RESEARCH
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THE CORRELATION OF PLACENTAL THICKNESS WITH GESTATIONAL AGE AND FETAL WEIGHT BY ULTRASONOGRAPHIC EXAMINATION IN SECOND AND THIRD TRIMESTERS OF PREGNANCY

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Abstract: Fetal wellbeing is influenced by many factors, one of the most important is the placenta, which is a highly specialized organ that indicates the status of both mother and fetus. The aim of this study is to evaluate the correlation between the placental thickness in the second and third trimesters with gestational age and estimated fetal birth weight. This study comprised 105 pregnant women, in each case the placental thickness, gestational age, and estimated fetal weight were measured by ultrasound examination. There was a significant correlation between gestational age and placental thickness in the second and third trimester, and a significant correlation between placental thickness and fetal birth weight in the second and third trimester. The examination of placental thickness by ultrasound can be used as an accurate indicator in the assessment of gestational age and estimated fetal weight because of its linear correlation.

Introduction

The precise measurements of gestational age (GA), fetal birth weight and placental thickness in the antenatal visits are important to differentiate between normal and abnormal pregnancy, diagnosing intrauterine growth restriction (IUGR), and helping in the decision to terminate pregnancy [1].

The well-being of the fetus is influenced by many factors, but a normal placenta is one of the most important factors to produce a healthy baby [2]. The placenta is a highly specialized organ, and it has a limited life period [3]. The placenta is a feto-maternal organ, which it indicates the status of both the mother and the fetus [2]. The placenta gives oxygen and nutritional materials to the fetus. Normal fetal growth and optimal fetal birth weight depend on appropriate function of the placenta [2]. The estimation of the fetal birthweight is very important because the fetal birth weight is found to be the most important indicator of neonatal survival [2]. The development of the placenta begins at the seventh day after oval fertilization [2]. Nowadays, Ultrasound is the gold standard to determine gestational age by measuring the dimensions of the fetus, like crown-rump length (CRL), biparietal diameter (BPD), femur length (FL), abdominal circumference (AC), and head circumference (HC) [1]. The visualization of the normal placenta on ultrasound begins approximately from 9 - 10 weeks of the gestational age, and the normal uniform echogenic appearance of the placenta on ultrasound, is visible in this stage of the gestational age [4]. The placenta dies after the delivery of the baby [2]. Many problems may occur during pregnancy and can cause fetal abnormalities and death. The most important of them is placental abnormalities [2] .The mature placenta measures about 22 cm in diameter and 2–2.5 cm in thickness, with the largest thickness at the center and becomes thinner peripherally [2]. The maturity of the placental surface

area is completed by the third trimester, and the placental thickness growth continues until the late third trimester [2]. The changes that occurs in the placenta in the middle of pregnancy, especially between 17 and 20 weeks, are found to correlate with the development of the fetus and indicate fetal anomalies [1]. Furthermore, the serial evaluation of the thickness of the placenta in second and third trimester could help to detect its normal development and function, and is considered a good predictor of fetal growth and fetal birth weight [4].

The thickness of the placenta is highly related to the fetal development and may be a key to predict perinatal outcome [2]. Sadler et al. (2004) measured a thickness of placenta of about 3cm and the diameter of 15–25cm at term. The diameter of the placenta of 18 cm and the thickness of 2 cm at 36 weeks is considered as A'warning limit' that predicts low-birth weight neonates [2]. Many serious diseases like chromosomal abnormalities, pre-eclampsia, diabetes mellitus of the pregnant women, intrauterine growth restriction and chronic infections of the fetus are closely related with small placentas [2]. Placental thickness of more than 4 cm at term are observed in many diseases, such as neonatal infections, diabetes mellitus, and immune or non-immune hydrops fetalis [2]. Perinatal mortality and morbidity was seen in higher incidence among the pregnant women with thick placentas, and higher rate of incidence of both large for gestational age and small for gestational age neonates at term [2]. The measurement of the placental thickness is considered as the easiest dimensional measurement of placenta [3]. In the recent years, significant attention of the placental appearance is received because of its direct connection to the fetal growth and fetal health [1].The placenta can be considered as the ‘mirror of the perinatal period [5]. The increment in the placental thickness is not considered as a single specific diagnostic tool of specific disorder but may contribute to the management of fetus at risk [6].The thickness of the placenta can be used as a parameter to estimate the gestational age, as it can be measured easily without preparation and without difficulty. The placenta is considered as non-mobile organ as compared with the fetus during ultra-sound examination [7].

Nowadays, the ultrasound examination still remains the important choice to detect the placental abnormalities because it is easy to use, cheap and of good safety profile [8].

Placental thickness can be used as a parameter for estimation of gestational age, as it can be measured without much difficulty. Placenta is relatively immobile as compared to the fetus while doing an ultra- sound. Placental thickness can be used as a parameter for estimation of gestational age, as it can be measured without much difficulty. Placenta is relatively immo-bile as compared to the fetus while doing an ultra- sound. The main objective of our study is to evaluate the correlation between the placental thickness in the second and third trimesters with gestational age and estimated fetal birth weight.

Materials and methods

This study was conducted at the Department of Radiology of Tikrit University/college of medicine from June 2023 to August 2023. Before commencing this study, an approval has been obtained from the Research Ethics Committee of the Department of Radiology of Tikrit University/college of medicine. The study comprised 105 pregnant women attending private clinics in Salah Al-Din governorate. In each case the placental thickness, gestational age, and estimated fetal weight were measured by ultrasound examination.

The assessment of gestational age was carried out by measuring the biparital diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL). Estimated fetal weight (EFBW) was determined by measurement of BPD, AC, and FL, adopting the formula devised by Hadlock. Detailed history was taken to rule out medical and surgical illnesses that could affect the study [2].

Inclusion criteria:

Singleton pregnancy, gestational age more than 12 weeks, known last menstrual period that was compatible with first trimester ultrasound examination, and age group of pregnant women of 19 - 45 years.

Exclusion criteria:

Abnormal placenta, poor visualization of placenta, hydrops fetalis, congenital malformations, twins, and polyhydramnios.

Scanning technique

In ultrasound examination, the placenta was examined and identified as a hyperechoic region separated from the fetus by a hypoechoic area of amniotic fluid. Both edges of the placenta were focused in a single ultrasound field in transverse and longitudinal sections, and placental thickness was measured from the echogenic chorionic plate to placental-myometrial interface near the mid portion of the placenta, and the ultrasound probe was moved all over the localized placental portion, the level of cord insertion was identified over the fetal surface and the placental thickness in mm was calculated. By

experienced sonographers, all sonographic examinations were performed trans-abdominally [2].

Statistical analysis

The data were entered and interpreted statistically by SPSS program-26. Pearson correlation test was applied in assessing correlation. Suitable statistical tests (Student test and One way ANOVA analysis test) for data were implemented accordingly and p value of ≤0.05 was significant.

Results

The present study was conducted in the Department of Radiology/College of medicine/Tikrit University. A total of 105 pregnant women were included in the study. The mean maternal age in our study was 26.7 ± 5.6. Women were in the group range of 19–45 years. 23 women were nulliparous, 73 women were para (1-4) and 9 women were para ≥5.The mean placental thickness was 39.2±10.7 mm. The mean EFBW by Hadlock was 1724.1±1081.4 gm. The mean gestational age was 29.2±7 weeks (Table 1).

Table 1: General characteristics of women and children.

Variable	No.	%
Maternal age mean±SD (26.7±5.6 years)		
<20 years	2	1.9
20-29 years	72	68.6
30-39 years	28	26.7
40-45 years	3	2.8
Parity history		
Nulliparous	23	21.9
Para 1-4	73	69.5
Para ≥5	9	8.6
Placental thickness mean±SD (39.2±10.7 mm)		
Fetal birth weight mean±SD (1724.1±1081.4 gm)		
Gestational age mean±SD (29.2±7 weeks)		
2nd trimester	37	35.2
3rd trimester	68	64.8
Total	105	100.0

We found a significant correlation between gestational age and placental thickness in the second trimester (P value = 0.03), and also in the third trimester (P value<0.001). (Table 2, Figures 1,2).

Table 2: Correlation between placental thickness and gestational age.

No. of cases	Placental thickness (mm)	Gestational age (weeks)	Pearson correlation coefficient (r)	P value
	Mean±SD	Mean±SD		
Second trimester				

37	32.05±8.4	21.03±4.16	0.35	0.03 S
Third trimester				
68	43.04±9.8	33.6±3.4	0.48	<0.001 S

S=significant.

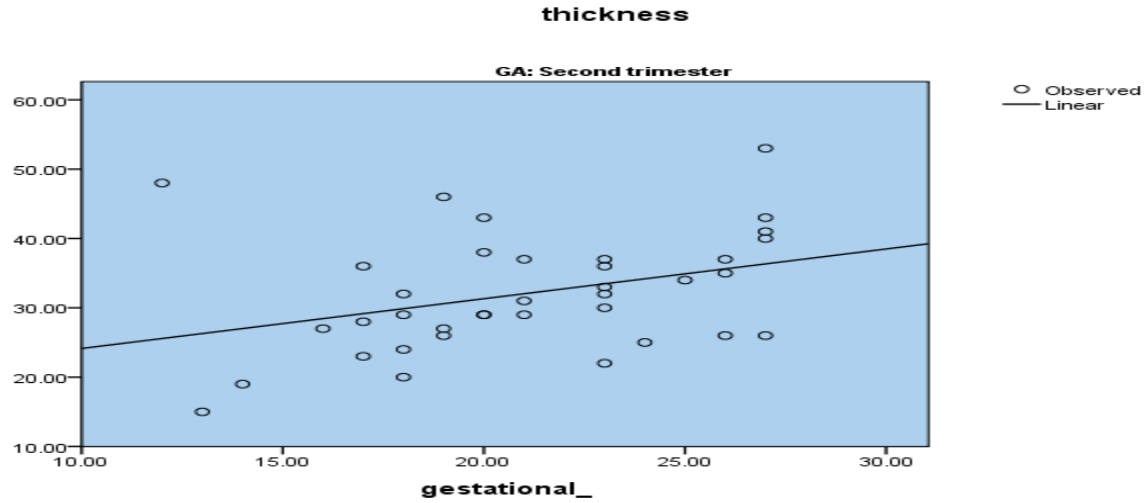

Figure 1: Gestational age and placental thickness at 2nd trimester.

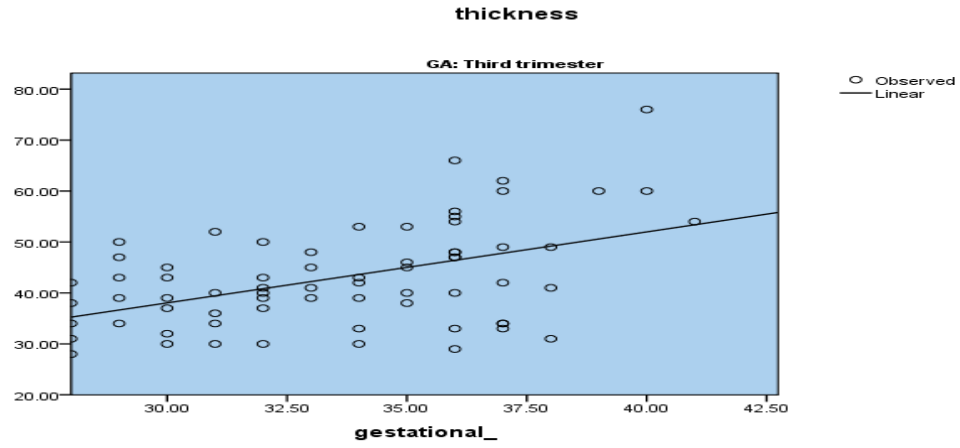

Figure 2: Gestational age and placental thickness at 3rd trimester.

We found a significant correlation between placental thickness and fetal Birth weight in the second trimester (P value= 0.01), and also in the third trimester (P value<0.001). (Table 3, Figures 3,4).

Table 3: Correlation between placental thickness and fetal birth weight.

No. of cases	Placental thickness (mm)	Fetal birth weight (gm)	Pearson correlation coefficient (r)	P value

	Mean±SD	Mean±SD		
Second trimester				
37	32.05±8.4	546.7±345.3	0.41	0.01 S
Third trimester				
68	43.04±9.8	2364.7±754.5	0.53	<0.001 S

S=significant.

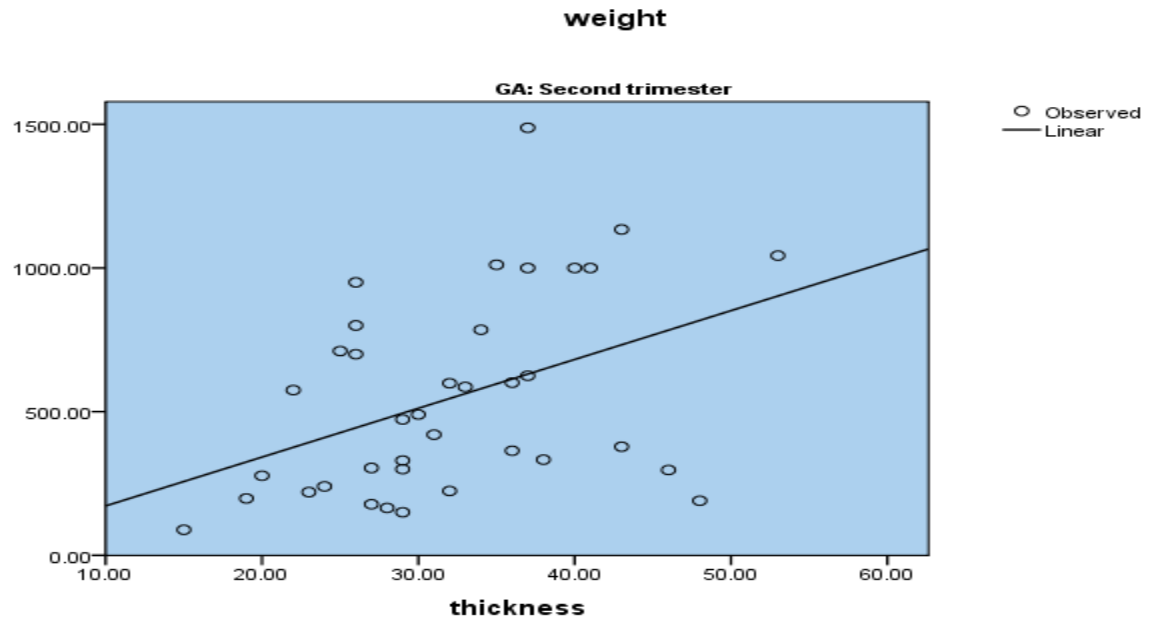

Figure 3: Placental thickness and fetal birth weight in 2nd trimester.

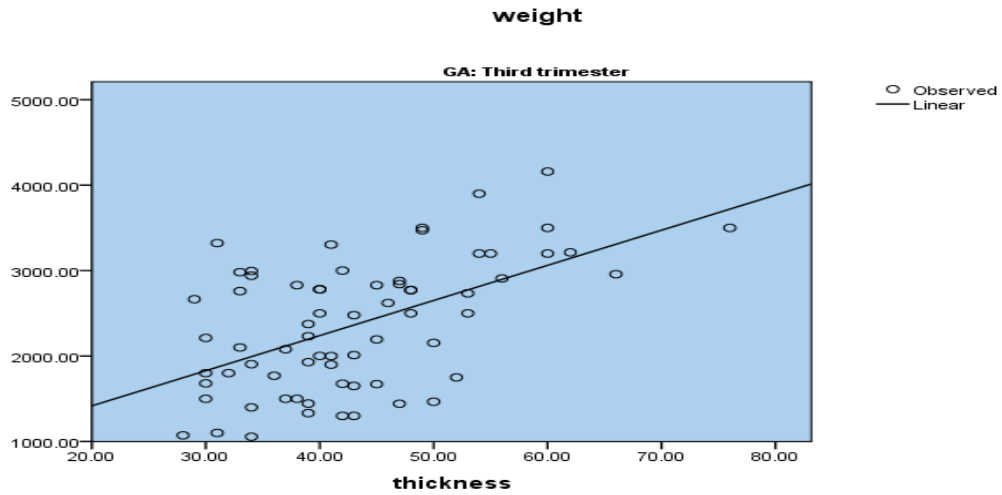

Figure 4: Placental thickness and fetal birth weight in 3rd trimester.

We found a significant correlation between placental thickness and maternal age (P value=0.01). No significant correlation was found between gestational age and maternal age (P value= 0.2), and between fetal birth weight and maternal age (P value= 0.1) (Table 4).

Table 4: Distribution of placental thickness, gestational age and fetal birth weight according to maternal age groups.

Parameter	<20 years	20-29 years	30-39 years	40-45 years	P value
Placental thickness (mm)	41.5±0.7	39±11.1	37.5±8.9	55.3±6.1	0.05 S
GA by US (weeks)	33.5±0.7	29.2±7.1	28.1±7.1	35±2.6	0.3 NS
Birth weight (gm)	1788±158	1738.7±10 78.5	1564.2±10 78.4	2855.6±6 07.7	0.2 NS
*One Way ANOVA analysis					

S=significant, NS=Not significant.

There was no significant correlation between placental thickness, gestational age, fetal birth weight and maternal parity (P values= 0.6, 0.8, 0.9) respectively (Table 5).

Table 5: Distribution of placental thickness, gestational age and fetal birth weight according to parity history.

Parameter	Nulliparous	Para 1-4	Para ≥5	P value
Placental thickness (mm)	37.4±11.5	39.8±10.7	37.7±8.7	0.6 NS
GA by US (weeks)	29.1±8	29±6.9	30.3±5.4	0.8 NS
Birth weight (gm)	1754.7±1123	1701.9±1088.8	1826.1±1023.3	0.9 NS
*One Way ANOVA analysis				

S=significant, NS=Not significant.

Discussion

Placental thickness is a significant indicator for the estimation of gestational age of the fetus because placental thickness increases with fetal gestational age [6].

In this study, we found a significant correlation between Placental thickness and gestational age in 2nd trimester, and in 3rd trimester.

A Previous study observed a positive increase in mean placental thickness with progressing gestational age in correlation analysis studies conducted to determine the relationship between placental thickness and gestational age [7].

In another study, the value of the mean placental thickness increased with progressing gestational age [8].

Another study compared the fetal age progress and the placental thickness in pregnant women and found a significant association between the increase of placental thickness and the gestational age. [9].

And another study in India found similar results [8].

In present study a significant correlation was found between placental thickness and estimated fetal birth weight in the second trimester (p= 0.01) and third trimester (p<0.001).

Similar to our study, a significant positive correlation was observed between placental thickness and estimated

fetal birth weight in the second and third trimesters in a non-IUGR group [10].

Also, two previous studies found that there is a positive correlation between placental thickness in second and third trimester and fetal birth weight [5,11].

The usefulness of this relationship between placental thickness and growth parameters is that subnormal placental thickness for a gestational age may be the earliest indication of fetal growth retardation [10].

Conclusion

In conclusion we found that the examination of placental thickness by ultrasound at the level of insertion of the umbilical cord can be used as an accurate sonographic indicator in the assessment of gestational age and estimated fetal birth weight because of its linear correlation. Therefore, it can be used as an additional sonographic tool in correlating gestational age in cases where last menstrual period (LMP) is unknown and in early detecting patients developing intrauterine growth retardation (IUGR).

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