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Ultrasonographic Measurement of Placental Thickness and Its Correlation with Estimated Fetal Weight

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Abstract

Background: Placenta is a materno-fetal organ, and its size is indicative of the fetus health and growth. Placental thickness (PT) is an additional ultrasonographic metric commonly used to evaluate the placenta.The objectiveof this study was to assess the relationship between PT (at 32- and 36-weeks of gestation) and to estimate the fetal weight. Methods: This observational study was performed at the Department of Obstetrics andGynecologyBenha University Hospital and ShebeenElkoom insurance hospital over a period from July 2020 to November 2021.Results: There was a significant positive correlation between PTat 32weeks and Apgar score at 1st and 5th min. Also, there was a significant positive correlation between PTat 36 weeks and Apgar score at 1st and 5th min. There was a significant positive correlation between PT at 32 weeks, PT 36 at weeks and femur length(FL), abdominal circumference (AC), biparietal diameter (BPD), head circumference (HC), estimated fetal weight (EFW) and amniotic fluid index (AFI). Conclusion: The evaluation of fetal weight(a vital element of prenatal treatment), relies heavily on ultrasonography(US).PT measured at the umbilical cord insertion point is a reliable sonographic indication for fetal weight evaluation, due to their linear correlation .

Keywords: Ultrasonography; Placental Thickness; Estimated Fetal Weight.

1. Introduction

The size of the placenta is an indicator offetal health and development.Placental thickness (PT) is an additional ultrasonographic parameter often employed to assess the placenta [1].

The human placenta develops to provide nutrients and oxygen to the fetus, as well as to eliminate carbon dioxide and other metabolic wastes. In addition to protecting the fetus from infection, the placenta secretes hormones into the mother's blood [2].

A properly functioning uteroplacental organ is crucial for fetal growth and as a result, a healthy birth weight. Sonographic analysis of the placenta can identify the fetal nutritional status. It is widely accepted that normal PT closely corresponds with gestational age [3].

The placenta has a discoid shape, a diameter of(15 to 25)centimeters(cm), a thickness of(3 to 5)cm, and a weight of(500 to 600)grams,which is around one-fifth the weight of the fetus. Abnormally thin or thick placentae increase the risk of prenatal diseases and new born death [4].

The PT is measured perpendicular to the insertion point of the umbilical cord. It was identified based on the contact between the echogenic chorionic plate and the placental myometrium. Myomata or contraction-induced myometrial thickening must be accounted for when determining PT[5].

The integration of PT at 32 and 36 weeks into fetal biometry can improve the accuracy of gestational/fetal age estimations and aid in the prediction of fetal outcome. Atypical PT for the proper gestational age may produce health concerns for the fetus or mother. Since the significance of PT in predicting fetal outcome remains uncertain, subsequent prospective investigationsare required to establish placental development as an indicator of neonatal outcome. This investigation aims to progress in this fashion [6].

This study assessed the relationship between PT (at 32 and 36-weeks of gestation) and estimatedfetal weight.

2. Methods

This observational study was performed at Obstetrics andGynecologyDepartment, Benha University Hospital and Shebeen-Elkoom insurance hospital over a period from July 2020 to November 2021on patients attending the obstetrics outpatient Clinics. The study was conducted after being approved by the institutional research committee. A consentwas obtained from the patients included in the study after explaining the idea of the study. During the study period, 150 pregnant females attending antenatalcare(ANC) clinic and deliver in these hospitals were examined at 32 weeks gestation (from the last normal menstrual period confirmed by ultrasound evaluation) and followed up at 36 weeks gestation.

A full detailed personal, present, past, menstrual and obstetrics history were taken from all participating patients in addition to a full physical examination.

Inclusion criteria weresingleton pregnancy, known last menstrual period, age group between (18 and 40) years old, normal BMI and patients were examined at 32 and followed up at 36 weeks gestation.

Exclusion criteria were women who are unsure of their last menstrual period, women with high risk medical or obstetric conditions like (HTN, DM, Chronic renal disease), congenital abnormalities of

the fetus, low lying placenta and placenta previa or eccentric insertion of the umbilical cord.

Sample size calculation

Results of sample size estimation using openEpi, version 3, open-source calculator—SsMean.

150 pregnant ladies included in the study were subjected at the first visit to **1-detailed history taking about general health and previous pregnancy and delivery (**Personal, Obstetric, Menstrual, and past history). **2-Physical examination to exclude any disease or medical condition. 3- obstetric examination.**

Then at 32&36 week of gestation all patients were subjected to: **Ultrasound examination.**

Procedure: Obstetric ultrasound examination was performed on Digital Color Doppler Ultrasound System (Voluson Pro V 730 Ob/Gyn) machine. PT and fetal biometry were measured at 32- and 36-weeks of gestation. The viability and gross anatomical deformities of the fetus were evaluated, and the gestational age was determined using multiple growth parameters: Biparietal diameter, femur length, abdomen and head circumference, and estimated fetal weight.

Technique of ultrasound examination:

Transabdominal ultrasonography was performed to all patients with the head of the bed elevated 30 degrees and a small pillow put under the right loin. Gestational age of the fetus was calculated by measuring its femur length, biparietal diameter, abdomenal and head circumferences, and approximate fetal weight. The fetusviability and gross anatomical deformities were also assessed. Placenta was localized in a longitudinal section. PT was measured at 32 and 36 weeks,excluding the retro placental zone. PT was measured longitudinally from the lateral chorionic plate to the umbilical cord insertion with an accuracy of 1 mm at the level of umbilical cord insertion. The insertion of the umbilical cord was verified utilizing color Doppler of the umbilical artery.

Grannum's scale was done to grade the placenta.**Post-delivery:** the baby birth and placental weight, maturity and sex of the baby andApgar score were recorded. There was a correlation between PT at 32 and 36 weeks and neonatal outcome and birth weight.

3. Results

The frequency distribution of study group regarding PT at 32 weeks was 17.3% had thin placenta, 14% had thick placenta and 68.7% had normal PT while the frequency distribution of study group regarding PT at 36 weeks was 22% had thin placenta, 13.3% had thick placenta and 64.7% had normal PT. **Table (1)**

Table (1): Study group regarding PT

	At 32 weeks		At 36 weeks	
	No.	**%**	**No.**	**%**
Thin placenta	26	17.3	33	22.0
Normal PT	103	68.7	97	64.7
Thick placenta	21	14.0	20	13.3

There was a significant positive correlation between PT at 32 weeks and Apgar score at 1st and 5th minutes, In addition, there was a significant positive correlation between PT at 36 weeks and Apgar score at 1st and 5th minutes, a non-significant positive correlation between PT at 32 weeks and age, BMI, weight, and height, and a non-significant negative correlation between PT at 36 weeks and GA.**Table (2)**

There was a significant positive correlation between PT 32 weeks, PT 36 weeks and FL, AC, BPD, HC, EFW and Afl. **Table (3)**

Table (2): Correlation between PT and general characteristics

	Placental thickness 32weeks		Placental thickness 36weeks	
	r	**p-value**	**R**	**p-value**
Age	0.02	0.83	0.07	0.41
GA	0.06	0.48	-0.04	0.65
BMI	0.06	0.47	0.12	0.14
height (m)	-0.04	0.64	0.01	0.86
Apgar score at 1st min	0.23	<0.001*	0.23	0.005*
Apgar score at 5 min	0.18	0.03*	0.31	<0.001*

Table (3): Correlation between PT and U/S finding at 32 weeks.

	Placental thickness 32 weeks		Placental thickness 36 weeks	
	r	**p-value**	**r**	**p-value**
FL	0.244	0.003*	0.384	0.000*
AC	0.302	0.000*	0.197	0.015*
BPD	0.252	0.002*	0.252	0.002*
HC	0.198	0.015*	0.240	0.003*
EFW	0.218	0.007*	0.283	0.000*
AFI	0.200	0.014*	0.224	0.006*

4.Discussion

Placenta serves as the link between mother and fetus. During intrauterine life, the placenta promotes fetal development by delivering oxygen and nutrients from the mother's blood and excreting wastes[7].

Badu et al. examined the association between PT, gestational age, and fetal weight throughout the third trimester of pregnancy in primigravida [8]. Also, Jinadu et al. [9]reported their findings in 2021 after correlating PT with foetal biometry to the estimation of GA and EFW.

RasoulK et al. [10], Noor et al. [11], and Sersam et al. [12] evaluated the connection between PT and EFW in future investigations.

Humadi et al. [13], Jadoon et al. [14], Njeze et al. [15], and Kakumanu et al. [16] conducted further researches that demonstrated an association between the average PT and the gestational age based on fetal development factors.

Regarding maternal age, it was shown that there was no significant link between PT at 32 and 36 weeks and maternal age, consistent with the findings of Jinadu et al.[9] ($r = -0.018$ and $p = 0.720$). In spite of the fact that placenta is primarily a maternal organ, it is speculated that maternal age has little effect on placental formation and development.

Nonetheless, Sersam et al. [12] found a significant increase in PT throughout the 2nd and 3th trimesters (P-value < 0.05), particularly in the(30-35 years)age range. This can be related to examination of many age groups and different sample sizes.

According to PT at 32 and 36 weeks, there was no correlation with GA, BMI, weight, and height, which differs from Jinadu et al.who

discovered a progressive linear increase in PT with increasing ultrasonographic estimated gestational age, with $r = 0.968$ and $p = 0.000$. r was 0.921 during the 2nd trimester and $r = 0.871$ during the 3thtrimester[9]. In the second trimester, the relationship between PT and GA was greater than that in 3rdtrimester. Came in line, Kapoor et al., found in 310 pregnant women that the Pearson correlation coefficient was greatest during the

2ndtrimester. This may be due to differing sample sizes.A longitudinal study with a bigger sample size and more precise placental measurement would have increased accuracy.

Jadoon et al. [14] examined the relationship between PT and gestational age and found a significant positive connection between the two variables, with a Pearson Correlation of 0.98 and a p-value of 0.001. Mangal et al. discovered a link between PT and gestational age ranging from 11 to 40 weeks. The PT in millimeters and gestational age in weeks were virtually equal. This link between PT and estimated fetal weight is instructive because it suggests that subnormal PT for gestational age may be an early sign of fetal growth retardation[14].

In their studies, Njeze et al. [15]and Humadi et al. [13] reported a significant relationship and linear increase of PT with GA. Khanal et al. [17] and colleagues were equally confident that PT will be used to determine gestational age.

As regard to PT at 32 and 36 weeks, it was found a significant correlation with Apgar Score at 1st and 5 minutes which coincides with **Sersam et al.[12]**whodemonstrated a significant relation between PT at 2nd and 3rd trimester withApgar Score at 1st and 5 minutes. Nagpal et al. [18]showed an increase incidenceof poor Apgar score,NICU hospitalizations and LBW infants with thick placentas.

On the other hand, Shinde et al., [19] found that pregnant women with thin placentae had a greater incidence of prenatal, intrapartum, and postpartum development of various issues, whereas pregnant women with thicker placentae had a higher incidence of polyhydramnios, possibly as a result of changing sample sizes.

Regarding U/S findings, this study demonstrated that the correlation of PT at 32 and 36 weeks was highly significant with all fetal growth parameters (FL, AC, BPD, HC, EFW, and AFL), which is consistent with Jinadu et al.[9], who demonstrated that PT in the index study correlated most strongly with AC with a Pearson's correlation

of 0.953, followed by BPD with r = 0.815.The least correlation was with HC in estimation of GA. These results are comparable to those ofIsmail et al. and Elsafi et al.[20].

Also, Jadoon et al., [14] demonstrated a significant positive correlation between PT and ultrasonographicfetal growth parameters, including(BPD, FL, AC, and HC), with Pearson correlation coefficients of 0.988, 0.987, 0.991, and 0.988 and p-values of 0.001, 0.001, 0.001, and 0.001, respectively.

In addition, Jinadu et al. [9] discovered a considerable correlation between PT and EFW (r = 0.90). Moreover, Adeyekun et al. [21] discovered a considerable positive correlation between PT and EFW in the second and third trimesters among Nigerian women.

Similar to the findings of Noor et al. [11], who discovered a significant positive association between PT and estimated fetal and birth weight. Findings of this study demonstrate a substantial positive link between PT and estimated fetal and birth weight. The association between estimated fetal weight and PT is 0.74 and 0.000, respectively. Nagpal et al. [18] demonstrated a substantial positive correlation at 32 (0.55r) and 36 (0.74r) weeks of gestation.

5. Conclusion

Ultrasonography plays a crucial role in fetal weight assessment, which is an essential aspect of prenatal care. PT recorded at the location of umbilical cord insertion can be used as a valid sonographic indicator for fetal weight estimation and fetal outcome, because of its linear correlation. Consequently, measurement of placental thickness must be included in all routine antenatal ultrasound examinations.

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