Correlation between placental thickness assessment in 2nd trimester and perinatal outcome

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Abstract

Background: Placental thickness (PT) is the simplest placental dimension to assess, till now a small number have information concerned the "normal" placental thickness as assessed by second-trimester sonography.

Objectives: was to find out the correlation between placental thickness assessment in 2nd trimester (13-26 wks) and perinatal outcome.

Patients and methods: This study was a prospective cohort one demonstrated out Qena University Hospital in the duration between April 2018 till April 2019.

Results: A highly statistical significant (p-value < 0.001) difference of AFI according to placental thickness. A highly statistical significant (p-value < 0.001) difference of NICU need according to placental thickness, A highly statistical significant (p-value < 0.001) difference of Apgar score according to placental thickness, and A highly statistical significant (p-value < 0.001) difference of (fetal distress, fetal malformation, meconium stained & IUFD) according to placental thickness.

Conclusion: In this study, a significant association was found among PT and neonatal outcomes regarding neonatal weight, APGAR scoring and the necessity of NICU, meconium stained fluid, and perinatal complications regarding oligohydraminos, congenital malformations and sudden IUFD.

Keywords: Placenta thickness; APGAR score; Neonatal outcomes; Sonography.

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Introduction

The human placenta progresses with the main feature of supplying vitamins and oxygen to the fetus. Satisfactory fetal increase and next ordinary birth weight relies upon at the efficient transport of vitamins from the mom to the fetus throughout normal operative utero-placental organ. **(Suri et al., 2013)**

Placental thickness (PT) is the simplest placental dimensions to calculate, yet little have info concerned the "normal" PT as calculated via second-trimester sonography. Thick placentas were as well accompanied with lower birth weight and opposing perinatal outcomes. **(Borat et al., 2013)**

One of proposed clarification of this affiliation is the discovered decrease in elaboration of outlying nutrient and gas ex-changing terminal villi in placentas from critically increase-constrained placentas. **(Nucci et al., 2014)**

A condition now defined by pathologists as distal villous hypoplasia. These gestations might secrete lesser placental growth factor (PlGF) than normal, ultimately presented with FGR. **(Poon et al., 2008)**

Abnormal placental thickness arises the suspicion of underlying pathological process. Small placentas were found to be related to chromosomal abnormalities, chronic fetal infections, preeclampsia, diabetes & intrauterine growth restriction [IUGR]. **(Kinare et al., 2015)**

Many investigations have concluded that there is a correlation among small placenta and low birth weight [LBW], and IUGR, secondary to abnormal villous development and defective fetoplacental circulation, and blood vessel formation**. (Miller et al., 2007)**

The hypothesis that affect placental size precedes the onset of any pathological condition makes placental thickness abnormalities with the corresponding pregnancy age [GA], one of the early warning signs for development of IUGR]. **(Fang et al., 2015)**

PT seems to be a hopeful parameter to estimate the pregnancy ages of the fetus due to growth in PT with pregnancy ages. **(Mital et al.2002)**

In spite of cautious antenatal surveillance including scrupulous examinations, a problem of significant unsuccess is that a mainstream of low delivery weights babies isn't detected till birth. **(Damodaram et al., 2010)**

Investigations have proven that diminished placental volume leads fetal increase delay as IUGR is related to impoverished villous improvement and fetoplacental angiogenesis. **(Cunningham et al., 2005)**

The work aimed to evaluate the correlation among placental thickness (PT) assessment in 2nd trimester (13-26 wks) and perinatal outcome.

Patients and methods

This study was a prospective cohort one demonstrated at Qena University Hospital in the duration between April 2018 till April 2019

Inclusion criteria: All pregnant women in 2nd trimester (12wk+\-6d – 26) wks

Exclusion criteria: any maternal chronic medical disorders**,** placenta previa**,** multiple pregnancy **and** IUFD

Methods

I –Detailed history taking

II - Examination

- **General examination:** Vital Signs Respiratory Rate, Blood Pressure, Pulse, Head & Neck Examination and Extremities Examination
- **Abdominal examination:** Inspect, palpate and auscultate the four quadrants, bowel Elimination and urinary Elimination.
- **Obstetrical Examination:** Inspection, fundal height, the lie, the presentation and the engagement

III - Investigations:

* Routine laboratory investigations. * Detailed 2D ultrasound evaluation: Using 2D U\S by (Medison X6 device) in pregnant women (13-26) wks with

no maternal medical disorder , measuring placental thickness in it's widest part.

Also measuring of fetal biometries, fetal weight, AFI, placental size and grading.

The technique of Transabdominal ultrasound

The sonographer used full bladder as a 'porthole' to the uterus, so patients had to drink plenty of water before the test, patients lie supine on an examination table or bed. Gel was applied to patient's abdomen and the sonographer moved the scanner in various positions, The thickness of the placenta in mm had been measured.

Research outcome measures

This work aimed to find out the association among placental thickness assessment in 2nd trimester (13-26wks) and perinatal outcome, regarding: APGAR score at 5 and 10 minutes, Fetal weight, fetal malformations, fetal distress, PTL, oligohydraminos, meconium-stained fluid, -mood of delivery, No. of IUFD or still birth and Need NICU admission.

Ethical Considerations: The research was reviewed by the committee of ethics of the Faculty of Medicine. Dealing with data and data dissemination is confidential. The research was conducted only by scientifically qualified and trained personnel. Informed consent was filled by each patient.

Statistical analysis

The data has been analyzed using Statistical Package for Social Sciences version-21 (SPSS-21). The quantitative data was introduced in the form of mean and Ranges, and the qualitative data in the form of numbers and precents (%). Chi-Square testing was employed to match qualitative parameters. Data was statistically defined by mean standard deviation (SD), medians and ranges, or frequencies (number of patients) and percent when suitable.

Results

The description of placental thickness in all studied patients. There were 28 patients (5.1%) of < 17 mm thickness, 176 patients (32%) of 17 – 20 mm thickness, 144 patients (26.2%) of 21 – 25 mm thickness & 202 patients (36.7%) of > 25 mm thickness, **(Table .1).**

The description of Apgar score at 5 min & need of NICU in all studied patients. As regard Apgar score at 5 min, there were 174 patients (31.6%) with good Apgar score, 261 patients (47.5%) with mild distress, 57 patients (10.4%) with moderate distress & 58 patients (10.5%) with IUFD. As regard NICU need, there were 203 patients (36.9%) on nasal O2, 57 patients (10.4%) on CPAP, 58 patients (10.5%) with IUFD while there 232 patients (42.2%) needed no NICU, **(Table.2).**

The description of neonatal complications in all studied patients. As regard fetal distress, there were 261 neonates (47.5%) with mild distress, 57 neonates (10.4%) with moderate distress & 58 neonates (10.5%) with IUFD while there were 174 neonates (31.6%) with no distress. As regard fetal malformation, there were 115 neonates (20.9%) with fetal malformation and 435 neonates (79.1%) with no malformations. As regard meconium staining, there were 261 neonates (47.5%) with stained meconium and 289 neonates (52.5%) without stained meconium. As regard IUFD / stillbirth, there were 58 neonates (10.5%) with IUFD and 492 neonates (89.5%) were free, (**Table .3).**

A highly statistical significant (p-value < 0.001) difference of AFI according to placental thickness, (**Table .4).**

A highly statistical significant (p-value < 0.001) difference of NICU need according to placental thickness, **(Table .5)**

A highly statistical significant **(p-value < 0.001)** difference of Apgar score according to placental thickness, (**Table .6)**

A highly statistical significant **(p-value < 0.001)** difference of (fetal distress, fetal malformation, meconium stained & IUFD) according to placental thickness. (**Table .7)**

Table 1. Description of placental thickness in all studied cases

Variables		**Studied cases (N = 550)**	
Placental thickness	**< 17 mm**	28	5.1%
	17 – 20 mm	176	32%
	21- 25 mm	144	26.2%
	> 25 mm	202	36.7%

Table 2. Description of Apgar score at 5 min & need of NICU in all studied patients

Variables		Studied cases (N = 550)	
Apgar score at 5 min	Good	174	31.6%
	Mild distress	261	47.5%
	Moderate distress	57	10.4%
	IUFD	58	10.5%
NICU need	No	232	42.2%
	Nasal O2	203	36.9%
	CPAP	57	10.4%
	IUFD	58	10.5%

Table 3. Description of perinatal complications in all studied cases

Variables		Studied cases (N = 550)	
Fetal distress	No	174	31.6%
	Mild	261	47.5%
	Moderate	57	10.4%
	IUFD	58	10.5%
Fetal malformation	No	435	79.1%
	Yes	115	20.9%
Meconium stained	No	289	52.5%
	Yes	261	47.5%
IUFD / stillbirth	No	492	89.5%
	IUFD	58	10.5%

Table 4. Relation between placental thickness and AFI in studied cases

Variables		Placental thickness								X^2	P-value
		< 17 mm (N = 28)		17 – 20 mm (N = 176)		21 – 25 mm (N = 144)		> 25 mm (N = 202)			
AFI	Average	10	27%	117	66.5%	115	79.9%	87	43.1%	90.6	< 0.001 HS
	Oligohydramnios	18	73%	59	33.5%	29	20.1%	115	56.9%		

X^2: Chi-square test. HS: p-value < 0.001 is considered highly significant.

Table 5. Relation between placental thickness and NICU need in studied cases

Variables		Placental thickness								X^2	P-value
		< 17 mm (N = 28)		17 – 20 mm (N = 176)		21 – 25 mm (N = 144)		> 25 mm (N = 202)			
NICU need	No	0	0%	146	83%	86	59.7%	0	0%	581.7	< 0.001 HS
	Nasal O2	0	0%	30	17%	58	40.3%	115	56.9%		
	CPAP	28	100%	0	0%	0	0%	29	14.4%		
	IUFD	0	0%	0	0%	0	0%	58	28.7%		

X^2: Chi-square test. HS: p-value < 0.001 is considered highly significant.

Table 6. Relation between placental thickness and Apgar score at 5 min in studied cases

Variables		Placental thickness								X^2	P-value
		< 17 mm (N = 28)		17 – 20 mm (N = 176)		21 – 25 mm (N = 144)		> 25 mm (N = 202)			
Apgar score	Good	0	0%	117	66.5%	57	39.6%	0	0.0%	525.8	< 0.001 HS
	Mild distress	0	0%	59	33.5%	87	60.4%	115	56.9%		
	Moderate distress	28	100%	0	0%	0	0%	29	14.4%		
	IUFD	0	0%	0	0%	0	0%	58	28.7%		

X^2: Chi-square test. HS: p-value < 0.001 is considered highly significant.

Table 7. Relation between placental thickness and outcome in studied cases

Variables		Placental thickness								X^2	P-value
		< 17 mm (N = 28)		17 – 20 mm (N = 176)		21 – 25 mm (N = 144)		> 25 mm (N = 202)			
Fetal distress	No	0	0%	117	66.5%	57	39.6%	0	0.0%	525.8	< 0.001 HS
	Mild	0	0%	59	33.5%	87	60.4%	115	56.9%		
	Moderate	28	100%	0	0%	0	0%	29	14.4%		
	IUFD	0	0%	0	0%	0	0%	58	28.7%		
Fetal malformation	No	0	0%	176	100%	115	79.9%	144	71.3%	159.9	< 0.001 HS
	Yes	28	100%	0	0%	29	20.1%	58	28.7%		
Meconium stained	No	28	100%	117	66%	86	59.7%	58	28.7%	87.9	< 0.001 HS
	Yes	0	0%	59	34%	58	40.3%	144	71.3%		
IUFD / stillbirth	No	28	100%	176	100%	144	100%	144	71.3%	111.7	< 0.001 HS
	Stillbirth	0	0%	0	0%	0	0%	58	28.7%		

X^2: Chi-square test. HS: p-value < 0.001 is considered highly significant.

Discussion

Placental thickness (PT) is the easiest measurements of placental volume and may be calculated at any centre has an ultrasound (US) devise. The association of PT with pregnancy aging was reported by several viewers. **(Balakrishnan et al., 2016)**

Afrakhteh et al., 2013 reported a positive association among PTs and pregnancy ages in their potential following-up in Iranian people.

In the other hand the current work was a potential following-up study that reported a strong positive association among PT and delivery weight and perinatal consequence from 13- to 26-wks. As well, normograms were outlined for PT.

The neonatal outcomes in accordance to delivery weights, Apgar scoring and neonatal ICU admissions was preferred in females with ordinary PT than those with unusually thin or thick placentae.

This may be utilized to detect the fetuses at danger by recognizing females with thin placenta (lesser than 10th centile) and thick placenta (greater than 95th percentile).

The study of **Afrakhteh et al., 2013** demonstrated on 250 Iranian females reported a significant positive association of PT in 2nd as well as 3rd trimesters with delivery weights.

However, they concluded that placental thickness alteration couldn't expect low delivery weight. **Ahn KH in 2017** reported that the higher PT-to-predicted fetal weight ratio at 18–24 weeks gestation was related to small-for-pregnancy-age infants.

In the present work, we detected elevated prevalence of perinatal morbidity in in accordance to low Apgar score and elevated NICU admissions in people with PT >2.5 cm at 26 weeks.

Thin placenta may be because of preeclampsia, intra-uterine growing restrictions and chorioamnionitis. Mathai et al., in 2013 investigated the association of PT in 498 topics

with ultra-sonographic pregnancy aging and fetal outcomes via separating them into groups Group-A (fetal weight <2500 g, n = 122) and group-B (fetal weight >2500 g, n = 376). They observed a positive association among PT and ultra-sonographic pregnancy ages in the two groups. They additionally reported that PT in Group-A from 26- and 27-wks and 30- and 31-wks had low mean values of 24.8 ± 0.63 mm ($p < 0.05$) and 27.6 ± 5.52mm ($p = 0.05$) in comparison to 30.4 ± 2.5 and 31.3 ± 1.83 mm in Group-B.

Ahmed et al., 2014 investigated ultra-sonographic PT in 53 Sudanese pregnant ladies in 2d and 3rd trimester. They reported that thickness of lesser than 2.5 cm throughout 3rd trimester is lesser than normal and is probably a sign of intra-uterine growing restrict and thickness of greater than 4.5 cm was taken into consideration thicker than normal, that is probably an illustration of maternal diabetes, high blood pressure, fetal hydrops and different anomalies.

Standard values of PT in normal Sudanese singleton fetuses had been in range of 2.5–4.5 cm withinside the third trimester, and from 1.8 to 2.4 cm, withinside the 2d trimester. **Li et al. in 2015** validated sonographic PT a cost-effective monitoring device for detection α-thalassemia main fetuses.

Also, there was shows highly statistical significant (p-value < 0.001) difference of AFI according to placental thickness.

As in thick placentas (PT>25mm), there were 56,9% of cases developed oligohydraminos, while 43,1% had normal AFI.

Also in thin placentas (thickness<17mm) , there were 73% of cases developed oligohydraminos.

On interpretation of data of our study, it showed highly statistical significant (p-value < 0.001) difference of NICU need according to placental thickness.

As in thick placentas >25mm, 56% of cases needed nasal O2 & 14% needed CPAP.

Also, there was highly statistical significant (p-value < 0.001) difference of Apgar score according to placental thickness.

In thick placentas>25mm, there were 56.6% mildy distressed and 14% moderately distressed.

There was highly statistical significant (p-value < 0.001) difference of (fetal distress, fetal malformation, meconium stained & IUFD) according to placental thickness.

There were 28% of cases with placental thickness>25mm developped IUFD.

And 28.7% developped congenital malformation.

While 71% of cases had meconium stained

The mean neonatal weight in all studied patients was 2769.8 ± 291.8 grams with minimum weight of 2200 grams and maximum weight of 3200 grams.

There was highly statistical significant (p-value < 0.001) of neonatal weight and placental thickness.

Our results agree with study of **Afrakhteh et al., 2013** as they reported a significant positive association was found among PT and fetal weight in the 2nd trimester [r=0.15, p=0.03].

Schwartz et al., **2012** investigated placental measurement in 1909 singleton gestations among 18 and 24 gestational wks. and reported that mean placental diameter and thickness were significantly lesser in small-for-pregnancy-ages infants.

Nagpal et al., 2018 reported a significant association was found among PT and neonatal weight [r = 0.55].

Our results support the **BaGhel et al., 2015** study and **Li et al., 2015** they reported that, mean placental thickness was 24.5 mm at 24 weeks.

So, the thickness of placenta in millimetres nearly coincides with pregnancy ages. It suggests a significant positive association among PT and neonatal outcomes.

Hence, PT can be considered an imporyant tool to expect any abnormalities about fetal weight or poor neonatal outcomes.

The present study shows that there is high significant relation between placental thicknesses second and Apgar score at 1 minute.

These results support that of **Nagpal et al., 2018** who reported that a proportionally association was found among PT and Apgar score.

The current study shows that there is significant relation between thickness of placenta second and third trimester and NICU admission.

These results are comparable to **Nagpal et al., 2018** who reported raised occurrence of perinatal complications in full-term neonates of lower Apgar score and raised NICU admissions in women with PT >40 mm at 36-wks, and the current work revealed that there is an increase in the occurrence rate of low delivery weight infants in people with unusually thick placenta.

This may be utilized to identify the fetuses at danger by recognizing females with thin/thick placenta.

Ahn et al., 2017 concluded that, the anomalous PT to calculated fetal weights ratio at 18 to 24-wks pregnancy was accompanied with small-for-pregnancy-age babies.

In the current work, there is significant positive association among 2nd trimester PT and measured fetal weight 2nd trimester, fetal birth weight, and APGAR score.

Changes in fetal weight can be predicted by placental thickness 2nd trimester by 12.5 %.

Balla et al., 2014 investigated PT in 53 pregnant women in their 2nd and 3rd trimesters. They revealed that, PT < 2.5 mm in 3rd trimester may be a mark of IUGR and thickness > 45 mm may be a mark of parental co-morbidity as diabetes and high blood pressure or fetal anomalies as hydrops fetalis.

Furthermore, **Ahn et al., 2017** reported proportional associations among PT and measured fetal weight in the 2nd and 3rd trimesters.

Damodaram et al., 2010 revealed a positive association, with rising placental sizes with rising pregnancy ages, but it was decreased in the growing-restricted fetuses.

Decreased PT for a pregnancy age might be the initial marker of fetal growing constraint.

In short, placental thickness measured by ultrasound seems to be a hopeful predictor for approximation of pregnancy ages of the fetus and expecting fetal outcomes as PT nearly equals pregnancy aging in weeks, PT <10th centile was reported to be accompanied with small delivery weight and IUGR.

Conclusion

In this study, there is a significant association among placental thickness (PT) and neonatal outcomes regarding neonatal weight, APGAR scores and the necessity of NICU,meconium stained fluid, and perinatal complications regarding oligohydraminos, congenital malformations and sudden IUFD.

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