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Original Research Article

Placental thickness measurement at second and third trimester and its association with fetomaternal outcome

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ABSTRACT

Background: Placenta is responsible for adequate foetal growth and development by performing nutritional, endocrine, excretory, respiratory and countless other important functions. Studying the architecture and morphology of placenta on USG antenatally can tip-off about health of the foetus in utero.
Methods: A prospective observational study was conducted at Kasturba Hospital, Delhi, from August 2023 to October 2024. The minimum required sample size was estimated to be 36 Considering a 95% confidence level, 90% power and an absolute error of 5% and a correlation coefficient of 0.51 between placental thickness and neonatal birth weight as reported by Gauri Raghunath Shinde et al.1 A total of 42 pregnant women were enrolled in the study in their first or second trimesters. Ultrasonography for placental thickness (PT) was performed at 25 and 35 weeks period of gestation (POG). Patients were followed up till delivery and various foetal and maternal outcomes such as birth weight, Pregnancy Induced hypertension (PIH), intrauterine growth restriction (IUGR), Gestational Diabetes Mellitus (GDM), Intrahepatic Cholestasis of pregnancy (IHCP) among many more were recorded. Statistical analysis was performed using SPSS-25 and a p-value <0.05 was considered significant.
Results: Mean PT at 25 weeks POG was found to be 26.29+4.47 mm and at 35 weeks POG was found to be 33.23 ±5.74 mm. Posterior wall placentae were found to be thicker as compared to anterior wall implanted placentae (at 25 weeks POG mean PT for anterior vs posterior placentae were 24.72 vs 27.57; at 35 weeks POG mean PT for anterior vs posterior placentae were 30.22 vs 35.44). Birth weight was found to increase with increase in PT (at 25 weeks POG Pearl's correlation coefficient R= 0.36, p=0.02; at 35 weeks POG Pearl's correlation coefficient R= 0.479, p=0.002). Pregnant Women (PW) with normal PT (>-2SD;<2SD) and thick PT (>2SD) at 25 weeks POG had mean birth weights 2.85kg and 3.13kg respectively. PW with thin (<-2SD), normal thickness (>-2SD; <2SD) and thick placentae (>2SD) at 35 weeks POG had mean birth weights 2.51kg, 2.85kg and 3.18kg respectively.
Conclusions: Measurement of PT antenatally on sonography can indicate about health of foetus in utero and its outcomes in the postnatal life.

Keywords: Birth weight, Foeto-maternal outcomes, IUGR, Placenta, Placental thickness, Ultrasound

INTRODUCTION

Placenta is a highly vascular foetal organ with a variety of functions such as metabolic, endocrinal, respiratory, excretory and nutritional.[2] A normal placental structure and function are required for appropriate foetal growth and development. As nutritional and other demands increase throughout pregnancy, placenta also experiences changes both in terms of surface area and thickness.[3] Placental abnormalities can affect the health of the mother and the fetus; similarly, any pathological changes in mother and fetus can also have a great effect on the placenta:4 infarction, intervillous thrombosis, inflammation, peri-villous fibrin deposition or compensatory hyperplasia to name a few.[5] However, the placenta is often overlooked in the routine evaluation of normal gestations, receiving attention only when abnormalities are detected.[6] Abnormally thickened or thinned placenta is indicative of

an at-risk pregnancy and warrants close monitoring. Thus, sonographic measurements of PT can indicate about weight and nutritional status of the fetus and help prognosticate the pregnancy.[6]

PT is a simple, safe, non-invasive parameter that can be easily assessed during routine 2D ultrasonography without prolonging the examination time.[6] It does not require sophisticated software to measure hence it does not add to the expenditure of the examination. It can be a promising parameter to measure especially in peripheral centres in India where facilities of Doppler and 3D Ultrasonography are not routinely available.[6]

Through this study we aimed to measure placental thickness on USG antenatally and study its relation with the outcomes of the mother and the baby in the postnatal periods if any.

METHODS

This prospective observational study was conducted at the Department of Obstetrics and Gynaecology, Kasturba Hospital, Delhi, from August 2023 to October 2024.

A total of 42 pregnant women attending the antenatal clinic in their first or second trimesters (<20 weeks POG) were enrolled in the study. The participants were subjected to ultrasonographic assessments for PT at 25 weeks and 35 weeks POG along with routine antenatal investigations. The study subjects were followed up till 1 week after delivery.

Inclusion criteria

Singleton, sure of dates, BMI >18.5 kg/m2 and <30 kg/m2, time of first visit on or before 20 weeks POG, age >18 years and <40 years.

Exclusion criteria

Multifetal pregnancy, not sure of dates, obese and underweight females according to the WHO Classification (BMI<18.5 kg/m2 and BMI >30 kg/m2). Rh negative blood group, essential hypertension, diabetes mellitus type 1 and type 2. Chronic renal disease, chronic liver disease, known case of hypothyroidism, moderate to severe anaemia at first visit, placenta praevia, placental abruption, abnormal placental anatomy.

Subjects were examined with the help of 2D Ultrasonography at period of gestation 250-6 and at 350-6 weeks POG according to the last menstrual period (LMP) and thickness of placenta was measured in the anteroposterior dimension at the level of cord insertion excluding retroplacental area (myometrial and sub placental veins). Placentomyometrial interface at the midpoint free from fetal shadowing was identified for accurate measurements in millimetres (mm). Data collected by Hoddick et al was used as a reference to classify patients into three groups.[7] Subjects with thickness below the 2SD (<17 mm at 25 weeks POG9; <25 mm at 35 weeks POG) were classified as Thin Placenta group, whereas patients with placental thickness more than 2SD (>33 mm at 25 weeks POG9; >40mm at 35 weeks POG) were classified as having a thick placenta group. PT lying within -2SD to +2SD was classified as normal placental thickness group.[7]

Other USG parameters recorded were Estimated Baby weight (EBW) at 25 weeks POG, EBW at 35 weeks POG, location of placenta, any gross congenital anomaly, any placental dysmorphology.

Foetal outcomes recorded were birth weight, viability, APGAR Score at 1 minute and 5 minutes of birth, any need for NICU admission, early neonatal death if any.

Maternal outcomes such as PIH, GDM, gestational hypothyroidism, IHCP, antepartum haemorrhage, IUGR, Anaemia (haemoglobin <11g/dl), polyhydramnios, oligohydramnios, intrauterine death, POG at the time of delivery, mode of delivery were also recorded.

Statistical analysis was performed using SPSS-25. Continuous variables were expressed as means with standard deviations and compared using Student's t-test. Categorical variables were expressed as percentages and analysed using Chi-square tests. A p value of less than 0.05 was considered statistically significant.

RESULTS

The mean age of the participants was 25.54+3.60 years. Approximately 55% of the subjects belonged to the lower socioeconomic status classified by the Modified Kuppuswamy scale. 45% belonged to middle class. 81% of the subjects had a normal BMI and 19% were overweight calculated at the time of booking with either pre-pregnancy weight or weight in the first trimester. Underweight and obese women were excluded at the time of subject selection. Approximately 60% of patients were Multigravida, rest all 40% were Primigravida.

44% of multigravidas amongst the study participants gave history of previous abortions, half of which gave history of abortions followed by dilatation and evacuation. None of the multigravida subjects gave history of short inter-conception period.

Mean PT at 25 weeks POG was found to be 26.29+4.47 mm and at 35 weeks POG was found to be 33.23±5.74 mm. Posterior wall placentae were found to be thicker as compared to anterior wall implanted placentae (at 25 weeks POG mean PT for anterior vs posterior placentae were 24.72 mm vs 27.57 mm; at 35 weeks POG mean PT for anterior vs posterior placentae were 30.22mm vs 35.44 mm). Birth weight was found to increase with increase in PT (at 25 weeks POG Pearl's correlation coefficient R=0.36; p=0.02. at 35 weeks POG Pearl's correlation

coefficient R= 0.479; p 0.002). PW with normal PT (>-2 SD;<2 SD) and thick PT (>2 SD) at 25 weeks POG had mean birth weights 2.85 kg and 3.13 kg respectively and PW with thin (<-2 SD), normal thickness (>-2 SD; <2 SD) and thick placentae (>2 SD) at 35 weeks POG had mean birth weights 2.51 kg, 2.85 kg and 3.18 kg respectively.

Around 40% of thin PT subjects developed IUGR vs 7.4% of normal and 0% of thick PT subjects (p value 0.05). One subject developed malpresentation at term which belonged to the thin PT group (20% of the thin placental thickness group). Chi-square test was performed and result was found to be statistically significant (p=0.028).

Two patients developed PROM (5% of all subjects). One of such patients had thin placenta at 35 weeks (20%) of all the patients with thin placenta and other patient had a thick placenta at 35 weeks of POG (12.5% of all the subjects with thick PT). Chi-square test was performed and result was found not to be statistically significant (p=0.094).

Total of 29% of thick placental subjects and 13% of normal placental subjects developed mild anaemia. 42.5% of all the patients had moderate anaemia (i.e. Hb ranging from 7g/dl–9.9g/dl). 50% of the normal placental patients and 67% of the thin placental patients developed moderate anaemia. None of the patients developed severe (Hb<7g/dl) and very severe (Hb<4g/dl) anaemias. Chi-square test was performed and result was found to be statistically not significant (p>0.05). Only 3 patients developed PIH. Two of those patients had normal PT and one had thin placenta at 35weeks POG (20% of thin PT patients and 7% of normal PT patients) Chi-square test was performed and data obtained was concluded to be statistically insignificant (p=0.43). There was a weakly negative correlation between PT with mean arterial pressure (MAP) (Spearman's rank correlation coefficient ρ=-0.021, p=0.89 at 25 weeks POG; ρ=-0.01023, p=0.95 at 35 weeks POG) although it was statistically insignificant. One patient developed IHCP having normal PT at 35 weeks of POG.

One patient developed GDM belonging to the thin PT group (20% of thin PT group patients). Chi-square test was performed and the result was found to be statistically significant (p=0.028). Spearman's Rank Correlation Coefficient for PT at 25,35 weeks POG and OGTT by DIPSI criteria was calculated and signified a weakly negative correlation between PT and development of GDM (at 25 weeks POG ρ=-0.00569, p=0.97; at 35 weeks POG ρ=0.22427, p=0.16). One patient developed hypothyroidism belonging to the normal pt group (4% of normal PT group). Chi-square test revealed the results to be Statistically insignificant (p=0.781). 30% of all the subjects delivered via operative delivery rest all delivered vaginally. 43%, 27% and 33% of patients with thick, normal and thin placentae in third trimester needed operative delivery respectively. Chi-square test was performed and result was not found to be statistically significant (p=0.717).

Table 1: Demographic data of subject population.

	Thin	Normal	Thick
Age (in years)			
20-25	2	18	4
25-30	1	8	4
>30	2	3	0
Education			
Uneducated	0	3	1
Primary	1	1	0
Secondary	2	16	3
Senior Secondary	2	6	4
Graduate	0	3	0
Religion			
Hindu	2	11	4
Muslim	3	18	4
Socioeconomic	Status		
Lower	2	12	1
Lower middle	2	8	5
Upper middle	0	3	1
Lower upper	1	6	1
Upper	0	0	0
BMI			
Underweight	0	0	0
Normal	5	25	5
Overweight	0	4	3
Obese	0	0	0

Table 2: Obstetric history.

	Thin	Normal	Thick
Gravida			
Primigravida	2	13	2
Multigravida	3	16	6
Abortions	2	6	3
D&E	2	3	0
Short ICP	0	0	0

Table 3: USG and foetal factors.

	Thin	Normal	Thick
Number of subjects at 25 weeks	0	39	3
Mean PT AT 25 weeks POG		2.629±0.447 cm	
Mean birth weight for these groups at 25 weeks POG	-	2.85±0.33 kg	3.13±0.25 kg
Pearl's correlation coefficient at 25 weeks		0.36	(p=0.02)
Number of subjects at 35 weeks	5	27	8
Mean PT AT 35 weeks POG		33.23±5.74 mm	
Mean birth weight for these group at 35 weeks	2.51±0.17 kg	2.85±0.31kg	3.18±0.21kg
Pearl's correlation coefficient at 35 weeks		0.479	(p=0.002)
Placental location			
Anterior	4	12	1
Posterior	1	15	7

Table 4: Maternal outcomes.

	Thin	Normal	Thick
IUGR	2	2	0
Doppler changes	0	0	0
Malpresentation	1	0	0
PROM	1	0	1
Oligohydramnios	0	0	0
Anemia			
Mild	0	4	2
Moderate	2	14	1
Severe	0	0	0
Very severe	0	0	0
PIH	1	2	0
IHCP	0	1	0
GDM	1	0	0
Hypothyroidism	0	1	0
Mode of delivery			
NVD	3	20	5
LSCS	2	7	3

DISCUSSION

In the present study involving 42 antenatal participants PT, measured on routine 2D ultrasonography showed a progressive increase from the second to the third trimester and demonstrated a significant positive correlation with neonatal birth weight. These findings emphasize the importance of PT as a simple, safe and non-invasive sonographic parameter that can serve as an additional indicator of fetal growth and well-being. In a similar study Bhagel et al mean placental thickness in second trimester (24 weeks POG) was found to be 24.5 mm and in third trimester (36 weeks POG) was calculated as 35.5 mm. They also deduced that both estimated foetal weight and

birth weight had a positive correlation with placental thickness in the third trimester (at 36 weeks, r=0.740, p=0.000). They reported development of IUGR in 10 patients. 80% of these patients had a thin placenta (PT<10th percentile) at 36 weeks which is comparable to our results.[8]

Agwuna et al and colleagues calculated mean placental thickness at 25 weeks as 27.8 mm and at 35 weeks as 37.33mm in their Nigeria based study in 2013 which is similar to what we obtained.[9]

Shinde et al in their similar study reported mean placental thickness in second trimester (24 weeks POG) as 24.05 mm and in third trimester (36 weeks POG) as 35.31 mm. They also calculated correlation between birth weight and placental thickness at 24 weeks POG (r=0.516, p<0.00001) and 36 weeks POG (r=0.669, p<0.00001). in their study reported 10 out of 110 patients to develop IUGR, 60% of whom had a thin placenta. They also reported development of severe PIH in total of 6 subjects, out of which 4 had a thin placenta and 2 had a normal placental thickness and just one case of GDM that ended up having a thick placenta in third trimester USG which all are corresponding to our measurements.[1]

Seyedeh H and colleagues in their cross-sectional study published in 2023 based in Rasht, Iran found out that in posterior position, placental thickness increased by 14% as compared to an anterior one. The mean of placental thickness (29.4±0.75) in the posterior part was greater than the thickness in the anterior part (26.94±10.72) which is similar to our results.[10]

Nagpal et al in their similar study in 2017 also calculated a strong positive correlation between placental thickness at 36 weeks POG and birth weight (r=0.740). 33.3%, 14.6% and 57% of thin, normal and thick placental groups at 36 weeks needed an LSCS for termination of pregnancy which is comparable to our study.[11]

Gaikwad et al and colleagues in 2023 also reported that the patients with HTN and IUGR in their study had a thinner mean placental thickness than their healthy counterparts whereas occurrence of thicker placenta in GDM patients in their new Delhi based study.[12]

Vinchurkar et al in their observational study conducted in 200 pregnant women based in Tamil Nadu, India concluded Placental thickness in the SGA group (mean 2.64+0.51) was signifcantly lower as compared to the normal group (mean 3.02+0.57) (p<0.001).[13] Rawal et al in their study based in new Delhi reported total 6.38% patients developed IUGR. 43% of thin placental subjects and just 2 % of normal placentae subjects were affected. None of the thick placentae subjects developed IUGR which is similar to our study.[6] Lelic et al and colleagues studied in 2014 the effect of maternal anaemia on placenta and the newborns. In their prospective study on 100 pregnant females and their newborn, they concluded that placental parameters (diameter, thickness, volume and weight) were lower for anaemics than controls. Also, the average birthweight babies born to anaemic mothers was significantly lower than control groups.[14]

Garg et al in her Rajasthan India based study in 2021 studied the effect on morpho-metric and histopathological aspects of maternal hypothyroidism on placenta and new born. Mean placental thickness in hypothyroid pregnant patients was lesser (1.16 cm) than patients with normo-thyroid patients (2.56 cm) and this result was statistically significant.[15]

Parveen et al and colleagues in a Delhi based study published in 2023 on histopathological changes in placenta with cholestasis of pregnancy reported no differences on gross examination in terms of size, colour, texture, weight and thickness in cases versus controls.[16]

Patil et al and her colleagues conducted a study similar to ours in year 2018 and out of their 100 subjects, only 18% were delivered by an LSCS, rest all delivered vaginally.[17] In summary, the present study demonstrates that placental thickness in the second and third trimesters correlates significantly with various fetomaternal outcomes, highlighting its potential as a simple, non-invasive predictor of pregnancy risk.

These findings underscore the importance of routine placental thickness assessment during antenatal ultrasonography as an adjunct tool for early identification of high-risk pregnancies.

The study was limited by its single-center design and relatively small sample size, which may affect generalizability of results.

CONCLUSION

Measurement of PT antenatally on sonography can indicate about health of foetus in utero and its outcomes in the postnatal life.

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