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Original Research Article

Assessment of placental thickness as a predictor of gestational age and fetal weight in second and third trimester of pregnancy

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ABSTRACT

Background: Estimation of precise gestational age as well as fetal weight is important and is usually done by ultrasound assessment of fetal biometry. Recently estimation of placental thickness as a marker of fetal maturity as well as fetal weight has become a topic interest amongst obstetricians because of the accuracy with which placental thickness can be used for estimation of gestational age. We undertook this observational study to find out whether placental thickness can be used for estimation of gestational age and fetal weight in healthy singleton pregnancies.
Methods: This was a prospective observational study in which 210 patients in second and third trimester of pregnancy who has undergone antenatal ultrasound examination were included on the basis of a predefined inclusion and exclusion criteria. First gestational age estimation was done using fetal biometry (head circumference, biparietal diameter, abdominal circumference and femur length). Placental thickness was measured at the level of cord insertion. Correlation between placental thickness and gestational age as well as fetal weight as determined by biometry was analyzed by pearsons coefficient. P value less than 0.05 was taken as statistically significant.
Results: Mean age of studied cases found to be 24.62±4.12 years. Mean gestational age of the studied cases was found to be 28.19±6.90 weeks. The most common location of placenta was anterior which was seen in 99 (47.14%) patients followed by posterior (32.38%) and fundal (10.95%). Analysis of mean placental thickness in studied cases showed that at 12 weeks of gestation the mean placental thickness was 12.96 mm. Mean placental thickness at 37 weeks found to be 36.82 mm and this value was determined to be cut-off value for differentiating between full term and preterm gestation. There was strong positive correlation between placental thickness and gestational age between 12-38 weeks. Similarly positive correlation also existed between placental thickness and gestational age between 14-37 weeks.
Conclusions: Placental thickness can be used for estimation of gestational age as well as fetal weight in cases where fetal biometry can not be entirely relied upon.

Keywords: Gestational age, Fetal weight, Placenta thickness, Fetal biometry

INTRODUCTION

Placental imaging is a crucial aspect of prenatal care as it allows for the detailed evaluation of the placenta and its functioning during pregnancy.[1] It helps in the early detection and diagnosis of various placental disorders such as placenta previa, placental abruption, and placental insufficiency, which can have significant implications for the health of both the mother and the foetus. Recently estimation of placental thickness as a marker of fetal maturity has become a topic interest amongst obstetricians because of the accuracy with which placental thickness can be used for estimation of gestational age.[2]

Precise estimation of gestational age is important since it is the gestational age which determines the likelihood of

newborn developing pathologies such as hyaline membrane disease, necrotizing enterocolitis and retinopathy of prematurity which are common in premature deliveries.[3] In many instances where there is evidence of uteroplacental insufficiency or fetoplacental insufficiency the gestational age of the fetus becomes important determinant of further course of management.[4] In case of preterm gestation the morbidity associated with a preterm delivery is weighed against the risk of continuing a pregnancy in which there is documented uteroplacental insufficiency or fetoplacental insufficiency. In addition to this estimation of gestational age is also important in undertaking various invasive diagnostic procedures such as chorionic villous sampling and amniocentesis.[5]

Conventionally fetal biometry such as crown to rump length up to 12 weeks and thereafter various other parameters such as head circumference, biparietal diameter, abdominal circumference and femur length is used for estimation of gestational age in second as well as third trimester of pregnancy.[6] Though fetal biometry can reliably determine gestational age in most of the instances in some conditions such as various syndromes, abdominal wall defects, diaphragmatic hernia, twin gestation, skeletal dysplasia, hydrocephalus/craniosynostosis fetal biometry cannot be entirely relied upon for estimation of gestational age.[7] In addition to these fetal factors maternal factors such as severe oligohydramnios can also make biometry unreliable for estimation of gestational age. Errors in estimation of gestational age, these situations may increase risk of premature deliveries on one hand and prolongation of a full-term gestation on the other hand.[8] In situations where there is compromised uteroplacental/ fetoplacental insufficiency continuation of pregnancy may be associated with adverse perinatal outcome. In all these circumstances fetal biometry cannot be reliably used for estimation of gestational age and hence some other parameter which is entirely independent of biometry is required. Estimation of placental thickness is such parameter which can be used for estimation of gestational age.[9]

In addition to gestational age fetal biometry is also routinely used for determination of fetal weight which is an important determinant of perinatal outcome. Low birth wight babies are more likely to need NICU admissions are more prone to develop pathologies such as hypoglycaemia sepsis and hyperbilirubinemia.[10]

Many studies shown that placental thickness have positive correlation with gestational age and fetal weight. During antenatal USG placenta is routinely imaged for assessment of location (to rule out low lying placenta, placenta previa/ abruptio placenta), and to find out pathologies as morbidly adherent placenta. Estimation of placental thickness can aid in estimation of gestational age and fetal weight in addition to finding out above mentioned pathologies.[11]

We undertook this observational study to find out whether placental thickness can used for estimation of gestational age and fetal weight in healthy singleton pregnancies.

Aims and objectives

Aim and objectives were to find out correlation between placental thickness and gestational age and fetal weight in healthy singleton pregnancies and to find placental thickness value which can be used as cut-off level for differentiating between preterm and term gestation.

METHODS

This was a prospective observational study in which 210 patients in second and third trimester of pregnancy who has undergone antenatal ultrasound examination were included on the basis of a predefined inclusion and exclusion criteria. The study was conducted in the department of obstetrics and gynaecology of NMC royal Women's hospital Abu Dhabi, UAE. The duration of study was 1 year (From December 2021 to December 2022). Informed and written consent was obtained from all the patients of the study. The study was approved by institutional ethical committee. A detailed history was taken from all the patients with respect to last menstrual period (LMP) date and gestational age by LMP was noted. History of co-morbid systemic illnesses such as diabetes mellitus, hypertension or bronchial asthma was asked for and noted down. Antenatal ultrasound was done using a convex probe. GE volusion 8 ultrasound machine was used for antenatal ultrasound scanning.

Pregnant women having singleton pregnancy who have completed 12 weeks of gestation were included in this study. Patient who refused consent, cases with multiple pregnancy, patients who were found to have severe systemic illnesses/those with gestational diabetes and pre-eclampsia were excluded from the study. Cases in whom gestational age was below 12 weeks or more than 42 weeks (Post term pregnancy) were also excluded from study.

First gestational age estimation was done using fetal biometry (head circumference, biparietal diameter, abdominal circumference and femur length). Gestational age so determined was noted. Thereafter placental imaging was done. Site of placenta was determined and any pathologies such as retroplacental hematoma, abruptio placenta, placenta previa or morbidly adherent placenta was ruled out. Placental thickness was measured at the level of cord insertion. Scanning was done perpendicular to chorionic and basal plates. Correlation between placental thickness and gestational age as determined by biometry was analyzed by pearsons coefficient.

Sample size was calculated according to previous reference studies, when placental thickness was used for estimation of gestational age, as the main result in the event of at least 180 patients was calculated by Open Epi-version 3 online software, a 10% difference could be determined between the group at 80% power and 5% significance (α=0.05, β=0.80). We therefor enrolled 210 patients in our study. For statistical purposes, SSPS 21.0 software was used. Microsoft excel was used for

preparation of charts and graphs. Normally distributed data was presented in terms of means and standard deviation. The mean values of the placental thickness and standard deviation were calculated for the various gestational ages in second and third trimester of pregnancy. P value less than 0.05 was taken as statistically significant.

RESULTS

In this study 210 women with singleton pregnancies were included. The analysis of age group of these cases showed that the most common age group was between 20-25 years (57.14%) followed by 26-30 years (22.38%) and above 30 years (9.52%). The 15 (7.14%) patients were less than 20 years of age and 8 (3.81%) patients were above 35 years of age. The mean age of the studied cases was found to be 24.62±4.12 years (Figure 1).

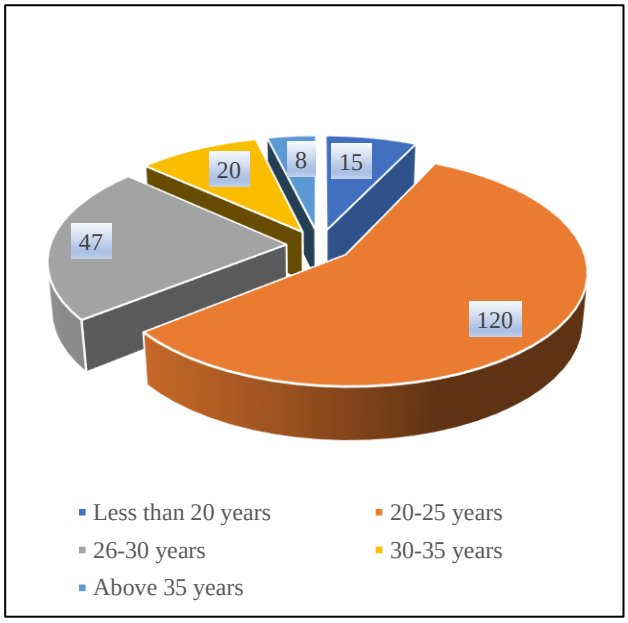

Figure 1: Age distribution of the studied cases.

The analysis of the cases on the basis of gestational age as determined from biometry showed that most of the patients were having a gestational age of 25-30 weeks (43.81%) followed by 31-37 weeks of gestation (29.52%). 38 (18.10%) patients belonged to gestational age between 13-24 weeks whereas 18 (8.57%) patients were between 37-42 weeks of gestation. Mean gestational age of studied cases was found to be 28.19±6.90 weeks (Table 1).

Table 1: Gestational age of studied cases.

Gestational age (Weeks)	N	Percentage (%)
13-24	38	18.10
25-30	92	43.81
31-37	62	29.52
37-42	18	8.57
Total	210	100
Mean gestational age: 28.19±6.90 weeks		

Analysis of patients on basis of placental location showed that the most common location of placenta was anterior which was seen in 99 (47.14%) patients followed by posterior (32.38%) and fundal (10.95%). Placenta was right lateral and left lateral in 11 (5.24%) and 9 (4.29%) respectively. In 178 (84.76%) patients, placenta located safely away from OS whereas in 28 (13.33%) there was low lying placenta and in 4 (1.90%) patients, placenta was partially or completely covering OS (Table 2).

Table 2: Assessment of location on ultrasound.

Location		N	Percentages (%)
Placental location	Anterior	99	47.14
	Posterior	68	32.38
	Fundal	23	10.95
	Right lateral	11	5.24
	Left lateral	9	4.29
	Total	210	100
Low lying or placenta previa	Safely away from OS	178	84.76
	Low lying placenta	28	13.33
	Placenta previa	4	1.90
	Total	210	100

The analysis of mean placental thickness in studied cases showed that at 12 weeks of gestation the mean placental thickness was 12.96 mm. There was steady increase in mean placental thickness throughout second and third trimester till 38 weeks of gestation. After 38 weeks till 42 weeks of gestation mean placental thickness slightly reduced. Mean placental thickness at 37 weeks was found to be 36.82 mm and this value was determined to be the cut-off value for differentiating between full term and preterm gestation. At 42 weeks of gestation the mean placental thickness was found to be 35.98 mm (Figure 2).

The mean placenta thickness between 12-24 weeks was found to be 18.83±3.37 cm whereas placental thickness was 30.58±3.89 cm between 24 weeks to 37 weeks. After 37 weeks up to 42 weeks placental thickness was found to be 36.23±0.36 cm. There was a gradual increase in mean placental thickness in second and third trimester till 38 from 12 after which the placental thickness didn't have a positive correlation with gestational age (Table 3).

Table 3: Mean placental thickness at different weeks of gestation.

Gestational age (weeks)	Mean placental thickness (cm)	SD (cm)
12-24	18.83	3.37
25-37	30.58	3.89
38-42	36.23	0.36

Analysis of placental thickness in patients from 14-42 weeks of gestation showed that there was positive correlation between placental thickness and fetal weight. Analysis of correlation between placental thickness and

fetal weight between from 14-24 week of gestation showed that there strong positive relationship between these parameters (r=0.8881). Positive correlation between placental thickness and fetal weight found to be statistically highly significant (p<0.00002). Similarly, there also positive correlation between placental thickness and fetal weight between 25-37 weeks (r=0.9898) and this positive correlation also found to be statistically highly significant (p<0.00001). Beyond 37 weeks of gestation till 42 weeks there was negative correlation between placental thickness and fetal weight as between 38-42 weeks placental thickness started decreasing while fetal weight continued increasing. However, this negative correlation was not statistically significant (p=0.062) (Table 3).

The correlation between placental thickness and gestational age was determined by Pearson's analysis. Analysis of mean placental thickness between 12-24 weeks of gestational age showed that there was a Strong positive correlation between placental thickness and gestational age (r=0.9816). Placental thickness was found to gradually increase from 12 to 24 weeks. This positive correlation between gestational age and placental thickness was found to be statistically highly significant (p<0.00001). Similarly, there was also a positive correlation between gestational age and placental thickness between 25-37 weeks (r=0.9969) and this positive correlation was also found to be statistically highly significant (p<0.00001). However, beyond 38 weeks of gestation till 42 week there was a negative correlation between gestational age and placental thickness between. This negative correlation was weak and statistically not significant (p=0.062) (Table 4).

Table 4: Correlation between placental thickness and gestational age.

Gestational age (Weeks)	Gestational age by fetal biometry (Weeks)	Mean placental thickness (mm)	Pearson co-efficient (R value)	P value
Gestational age (From 12-24 weeks)	12	12.96	0.9816 (Strong positive correlation between placental thickness and gestational age)	<0.00001 (Highly significant)
	13	14.93		
	14	15.26		
	15	15.96		
	16	17.6		
	17	18.71		
	18	19.46		
	19	20.12		
	20	21.4		
	21	21.54		
	22	21.58		
	23	22.12		
	24	23.24		
Gestational age (From 25-37 weeks)	25	24.46	0.9969 (Strong positive correlation between placental thickness and gestational age)	<0.00001 (Highly significant)
	26	25.12		
	27	26.78		
	28	27.98		
	29	28.84		
	30	29.46		
	31	30.76		
	32	31.46		
	33	32.56		
	34	33.56		
	35	34.86		
	36	34.92		
	37	36.82		
Gestational age (From 38-42 weeks)	38	36.86	-0.8593 (Negative correlation between placental thickness and gestational age)	0.062195 (Not significant)
	39	36.22		
	40	36.1		
	41	36.02		
	42	35.98		

Table 5: Correlation between placental thickness, gestational age and fetal weight.

Gestational age (Weeks)	Gestational age by fetal biometry (Weeks)	Mean placental thickness (mm)	Weight (gm)	Pearson co-efficient (r Value)	P value
Gestational age (From 12-24 weeks)	12	12.96	--	0.8881 (Strong positive correlation between placental thickness and fetal weight)	0.0002 (Highly significant)
	13	14.93	--		
	14	15.26	112		
	15	15.96	136		
	16	17.6	172		
	17	18.71	210		
	18	19.46	288		
	19	20.12	246		
	20	21.4	352		
	21	21.54	464		
	22	21.58	512		
	23	22.12	684		
	24	23.24	792		
Gestational age (From 25-37 weeks)	25	24.46	648	0.9898 (Strong positive correlation between placental thickness and fetal weight)	<0.00001 (Highly significant)
	26	25.12	872		
	27	26.78	1234		
	28	27.98	1298		
	29	28.84	1358		
	30	29.46	1466		
	31	30.76	1584		
	32	31.46	1810		
	33	32.56	2180		
	34	33.56	2240		
	35	34.86	2542		
	36	34.92	2610		
	37	36.82	2942		
Gestational age (From 38-42 weeks)	38	36.86	2964	-0.7738 (Negative correlation between placental thickness and gestational age)	0.1277 (Not significant)
	39	36.22	3012		
	40	36.1	3046		
	41	36.02	3110		
	42	35.98	3210		

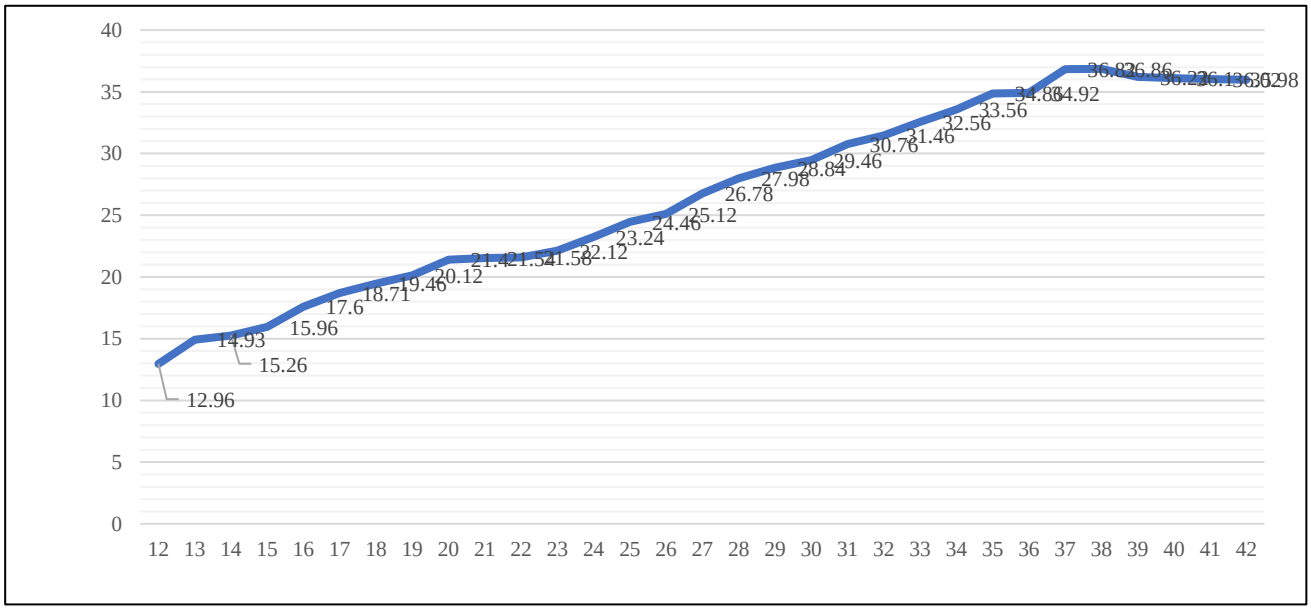

Figure 2: Placental thickness in studied cases.

DISCUSSION

Estimation of gestational age as well as fetal weight is important from the obstetricians' perspective and is one of the crucial parts of assessment of pregnant women. Estimation of gestational age is usually done by antenatal ultrasound examination. In second and third trimester of pregnancy fetal biometry such as head circumference, biparietal diameter, abdominal circumference and femur length is routinely used for estimation of gestational age. However, there are certain conditions such as fetal hydrocephalus, craniosynostosis and skeletal dysplasia fetal biometry cannot be reliably used for determination of gestational age and fetal weight and in these cases placental thickness can be used for determination of gestational age and fetal weight independent of fetal biometry.

IN our study most of the patients were having a gestational age of 25-30 weeks (43.81%) followed by 31-37 weeks of gestation (29.52%). The 38 (18.10%) patients belonged to gestational age between 13-24 weeks whereas 18 (8.57%) patients were between 37-42 weeks of gestation. The analysis of placental thickness in studied cases showed that at 12 weeks of gestation the mean placental thickness was 12.96 mm and there was a steady increase in placental thickness till 38 weeks of gestation following which there was a slight reduction in it. Mean placental thickness at 37 weeks was found to be 36.82 mm and this value was determined to be the cut-off value for differentiating between full term and preterm gestation. Humadi et al conducted a cross sectional study to determine the validity of the placental thickness for calculating the gestational age during the third trimester.[12] In this study 90 women with low-risk pregnancy and gestational age between 34 to 37 completed weeks, recruited from the antenatal clinic. The foetal gestational age was estimated by the accurate date of the last menstrual period and early ultrasound at 11-14 weeks of gestation. Placental thickness was determined at the umbilical cord implantation site. The association between placental thickness and gestational age was established. The study found a cut off placental thickness more than 36.3 mm can be used to differentiate between term and preterm pregnancy. Similar findings were also reported by the authors such as Erkamp et al and Njeze et al.[13,14]

IN our study we found that that there was a Strong positive correlation between placental thickness and gestational age from 12 weeks to 38 weeks of gestation after which there was negative correlation between placental thickness and gestational age. Karthikeyan et al conducted a cross sectional study to estimate the (Placental thickness) PT and at investigating the relationship between PT and the foetal growth parameters in normal singleton pregnancies.[15] For this purpose two hundred eleven pregnant women were enrolled in the study. The pregnancies were between 11 to 40 weeks and they were not complicated by either maternal or foetal diseases. The biparietal diameter (BPD), the abdominal circumference (AC), the head circumference (HC), the femur length (FL) and the PT were measured. The study found that there was a strong positive correlation between PT and GA, with the correlation coefficient values for the 1st, 2nd and 3rd trimesters being r=0.609, r=0.812 and r=0.814 respectively. There was a significant positive correlation between PT and BPD, AC, FL, ABC, HC and FW also. The authors concluded that PT can be used as a predictor of the GA. The subnormal PT for the corresponding GA should be evaluated for any disease condition. So, the measurement of PT should therefore be carried out routinely during the obstetric USGs. Similar positive correlation between placenta l thickness and gestational age was also reported by the authors such as Keshavarz et al and Azagidi et al.[16,17]

The analysis of correlation between placental thickness and fetal weight between from 14-38 week of gestation showed that there was a strong positive relationship between these parameters. This positive correlation between placental thickness and fetal weight was found to be statistically highly significant. Beyond 37 weeks of gestation till 42 weeks there was a negative correlation between placental thickness and fetal weight. Afrakhteh et al conducted a study to investigate relationship between placental thickness during the second and third trimesters and placental and birth weights.[18] In this study a total of 250 singleton pregnant women were included. All recruited women were assessed at the 1st trimester screening for baseline demographic and obstetric data. The placental thickness was measured trans-abdominally in the area of the cord insertion at second and third trimester. Pearson's correlation analysis was used to establish the degree of relationship between placental thickness and birth and placental weights. The study found that There was a significant positive correlation between placental thickness and birth weight in the second and third trimesters (r=0.15, p=0.03; r=0.14, p=0.04 correspondingly). The authors concluded that birth weight has a positive relation with both second and third trimester placental thickness. Similar positive correlation between placental thickness and fetal weight was also reported by the authors such Hamidi et al and Salafia et al.[19,20]

Limitations

In all cases a single reading of the placental thickness was taken and same patient was not followed up for changes in placental thickness as pregnancy advances. This was the limitation of our study.

CONCLUSION

Though fetal biometry is widely used for estimation of gestational age as well as fetal weight there are instances where it can not be entirely relied upon. In such instances placental thickness can be used for estimation of gestational age as well as fetal weight. However, population-specific placental thickness charts will be preferable for estimation of gestational age and fetal weight.

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