



ORIGINAL ARTICLE

Ultrasound Assessment of Placental Thickness in The Last Two Trimesters of Normal Pregnancy and Its Relation with Fetal Outcome

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ABSTRACT

Background: The placenta is avital organ which plays an important role in the normal fetal growth and development process. **The aim of work:** Is to assess the relation between thickness of the placenta during the 2nd and 3rd trimesters and fetal birth weight and placental weight. **Patients & Methods:** 50 cases of uncomplicated pregnant women who were attended the outpatient clinic at Zagazig University Maternity Hospital were involved in this cohort study from the period between June 2018 to March 2019; The thickness of the placenta was measured by transabdominal ultrasound during second and third trimester. The relation between thickness of the placenta and fetal outcome was examined by Pearson's correlation.

Results: according to our study there was positive relation between thickness of the placenta at the 2nd trimester and 3rd trimester with fetal birth weight, placental weight and APGAR score. The fetal outcome was better with normal placental thickness (10th- 90th) in comparison to that with thin (<10th) and thick placenta (>90th) & the incidence of NICU admission increased in thick placenta and thin placenta.

Conclusions: The thickness of the placenta by ultrasound can be used beside other biometric parameters in predicting neonatal outcome and measurement of placental parameters should be involved in all routine antenatal ultrasounds.

Keywords: Fetal outcome, placental thickness at the 2nd trimester and 3rd trimester, The thickness of the placenta by ultrasound

INTRODUCTION

Normal functions of the placenta are needed for normal fetal growth and development process [1]. Placenta is a highly vascular fetal organ which maintains the materno-fetal circulation and its main functions are the exchange of gaseous and metabolic product between mother and fetus with production of hormones [2]. In the first trimester, placental growth is more rapid than that of the fetus. But by approximately 17 weeks, placental and fetal weights are approximately equal [3]. At term, the placenta is characterized by that it is discoid in shape, 15 to 25 cm in the diameter, About 3 cm

in thickness and about 500 to 600 g in weight [2].

The definitive placenta is visible on transabdominal ultrasound at 10 weeks of gestation, when it is seen as a uniformly granular echogenic rims surrounding the gestational sac [3]. Ultrasonography (US) used for the assessment of the placenta and the detection of any abnormalities in the placenta using different parameters (such as placental thickness and volume) or especial techniques like three-dimensional (3D) power Doppler [4]. For more than two decades, Ultrasound measurement of placental thickness had been used as a simple, reproducible and clinical useful way [4].

Placenta can reflect the fetus situation, and any abnormalities can be indicated by an abnormal placental size during third trimester^[5]. Growth restriction is indicated by small placenta with thickness of less than 2.5cm^[6]. While, Placental thickness more than 40 mm at term is seen with gestational diabetes, intrauterine infections and hydrops fetalis^[7].

Few studies have discussing the use of the placental thickness as a predictor for fetal outcome ^[1] ,Most of these studies were retrospective or cross-sectional in design and could not truly show the relation between placental measurements and fetal outcome^[8] .So, The presence of a prospective study that examinethe placental thickness in second and third trimester could be helpful in the evaluation of normal development of the placenta and its relation with the fetal weight. Hence, the aim of our study is to evaluate the relation between thickness of the placenta during the 2nd and 3rd trimesters and fetal outcome through cohort study.

PATIENTS AND METHODS

This present study was Cohort observational study conducted in Zagazig University Maternity Hospital within the period between June 2018 to March 2019 and including about 50 pregnant women who were attended to the outpatient clinic .

Inclusion criteria: pregnant women Aged between 18 and 35 years, non-scared uterus and Singleton viable pregnancy.

Exclusion criteria: pregnant women with any disorder that might affect the size or weight of the placenta will be excluded from the study as: chronic illness (diabetes, HTN, renal disease, liver disease,), Known ultrasound congenital fetal anomalies, Multiple gestation, IUFD , Anatomical defect of pregnant uterus, Abnormally located placenta or placental anomalies, Morbid obesity.(BMI>40), Incomplete records and Unwilling to join in the study.

Methodology:

Written informed consent was obtained from all participants and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The

work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

All involved women in our study were assessed for standard demographic and obstetric information including age, parity, body mass index (BMI) and past medical history. Smoking, alcohol and drug use were also determined. Placental thickness of involved cases measured by transabdominal ultrasound at second(15-20 week) and third (30-34 week) trimesters. All sonographic examinations were performed by Voluson 730 pro-v machine (GE, healthcare Austria) with abdominal transducer 5-7.5MHZ frequency.

The sonographic technique of placental thickness measurement:

The patient will be examined with a moderately distended bladder in supine position. The transducer was placed on the skin surface after applying the couple agent. The thickness of placenta in mm was estimated at the level of cord insertion site^[9].

The transducer was situated to scan perpendicular to both the chorionic and basal plates as tangential scan will distort the measurement of the thickness of the placenta.

The thickness of the placenta will be calculated from the echogenic chorionic plate to placental myometrial interface near the mid-placental portion. The myometrium and sub placental veins were excluded in the estimations.

After delivery: Fetal weight was detected in grams and fetal status and morbidity including (Apgar scores, fetal distress or fetal death and admission to the NICU) were also determined

The placental thickness of involved women in the study are divided to 3 sub groups **Normal placental thickness**(placental thickness between 10th and 90th percentile), **Thin placenta**(placental thickness less than 10th percentile) and **Thick placenta**(placental thickness more than 90th percentile)^[8].

Results were given as mean \pm SD. Statistical analysis was performed using the Statistical Package for Social Science (SPSS version 22). Pearson's correlation analysis

was used to establish the of relation between thickness ofplacenta and fetal outcome . P

values of < 0.05 were considered statistically significant.

RESULTS

Table (1):Correlation between placental thickness at 2ndor3rdtrimester and fetal birth weight, placental weight and APGAR score

Variable	Placental thickness at 2 nd trimester		Placental thickness at 3 rd trimester	
	Pearson r	p-value	Pearson r	p-value
Birth weight	0.354	< 0.05	0.319	< 0.05
Placental weight	0.332	< 0.05	0.28	< 0.05
APGAR score	0.423	< 0.05	0.414	< 0.05

Table (2):Correlation between normal and abnormal thickness of placentaat 2ndtrimester with birth weight, placental weightand APGAR score

Variable	Placental thickness at 2 nd trimester			F test	P value
	Thin placenta < 17.7	Normal placental thickness (17.7 -26.2)	Thick placenta >26.2		
Birth weight(g) (Mean ±SD)	2751.5±322.6	3324.1±377.9	2800±833.7	5.67	<0.05 (S)
Placental weight (g) (Mean ±SD)	462.2±49.2	532.3±37.2	452.5±102	9.36	<0.001 (HS)
APGAR score (Mean ±SD)					
APGAR score 1minute	4±1.1	7.05±0.91	4.25±1.2	87.25	<0.001 (HS)
APGAR score 5minute	6.25±0.85	8.9±0.9	6±0.81	31.51	<0.001 (HS)

Table (3):Correlation between normal and abnormal thickness of placentaat 3rdtrimester with birth weight, placental weight and APGAR score

Variable	Placental thickness at 3 rd trimester			F test	P value
	Thin placenta <31.2	Normal placental thickness (31.2 -41.7)	Thick placenta >41.7		
Birth weight(g) (Mean ± SD)	2751.5±322.6	3305.2±361.9	3060±458	3.37	<0.05 (S)
Placental weight (g) (Mean ± SD)	462.2±49.2	530.5±35.6	483.6±112.4	9.29	<0.05 (S)
APGAR score (Mean ± SD)					
APGAR score 1 minute	4±1.1	7.07±0.92	4.6±1.0	99.9	<0.001 (HS)
APGAR score 5 minute	6.25±0.85	8.9±0.9	6.6±0.82	30.9	<0.001 (HS)

Table (4): Correlation between normal and abnormal thickness of placenta at 2ndtrimester and NICU admission

NICU admission	Placental thickness at 2 nd trimester			χ^2	P value
	Thin placenta < 17.7	Normal placental thickness (17.7 -26.2)	Thick placenta >26.2		
	N=4	N=42	N=4		
Cases admitted	2 (50%)	4(9.5%)	3(75%)	13.62	<0.05 (S)
Not admitted cases	2 (50%)	38(90.5%)	1(25%)		

Table (5):Correlation between normal and abnormal thickness of placentaat third trimesterand NICU admission

NICUadmission	Placental thickness at 3rd trimester			χ^2	P value
	Thin placenta <31.2	Normal placental thickness (31.2 -41.7)	Thick placenta >41.7		
	N=4	N=41	N=5		
Cases admitted	2 (50%)	4(9.8%)	3(60%)	10.64	<0.05 (S)
Not admitted cases	2 (50%)	37(90.2%)	2(40%)		

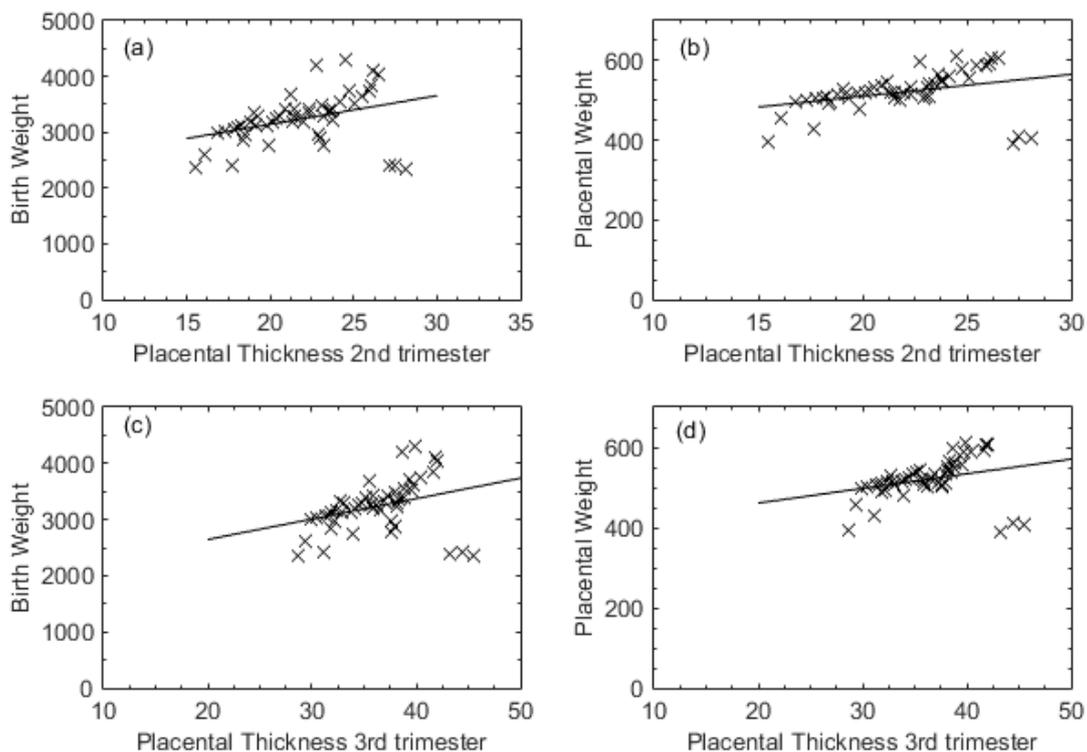


Figure (1) Correlation between placental thickness at 2nd or 3rdtrimester and fetal birth weight and placental weight

RESULTS

Of the 50 pregnant women involved in our study 23 cases had normal vaginal delivery(46%)and 27 cases delivered by cesarean section (54%).The mean age of our study was 27 ± 3.1 with range of (20-33), mean weight was 79 ± 12 with range of (55-115), mean height was 1.69 ± 0.07 with range of (1.56-1.78) and mean BMI was 27.4 ± 3.5 with range of (22-34.50)., About 6% of the involved cases had gestational diabetes (3 cases) , 8% of the cases had gestational hypertension (4 cases) and about 4% of the cases suffered from preeclampsia(2 cases).

The involved cases were divided according to placental thickness into 3 sub-groups:

Normal placental thickness: placental thickness between 10th and 90thpercentile (N=42 at 2nd trimester, N =41 at 3rd trimester).

Thin placenta: placental thickness less than 10thpercentile . (N=4 at 2nd trimester, N =4 at 3rd trimester).

Thick placenta : placental thickness more than 90thpercentile.(N=4 at 2nd trimester, N =5 at 3rd trimester).

Mean \pm SD of birth weight (g) was 3236.4 ± 458.01 with range of (2350-4307) , mean Placental weight was 520.36 ± 52.12 with range of (390-608).Values of mean APGAR score 1minute and 5 minute 6.58 ± 1.7 (range3-9), 8.46 ± 1.5 (range 5-10) respectively.

Ultrasonographic measures of placental thickness in second and third trimester and changes between them were 21.82 ± 3.169 (range: 15.5-28.1 mm), 36.27 ± 4 (range: 28.6-45.6mm) and 14.45 ± 1.7 mm respectively. There was a significant positive correlation ($p<0.05$) between the thickness ofplacenta in the 2nd trimester with fetal birth weight, placental weight and Apgar score. ($r=0.354$; $r=0.332$; $r=0.423$ correspondingly), Also, there was a significant positive correlation ($p<0.05$) between the thickness ofplacenta in the 3rd trimester with fetal birth weight, placental weight and Apgar score. ($r=0.319$; $r=0.0.28$; $r=0.414$ correspondingly). (**Tab 1, Fig 1**)

According to our study results, the difference in fetal outcome was clearly observed

between normal and abnormal placental thickness:

For the 2nd trimester, mean birth weight with normal thickness was (3324.1) gm but with thin placenta was (2751.5) gm and with thick placenta was (2800) gm. Also, mean Apgar score with normal placental thickness was (8.9) but with thin placenta was (6.25) and with thick placenta was (6).(**Tab 2**)

For the 3rd trimester, mean birth weight with normal thickness was (3305.2) gm but with thin placenta was (2751.5) gm and with thick placenta was (3060) gm. Also, mean Apgar score with normal placental thickness was (8.9) but with thin placenta was (6.25) and with thick placenta was (6.6).(**Tab 3**)

In the second trimester, Only about 9.5% of the cases with normal placental thickness was admitted to nicu after delivery , while in thin placenta 50% of the cases need nicu admission and 75% of the cases with thick placenta need nicu admission after delivery. . (**Tab 4**)

In the 3rd trimester, Only about 9.8% of the cases with normal placental thickness admitted to nicu after delivery , while in thin placenta 50% of the cases need nicu admission and 60% of the cases with thick placenta need nicu admission after delivery. (**Tab 5**)

DISCUSSION

The development of the embryo is influenced by many factors but a healthy placenta is the most significant factor in producing a healthy baby. Pregnancy outcome depends on placental morphology, and its efficiency to move supplements, gases, waste products, heat, hormones, and other regulatory molecules [10]. Early detection of any pathology in the placental bed and villi helps obstetrician to consider prenatal care precisely. Several aspects of placental development including volume, weight, and plate area were investigated in different researches in order to discover their correlation with fetal anthropometry [11]. However, there are not many studies that investigate the relation between the thickness of placenta with fetal outcome. The

role of thin, thick and normal placenta in determining neonatal outcome still remains vague. Majority of these studies were retrospective [12]. The cases were divided according to placental thickness to 3 subgroups of normal placenta (10-90th percentile), thin placenta (<10th percentile) and thick placenta (>90th percentile).

The results of our study, shows that placental thickness during the 2nd trimester has significant relation (p value <0.05) with fetal weight (r =0.354), placental weight (r=0.332), and Apgar score (r=0.423).

Also, the thickness of placenta during the 3rd trimester has significant relation (p value <0.05) with fetal weight (r =0.319), placental weight (r=0.28), and Apgar score (r=0.414)

According to our study results, the difference in fetal outcome was clearly observed between normal and abnormal placental thickness:

For the 2nd trimester, mean birth weight with normal thickness was (3324.1) gm but with thin placenta was (2751.5) gm and with thick placenta was (2800) gm. Also, mean Apgar score with normal placental thickness was (8.9) but with thin placenta was (6.25) and with thick placenta was (6).

For the 3rd trimester, mean birth weight with normal thickness was (3305.2) gm but with thin placenta was (2751.5) gm and with thick placenta was (3060) gm. Also, mean Apgar score with normal placental thickness was (8.9) but with thin placenta was (6.25) and with thick placenta was (6.6).

SO, according to our study there was good correlation between placental thickness at the 2nd trimester and 3rd trimester with fetal birth weight, placental weight and Apgar score. But the fetal outcome was better in women with normal thickness of placenta (10th - 90th percentile) than those with abnormally thin or thick placenta. This can be used to identify the fetuses at risk by identifying women with thin placenta (below 10th percentile) and thick placenta (>90th percentile).

The results of our study agree with the results of other researches in some points but

these disagree with the others. For example, in our study a positive correlation was observed between placental thickness in the second and third trimesters and birth weight, mainly in birth weight (2500-4000), this was also observed by (Kinare et al^[13] and Afrakhteh et al^[14])

But still, we didn't find a relation between thick placenta and low or high birth weights; this might be explained by small sample size in our study. This disagree with the findings by Elchalal et al^[8] who reported a higher percentage of thick placentas in birth weight at term above 4000 gm or less than 2500 gm.

Also, there is positive correlation between placental thickness in the second and third trimesters and placental weight but this disagree with the findings obtained by Afrakhteh et al^[14] which show no relation between placental thickness in the second and third trimesters and placental weight and this may be explained by small sample size of the study.

In our study, we observed increased incidence of perinatal morbidity in terms of low Apgar scores and increased NICU admissions in those with abnormally thin or thick placenta in the second and third trimesters groups, out of eight babies have thin or thick placenta in the second trimester, six babies (75%) admitted to NICU. and out of nine babies have thin or thick placenta in the third trimester, five babies (55%) admitted to NICU. this was also found by other researches^[15] who described an association between thick placentas and increased risk of adverse perinatal outcome, e.g. abruptio placentae, admission to neonatal intensive care unit, congenital anomalies, perinatal death, pregnancy-induced hypertension (PIH), low Apgar scores, number of emergency cesarean section deliveries, , intrauterine fetal demise (IUID), and gestational diabetes mellitus (GDM). These abnormalities are closely related with placental dysfunction. Indeed, placental infarction, intervillous thrombosis, and inflammation were frequently identified in thick placenta by pathological examination^{[8],[15]}. Placental dysfunction may also result in thick placenta by the

compensatory proliferation and edema of placental villi [15]. Conversely, **Thompson et al.** discovered no connection between a thick placenta and poor obstetrical outcome, apart from a mild association with severe preeclampsia [16].

CONCLUSION

The thickness of the placenta by ultrasound can be used beside other biometric parameters in predicting neonatal outcome and measurement of placental parameters should be involved in all routine antenatal ultrasounds.

Declaration of interest

The authors report no conflicts of interest. The authors along are responsible for the content and writing of the paper.

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REFERENCES

- 1-SCHWARTZ, N.; WANG, E.; PARRY, S. Two-dimensional sonographic placental measurements in the prediction of small-for-gestational-age infants. *Ultrasound in Obstetrics & Gynecology*, 2012, 40.6: 674-679.
- 2- Sadler TW .Langman's medical embryology. 9th Edition. Baltimore, MD: Lippincott Williams and Wilkins,2004. pp. 177-148.
- 3- 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: 745-750.
- 4- Chen, M., Leung, K. Y., Lee, C. P., Tang, M. H. Y., & Ho, P. C. Placental volume measured by three-dimensional ultrasound in the prediction of fetal α -thalassemia: a preliminary report. *Ultrasound in Obstetrics and Gynecology*, 2006, 28.2: 166-172.
- 5- NORMAN, C.; SMITH, A.; SMITH, P. M. *Obstetrics and Gynaecological Ultrasound Made Easy*. 2006.
- 6- OHAGWU, Christopher Chukwuemeka; ABU, Paulinus Oshiotse; UDOH, Benjamin Effiong. Placental thickness: A sonographic indicator of gestational age in normal singleton pregnancies in Nigerian women. *Internet Journal of Medical Update-EJOURNAL*, 2009, 4.2.
- 7- Karthikeyan, T., Subramaniam, R. K., Johnson, W. M. S., & Prabhu, K. Placental thickness & its correlation to gestational age & foetal growth parameters—a cross sectional ultrasonographic study. *Journal of clinical and diagnostic research: JCDR*, 2012, 6.10: 1732.
- 8-Elchalal, U., Ezra, Y., Levi, Y., Bar-Oz, B., Yanai, N., Intrator, O.,etal.Sonographically thick placenta: a marker for increased perinatal risk—a prospective cross-sectional study. *Placenta*, 2000, 21.2-3: 268-272.
- 9- Hoddick WK, Mahony BS, Callen PW, et al.Placental thickness. *J Ultrasound Med*.1985 , 4(9):479-82.
- 10- Balihallimath, R. L., Shirol, V. S., Gan, A. M., Tyagi, N. K., & Bandankar, M. R.. Placental morphometry determines the birth weight. *Journal of Clinical and Diagnostic Research: JCDR*, 2013, 7.11: 2428.
- 11- Azpurua, H., Funai, E. F., Coraluzzi, L. M., Doherty, L. F., Sasson, I. E., Kliman, M., et al. Determination of placental weight using two-dimensional sonography and volumetric mathematic modeling. *American journal of perinatology*, 2010, 27.02: 151-155.
- 12- LEE, Anna J.; BETHUNE, Michael; HISCOCK, Richard J. Placental thickness in the second trimester: a pilot study to determine the normal range. *Journal of Ultrasound in Medicine*, 2012, 31.2: 213-218.
- 13- Kinare, A. S., Natekar, A. S., Chinchwadkar, M. C., Yajnik, C. S., Coyaji, K. J., Fall, C. H., et al. Low midpregnancy placental volume in rural Indian women: A cause for low birth weight?. *American journal of obstetrics and gynecology*, 2000, 182.2: 443-448.
- 14- Afrakhteh, M., Moeini, A., Taheri, M. S., & Haghightakhah, H. R. Correlation between placental thickness in the second and third trimester and fetal weight. *Revista Brasileira de Ginecologia e Obstetrícia*, 2013, 35.7: 317-322.
- 15- Raio, L., Ghezzi, F., Di Naro, E., Buttarelli, M., Franchi, M., Dürig, P., et al. Perinatal outcome of fetuses with a birth weight greater than 4500 g: an analysis of 3356 cases. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 2003, 109.2: 160-165.
- 16- Thompson MO, Vines SK, Aquilina J, Wathen NC, Harrington K. Are placental lakes of any clinical significance?. *Placenta*, 2002, 23.8-9: 685-690.

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