

PLACENTAL THICKNESS EVALUATION IN NORMAL PREGNANCY, GESTATIONAL DIABETES AND PREGNANCY INDUCED HYPERTENSION

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Abstract

Background and purpose:

Placental thickness measured at the level of the umbilical cord insertion can be used as a new parameter to estimate gestational age. The present study was undertaken to evaluate the relationship between placental thickness and gestational age and to assess the growth pattern of placenta with advancing gestational age in pregnancy induced hypertension and gestational diabetes mellitus.

Objectives:

1. To assess the placental thickness in normal pregnancy, Pregnancy induced hypertension and gestational diabetes mellitus
2. To compare the placental thickness in normal pregnancy with placental thickness in gestational diabetes mellitus and in pregnancy induced hypertension.

Methods:

The study included 120 antenatal cases of gestational age between 24-28 weeks of gestation based on each 40 cases of normal pregnancy, gestational diabetes mellitus and pregnancy induced hypertension women aged between 18-40 years, who attending Adichunchanagiri Institute of Medical Sciences and referred to the Radiodiagnosis department for antenatal Ultrasound from the period of November 2019 to May 2020

Results:

The study mainly aimed at detailed assessment of placental thickness in normal pregnancy, pregnancy induced hypertension and gestational diabetes mellitus to assess the spectrum of placental changes and to correlate these findings with severity and duration of maternal disease and with the fetal outcome. A study of 120 pregnant patients were done with the collaboration of Department of Obstetrics and Gynecology, to find out the thickness of placenta in pregnancy induced hypertension, gestational diabetes mellitus and normal pregnancy. Mean placental thickness found to be much lower in the study group of pregnancy induced hypertension and increased in gestational diabetes mellitus in comparison to placental thickness of normal pregnancy. Placental thickness of normal pregnancy corresponds to the gestational age with normal fetal outcome. Multiparous women with increasing age groups were more likely to have gestational diabetes mellitus than primi-gravida women.

Conclusion: To conclude on the outcome received in our study signifies placental thickness can be used as an accurate indicator for estimating the fetal and maternal well-being. The variations in placental thickness decide whether a fetus is considered to be at risk. Also in our study the thickness of placenta did not show any variation with the location of placenta. Abnormal placental thickness in the early stages helps to detect intrauterine growth restriction(IUGR) and gestational diabetes mellitus(GDM).

In normal pregnancy the placental thickness almost corresponds to the gestational age and results in healthy fetus and mother.

In GDM the placenta thickness appears thickened and undergoes alterations in its formation, structure, and function. According to the review, these alterations are related to an oxygenation deficiency in the fetus, changes in the transplacental transport of nutrients and other alterations that cause fetal overgrowth by increasing their availability, and other consequences to the developing fetus.

Placental thickness is reduced in pregnancy induced hypertension due to increased blood pressure. Pregnancy induced hypertension, produces accelerated maturation and rapid aging of the chorionic villi with the risk of inducing a placental abruption. In addition, placental circulation is reduced causing decrease in oxygen saturation of the fetus.

Keywords: Pregnancy induced hypertension, Gestational diabetes mellitus, placental thickness, normal pregnancy.

INTRODUCTION

The placenta is a fetal organ with important metabolic, endocrine and immunological functions and also it has a role in protecting the fetus from noxious agents. Placental evaluation by ultrasonography has been used to characterize placental position and morphologic changes as the placenta matures. Sonography has provided a safe and non-invasive means to evaluate the placenta whose normal and abnormal size; appearance and growth pattern can have significant antenatal implications.

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 use¹.

The measurement of placental thickness is relatively simple and clinically useful. Abnormal thickness of placenta is well recognized as a diagnostic harbinger in a wide spectrum of pathologic events. Placental thickness can contribute to the management of fetus at risk².

Ultrasound still remains the choice in detecting placental abnormalities for the advantages it offers for it is easy to use, good safety profile³ and most importantly its contribution in real time diagnosis.⁴

Placental thickness is reduced significantly in IUGR and in those with pre eclampsia³.

In our modern world due to changes in lifestyle, food habits..etc. , the prevalence of hypertension and diabetes

mellitus is more⁵. As per the recent study conducted in India on march 2018 by Indian Institute of public health and public health foundation of India in association with foreign universities, on 1.3 million adults revealed that the prevalence of diabetes mellitus is 7.5% and hypertension is 25.3% of population. Among the studied population, half are young women.^{6,7}

There are many placental changes which happen in association with gestational diabetes mellitus and hypertension. Because of its unique position, the placenta is exposed to regulatory influence of hormones, cytokines, growth factors and can undergo changes in different conditions.^{8,9} Placental abnormalities causes increased risk for congenital malformations, feto-maternal complications. Identification of placental thickness using ultrasonography can prevent such complications arising in the pregnancy.^{10,11,12}

MATERIAL AND MATHODS

The present study was a cross-sectional observational study conducted at the Department of Radiology, Adichunchanagiri Institute of Medical Sciences, Bellur, Karnataka for the duration 18months. The study included pregnant women with 24-28 weeks of gestational age referred from the department of Obstetrics and Gynaecology for routine obstetric ultrasound scanning. Sample Size of 40 in each group of pregnancy induced hypertension, normal pregnancy and gestational diabetics.

INCLUSION CRITERIA A)FOR

DIABETIC WOMEN-

Fasting plasma glucose values exceed 92 mg/dl (one hour), 180mg/dl(two hour), 153mg/dl.(as per international association of diabetes and pregnancy study group).

B)FOR HYPERTENSION PREGNANT WOMEN

Singleton pregnancy Gestational

hypertensionPreeclampsia

Eclampsia

Preeclampsia superimposed on chronic hypertensionChronic

hypertension

EXCLUSION CRITERIA:

Uncooperative patients.

Previously known diabetes mellitus

Patients with other associated medical conditions under treatment.METHOD OF

COLLECTION OF DATA

After obtaining approval from Institutional Ethics committee, the material for the present study is proposed to be collected from consecutive patients who visit OPD in Dept. of Obstetrics and Gynecology, Adichunchanagiri Institute of Medical Sciences, B.G.Nagara andreferred to radiology department.

All pregnant women will be carried out the Oral Glucose Tolerance Test(OGTT) with 75gm hydride glucose. Other parameters check will be Glycated Hb, Total cholesterol, High Density Lipoprotein, Low Density Lipoprotein, Triglycerides and fasting glucose level. Diagnosis of gestational diabetes will be confirmed when fasting plasma glucose values exceed 92 mg/dl (one hour), 180mg/dl (two hour), 153mg/dl(as per international association of diabetes and pregnancy study group).

Blood pressure will be monitored using a mercury sphygmomanometer in all subjects for 3 consecutive times. Grading of BP- Mild hypertension- BP elevation of greater than 140/90

mmHg on 2 measurements 4 hours apart during 24 hour. Severe hypertension- BP elevation of greater than

160/110 mmHg on 2 measurements 4 hours apart or one diastolic pressure of greater than 110 mmHg during 24 hours.

THE SCANNERS AND TRANSDUCERS USED

Ultrasonography-The 2D ultrasonography done for placental thickness in pregnant women between 24 to 28weeks referred for routine obstetric scan.

The grey scale real time ultrasonographic examinations were performed using a SamsungHS70A and GE voluson E6 ultrasound scanner and the probe used for the study was 3.5MHz convex array transducer.

The sonographic measurement of Placental thickness:

Pregnant women were scanned in supine position. The transducer was placed on the skin surface after applying the couple agent.

The placental thickness in mm was measured at the level of cord insertion site(Figure 1). The transducer was oriented to scan perpendicular to both the chorionic and basal plates as tangential scan will distort the measurement of the thickness of the placenta.



Figure 1: Ultrasound image of placenta in a normal pregnant at 24weeks, 5 days showing a placental thickness of 2.4 cm

STATISTICAL ANALYSIS: The data was expressed in number, percentage, mean and standard deviation. Statistical Package for Social Sciences (SPSS 20.0) version used for analysis. One way ANOVA (Post hoc) followed by Shiffes test applied to find the statistical significant between the groups. p value less than 0.05 considered statically significant at 95% confidence interval.

RESULTS

The present study included 120 pregnant women 40 each for normal pregnancy, gestational hypertension group and Gestational diabetes mellitus group including primigravida and multigravida, between the age group of 18-40 years.

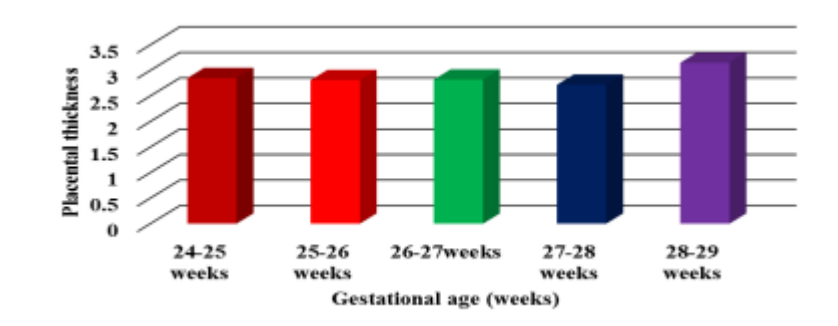
Placental thickness in individuals from 24 -28 weeks of gestation is given with gestational age and is observed that there is a linear relationship between placental thickness (in mm) and gestational age in

weeks) in normal pregnancy. In normal pregnancy mean placental thickness corresponds to the gestational age.

Table-1: Mean placental thickness in relation to gestational age in normal group

Gestational age (Weeks)	Placental Thickness (MEAN±SD)
24-25 weeks	2.55±0.05
25-26 weeks	2.61±0.28
26-27weeks	2.72±0.27
27-28 weeks	2.72±0.30

Graph-1: Mean placental thickness in relation to gestational age in normal group



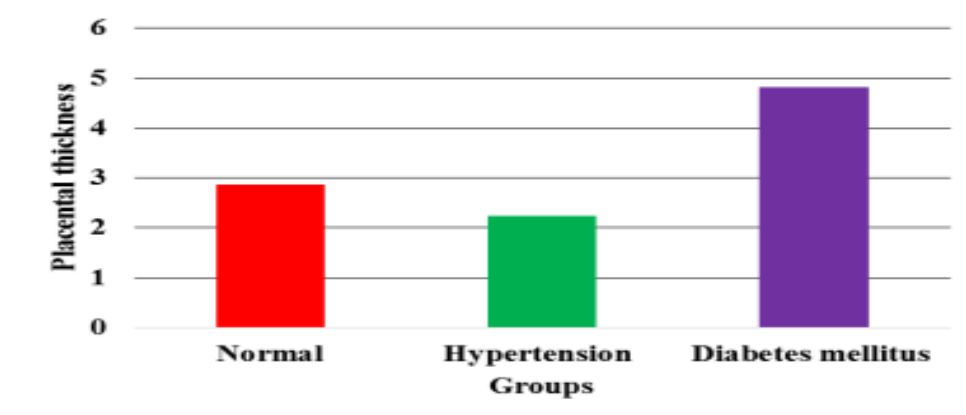
From the study, the thickness of the placenta was less in gestational hypertension with mean placental thickness measuring 22.4 mm and thickness of the placenta is more in Gestational diabetes mellitus group with mean placental thickness is 48.2mm and normal placenta with mean placental thickness is 28.0 mm.

From the study of 120 cases, normal pregnancy placental thickness ranges from 2.5 cm to 4 cm, in Gestational Hypertension group shows placental thickness below 2.5 cm and in Gestational Diabetes mellitus placental thickness is above 4.0 cm.

Table-2: Mean placental thickness of three different groups

Groups	Placental Thickness (MEAN±SD)
Gestational Hypertension	2.24±0.22
Normal	2.87±0.34
Gestational Diabetes mellitus	4.82±0.36

Graph-2: Mean placental thickness of three different groups



It is observed that mean placental thickness is 28.7 mm in normal pregnancy and 22.4mm in pregnancy gestational hypertension group. There is a highly significant difference between 0 hypertensive and normal pregnancy placental thickness as $p < 0.05$.

It is observed that mean placental thickness is 2.24 mm in gestational hypertension and 4.82 mm in gestational diabetes mellitus group. There is a highly significant difference between gestational hypertension and gestational diabetes mellitus placental thickness as $p < 0.05$.

Mean age group of patients were in 26-30 years of age (42.0%) in gestational hypertensive group, 26-30 years (52%) in Gestational diabetes mellitus and 21-25 years of age (65.0%) in normal pregnancy. We have found out gestational diabetes mellitus and gestational hypertension is more in increased maternal age group. Multiparous women were more likely to have gestational diabetes mellitus than primigravida women.

DISCUSSION

Donald introduced placental localization by ultrasound in 1965.¹³ Usually during ultrasound examination, the placenta was examined only for the location and position. But nowadays due to detailed ultrasonography, we can detect the morphological changes of the placenta as the placenta matures. As the gestational age advances the placental thickness also increases gradually so abnormally thick and thin placenta can be evaluated and correlated with other parameters during routine scanning. For every week of gestational age, we can define the normal placental thickness measurement, So we can determine the placental thickness whether it is normal or abnormal.

In present study we assessed the relationship of placental thickness (in mm) with sonographic gestational age (in weeks) which increases with advancing gestational age. The study showed placental thickness (in mm) increases with gestational age (in weeks) in normal pregnancy. The rate of increase of placental thickness (in mm) gradually decreased with gestational age (in weeks) in pregnancy induced hypertension. Steady increase in the placental thickness (in mm) which is not matching with corresponding gestational age (in weeks) in gestational diabetes mellitus.

The results of our study are consistent with observation made by authors of previous studies.

Hoddick et al (1985) found average placental thickness (in mm) to be roughly equivalent to the gestational age (in weeks)¹⁴. Mital and Hooja N also found an increasing trend in the values of mean placental thickness (in mm) coincides almost exactly in the gestational age in weeks.¹⁵

Anupama Jain et al reported similar correlations between placental thickness and gestational age. They found placental thickness (in mm) almost matched gestational age (in weeks)¹⁶ our study showed similar correlation

Karthikeyan et al concluded that placental thickness can be used as a predictor of the gestational age. The subnormal placental thickness for the corresponding gestational age should be evaluated for any disease condition. So, the measurement of placental thickness should therefore be carried out routinely during the obstetric USGs.¹⁷In our study we found thin placental associated with pregnancy induced hypertension.

Ichiro Miwa conducted a study to understand the importance of placental thickness using ultrasonography between 2005 and 2009. The study concluded that Ultrasonographic measurement of placental thickness is a simple method to estimate placental size. Thick placenta may be a useful predictor of adverse pregnancy outcomes¹⁸and suggestive of gestational diabetes mellitus. Our study also showed increase in placental thickness in gestational diabetes mellitus.

A study done on structural changes in placenta in pregnancy induced hypertension by Deepalaxmisalmani et al observed that weight and dimensions of placenta were less in study group. The mean neonatal body weight was more in normal pregnancy and mean fetal placental weight ratio was high in PIH group.¹⁹Which was correlating with our study.

Placental thickness changes are an expression of normal growth of the foeto placental unit amenable to measurement with USG and of value in describing normal physiology.

Some diseases or abnormalities of the fetus can be detected through measurement of placental thickness. The measurements relative to gestational age should serve to facilitate recognition of altered placental thickness induced by pathologic processes.

Thin placenta is often a marker for a small for dates fetuses and a sign of growth restriction. Placental thinning is also seen in patients with pre-eclampsia, chromosomal abnormalities and severe intra-uterine infection.

Thick placentae are associated with Hydrops fetalis, diabetes mellitus and intrauterine infections. Sonographically thick placenta is associated with increased perinatal risk with increased mortality related to fetal anomalies and higher rates of both small for gestational age and large for gestational age infants at term.

To obtain an accurate placental measurement, it is important to identify the placental-myometrial interface. When placenta is posterior, identification of this region is facilitated by the acquisition of images as free from acoustic shadowing from the fetus as possible.

When the placenta is anterior, proper transducer position and gain settings are important to minimize near field and reverberation artifacts.

Correct identification of the placental-myometrial interface should also preclude the illusion of placental thickening induced by focal myometrial thickening. Since the placenta is a passive structure lacking the capacity to expand focally, measurements of placental thickness at any point yields similar results.

Placental thickness may appear focally increased over uterine contractions or myomata, attention to the placental-myometrial echogenicity difference should confirm that the placenta drapes over these regions of myometrial thickening. Thoughtful attention to technical details and correlation with gestational age should facilitate the detection of abnormal placental thickness and normal growth pattern in prenatal sonographic evaluation.

LIMITATIONS OF THE STUDY

A method to estimate the thickness of the in-situ placenta from USG images in a single dimension has its own limitations. Placental volume measurement using 3-D USG may be more accurately assess placental size than placental thickness measurements. However, 3-D sonography is expensive, time consuming and not widely available.

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.

CONCLUSION

To obtain an accurate placental measurement, it is important to identify the placental- myometrium interface. The measurement of placental thickness in ultrasound at the level of the umbilical cord insertion is very easy technique which gives best knowledge about maternal diseases and fetal abnormalities.

Placental thickness can be considered as one of the criteria for assessing gestational age. Placental thickness (in mm) increases with increasing gestational age.

The thickness of the placenta and growth pattern did not vary relative to the placental location.

The relationship of placental thickness with gestational age in pregnancy induced hypertension showed reduced thickness with advancing gestational age.

For every week of increase in gestational age there is accelerated increase in placental thickness (in mm) noted in gestational diabetes mellitus patient.

Normal placental thickness nomograms have been established in the present study to determine whether a given placental thickness is normal or abnormal for a particular gestational age.

By comparing the present study placental thickness can be used as a one of the important parameters for finding any abnormalities in fetal development and helpful in assessment of mothers with gestational diabetes mellitus and pregnancy induced hypertension.

Study shows placental thickness measurement helps the medical team to manage adverse pregnancy outcomes.

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