness correlated well with the estimated fetal weight which is equivalent to that of standard biometric variables assessed in routine antenatal sonographic survey. Thus Placental thickness can be used as a potential predictor of estimated foetal weight as an alternative to standard biometric parameters and can be useful in early detection of abnormal foetal growth as placental changes precede the fetal morphological change.

Abbreviation: BPD: Bi parietal diameter, HC: Head circumference, AC: Abdominal circumference, FL: Femur length, AC: Abdominal circumference, EGA : Estimated gestational age, EFW: Estimated fetal weight, LMP: Last menstrual period, USG: Ultrasonography, mm: Millimetre, PT: Placental thickness, gms: grams

REFERENCES:

1. Suri S, Muttukrishna S, Jauniaux E. 2D-ultrasound and endocrinologic evaluation of placentation in early pregnancy and its relationship to fetal birthweight in normal pregnancies and preeclampsia. *Placenta*. 2013;34(9):745-50.
2. Azpurua H, Funai EF, Coraluzzi LM, Doherty LF, Sasson IE, Kliman M, et al. Determination of placental weight using two-dimensional sonography and volumetric mathematic modeling. *Am J Perinatol*. 2010;27(2):151-5.
3. Salafia CM, Zhang J, Miller RK, Charles AK, Shrout P, Sun W. Placental growth patterns affect birth weight for given placental weight. *Birth Defects Res Clin Mol Teratol*. 2007;79(4):281-8.
4. Hoddick WK, Mahony BS, Callen PW, Filly RA. Placental thickness. *J Ultrasound Med* 1985;4(9):479-82.
5. Pinette MG, Pan T, Blackstone J, Pinette SG. Ultrasound Placental thickness measurements and pregnancy outcomes. *Am J Obstet Gynecol*. 1998;178 (suppl):S167.
6. Spirt BA, Gordon LP. Sonography of the placenta. In: Fleischer AC, Manning FA, Jeanty P, Romero R, editors. *Sonography in obstetrics and gynaecology: principle and practice*. Appleton & Lange; 1996; p.173-202.
7. Benirschke K, Kaufmann P. *Pathology of the human placenta*. 2nd edition. New York: Springer-Verlag; 1990.
8. Afrakhteh M, Moini A, Sanei M, Raza H. Correlation between placental thickness in the second and third trimester and fetal weight. *Rev bras Gynaecol Obstet*. 2013;35(7):317-23.
9. Abu et al., [12] in a study among Nigerian women also noted significant positive correlation between placental thickness and EFW in the second and third trimesters.
10. Habib FA. Prediction of low birth weight infants from ultrasound measurement of placental diameter and placental thickness. *Ann Saudi Med*. 2002; 22(5-6):312-14.
11. Adhikari R, Deka PK, Tayal A, Chettri PK. Ultrasonographic evaluation of placental thickness in normal singleton pregnancy for estimation of gestational age. *Int J Med Imaging*. 2015;3(6):143-7.