



“ANALYSING PLACENTAL THICKNESS IN RELATION TO GESTATIONAL AGE AND FETAL WEIGHT – A CORRELATIVE STUDY”

Radio-Diagnosis

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ABSTRACT

Background: Historically, placental weight is about 20% of fetal weight, and placental thickness is connected fetal development. Sonographic placenta evaluation may reveal the fetus's nutrition. Placental thickness usually matches gestational age. Few studies directly link placental thickness to infant outcomes. **Objective:** To study the association between placental thickness, fetal weight, and gestational age in the second and third trimesters. **Methods:** 100 pregnant women with gestational ages between 20 to 40 weeks were included in our research. The ultrasound measurements of fetal biometry and placental thickness were obtained utilizing a 3.5 Hz convex array transducer. **Results:** Placental thickness significantly varies with placental grade and position. The presence of retro-placental hematoma significantly increases thickness compared to its absence. Other factors like history of previous LSCS and hypothyroidism presence did not show significant differences in placental thickness. The study found that the presence of hematoma significantly increased thickness compared to its absence. **Conclusion:** A positive correlation between placental thickness and gestational age and fetal weight was established throughout the second and third trimesters. Thus, measuring placental thickness should be included alongside biometric parameters in ultrasounds for antenatal women.

KEYWORDS

Placental thickness, Ultrasound, fetal weight, Neonatal outcome, Biparietal diameter

INTRODUCTION:

Placentas are vascular organs that carry hormones, gases, and nutrients from mother to fetus. After developing from the chorionic villi, the placenta displays a homogeneous echogenic pattern on ultrasound by the 9th to 10th week. [1] A healthy placenta is necessary for successful fetal development. [2]

Determining the gestational age is essential for a healthy pregnancy and delivery. Ultrasound is an important tool for gestational age measurement. EDD is best determined using dating scans. Mean gestational sac diameter is a ultrasonography measurement used to determine early gestational age. first-trimester crown-rump length (CRL) is another parameter used. Head circumference, femur length, biparietal diameter, and abdominal circumference indicate gestational age in the second and third trimesters. Hadlock formula is used for the calculation. These measures become unstable in the late middle and final trimester. The accuracy of these parameters varies in third trimester. Thus, additional characteristics are needed to determine gestational age. Additional parameters include trans cerebellar diameter, humerus length, intraocular distance, and binocular distance. Another sonological parameter is placental thickness. [3-7]

USG characterizes placental position, detects anomalies, and evaluates them. Sonography distinguishes the thicker chorion frondosum from the thinner opposite laeve in the 8th and 9th weeks. The disk-shaped placenta may be identified from its surrounds from 10 weeks of pregnancy [8]. PT can determine gestational age. Thus, in addition to fetal physiological signs, additional aspects during the third trimester must be investigated to increase gestational age calculation accuracy. [10].

Placenta thickness increases linearly (1 mm/week) between 22 and 35 weeks of gestation, according to many studies. Large placental may be due to anemia, hemolytic disease, TORCH infections, fetal macrosomia, hydrops fetalis, and maternal diabetes. Pre-eclampsia, chorioamnionitis, IUGR, IUFD, chromosomal abnormalities, and persistent fetal infections reduce placental thickness [11,12].

Fetal weight is critical to neonatal survival at delivery, thus it must be monitored periodically.[13] A link between IUGR and placental thickness reduction may assist to monitor and detect high-risk pregnancies. Studies suggest that placenta enlargement precedes fetal growth retardation. Thus, thorough placental thickness monitoring reduces prenatal issues and fetal fatalities.[14] Our research uses ultrasonography to analyse the link placental thickness, fetal weight, and gestational age in the second and third trimesters and their correlation with each other.

MATERIAL AND METHODS –

100 pregnant women whose gestational age was between 20 and 40 weeks were taken for our prospective cross-sectional study from

outpatient and inpatient clinics who were referred by the Obstetrics and Gynaecology department to the department of radio-diagnosis for prenatal examination. Ethics committee of the Jaipur National University Institute for Medical Sciences and Research Centre gave its approval. Informed consent was taken from all participants.

Exclusion criteria were pregnant women with a battledore, velamentous, succentrate or lobulated placenta, twin pregnancies, pregnancy-induced hypertension (PIH) or diabetes. Participants underwent a thorough obstetric history followed by a transabdominal ultrasound scan.

The ultrasound devices used in this study consisted of the Mindray DC-70 and BPL e Cube 8 systems, both equipped with a 3.5 Hz convex array transducer and electronic calipers for precise measurements.

Placental thickness was assessed in millimeters at the insertion site of the umbilical cord with a use of transducer positioned perpendicular to the chorion and basal plate. Gestational age and fetal weight was calculated using fetal biometry. This included measuring the biparietal diameter (BPD), abdominal circumference (AC), head circumference (HC) and femur length (FL) using the Hadlock formula with an ultrasound machine.

Pearson's correlation coefficient was used to determine the relationship between placental thickness and gestational age and fetal weight. A statistical significance level of $p < 0.05$ was considered significant.

RESULTS:

This study included 100 pregnant women aged 18-35+ years (mean age 25.78 ± 4.15 years), referred for prenatal examination. Participants were primarily multigravida (55%) and predominantly in the 25-37 week gestational age range (77%). Gestational age was determined using LMP (mean 31.32 ± 5.60 weeks), USG (30.67 ± 5.22 weeks), and fetal biometry: BPD (30.85 ± 5.25 weeks), HC (30.91 ± 5.29 weeks), AC (30.28 ± 5.23 weeks), and FL (30.69 ± 5.32 weeks). Fetal weight estimation followed these biometric measurements.

Table 1: Baseline characteristics of the pregnant women

		n	%
Age (years)	18-25 years	54	54.00
	26-30 years	32	32.00
	31-35 years	12	12.00
	>35 years	2	2.00
	Mean \pm SD	25.78 \pm 4.15	
Gravida	Primigravida	45	45.0
	Multigravida	55	55.0
Gestational age	\geq 24 weeks	18	18.00
	25-37 weeks	77	77.00

	>37 weeks	5	5.00
Methods for determining gestational age		Mean	Std. Deviation
	LMP	31.32	5.60
	USG	30.67	5.22
	BPD	30.85	5.25
	HC	30.91	5.29
	AC	30.28	5.23
FL	30.69	5.32	

Placental thickness significantly varied with placental grade: Grade I (23.46±2.45 mm), Grade II (31.56±4.22 mm), and Grade III (35.24±5.92 mm) (p<0.001). Thickness also differed by position: anterior (31.56±4.22 mm), posterior (28.30±5.42 mm), lateral (35.32±1.90 mm), and fundal (34.28±4.14 mm) (p=0.003). Presence of retro-placental hematoma significantly increased thickness (41.22±22.90 mm) compared to its absence (30.96±5.15 mm) (p=0.005).

Other factors showed no significant impact on placental thickness. History of previous LSCS presence (30.89±5.18 mm) versus absence (31.33±6.46 mm) (p=0.809), and systemic illness like Hypothyroidism presence (32.79±1.32 mm) versus absence (31.18±6.42 mm) (p=0.580) did not show significant differences (Table 2).

Table 2: Association of mean placental thickness, placental grade, placental location, retro-placental hematoma, LSCS, and hypothyroidism

		Placental thickness		
		Mean	±SD	p-Value
Placental Grade	Grade I (n=20)	23.46	2.45	<0.001
	Grade II (n=44)	31.56	4.22	
	Grade III (n=36)	35.24	5.92	
Placental Position	Anterior (49)	31.56	4.22	0.003
	Posterior (30)	28.30	5.42	
	Lateral (9)	35.32	1.90	
	Fundal (12)	34.28	4.14	
Retro-placental hematoma	Absent (n=97)	30.96	5.15	0.005
	Present (n=3)	41.22	22.90	
Previous LSCS history	Absent (n=86)	31.33	6.46	0.809
	Present (n=14)	30.89	5.18	
hypothyroidism	Absent (n=95)	31.18	6.42	0.580
	Present (n=5)	32.79	1.32	

Placental thickness was positive significant correlated with fetal weight, gestational age and advancing gestational age (>24 week). Placental thickness was negative significant correlated with AFI (cm). There was a strong positive correlation between placental thickness and the measurements of BPD (mm), HC (mm), AC (mm), and FL (mm). (Table 3)

Table 3: Pearson Correlation of Placental thickness with fetal weight, gestational age, AFI (cm) and Advancing gestational age (>24 week) & Biparietal Diameter (BPD), the Head Circumference (HC), the Abdominal Circumference (AC) and the Femur Length (FL)

Placental thickness	Pearson Correlation	p-Value
Fetal weight	0.687	<0.001
Gestational age	0.766	<0.001
AFI (cm)	-0.450	<0.001
Advancing gestational age (>24 week)	0.687	<0.001
Biparietal Diameter (BPD)	0.751	<0.001
Head Circumference (HC)	0.737	<0.001
Abdominal Circumference (AC)	0.764	<0.001
Femur Length (FL)	0.823	<0.001

DISCUSSION:

For optimal fetal growth, the placenta must be properly functioning and structured. Several studies have established a correlation between the thickness of the placenta and the duration of pregnancy [15,16].

In our study, 18.00% of patients had a gestational age ≥24 weeks, 77.00% had a gestational age of 25-37 weeks and 5.00% were more than 37 weeks pregnant. Omer Ahmed et al. (2023) found that 43.81% of patients were 25-30 weeks pregnant and 29.52% were 31-37 weeks pregnant [17].

The study found that placental thickness averaged 23.82±5.53 in pregnancies between 20-24 weeks, 32.56±5.16 in pregnancies between 25 and 37 weeks and 38.06±0.54 in pregnancies over 37 weeks. With increasing gestational age, placental thickness also increased. Vinchurkar et al (2023) observed that the placenta becomes thicker over the course of pregnancy, peaking at 35 weeks [18]. The mean thickness of the placenta at 32 and 36 weeks' gestation was 33.45 ± 1.62 and 35.7 ± 2.08 mm, respectively.

In this study, we found a correlation between placental thickness and gestational age, biparietal diameter, head circumference, abdominal circumference and femur length. According to Vinchurkar et al (2023), placental thickness correlates with gestational age, biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL) [18]. Karthikeyan et al (2012) also found a favorable correlation between placental thickness and gestational age. In a baby with hydrocephalus, placental thickness can be used as a surrogate for inadequate measurement of the distance between the two parietal bones of the skull (biparietal diameter or BPD) and other markers of fetal development to accurately determine the stage of gestation. Thus, our data support the consistency of ultrasound-based assessment of placental thickness for gestational age determination. This is especially true for macrosomic babies with advanced gestation.

The average fetal weight in this study was 1801.50 and ranged from 313.00 to 3540.00. A positive correlation is present between placental thickness and fetal weight. Hamidi et al. (2019) and Salafia et al. (2008) found a correlation of placental thickness with fetal weight, with the interval [19,20] representing the value. Nagpal et al. (2018) showed that bulky placentas increased low birth weight [21].

Our research found a mean placenta thickness of 31.33±6.46 in the previous vaginal delivery group and 30.89±5.18 in the previous LSCS group. The average placenta thickness was not significantly different between LSCS and vaginal delivery cases. Song et al. discovered a statistically significant difference in placental thickness between vaginal and cesarean births [22]. Smith et al. (2020) found that larger placentas enhanced the likelihood of vaginal birth in numerous studies. Their theory is that placental thickness increases uterine contractility, increasing the likelihood of a vaginal birth [23].

Placental abruption may cause premature labor and delivery and neonatal death. Sonographic imaging demonstrates a fluid buildup behind the placenta and increased thickness [24,25]. The study found that placenta thickness ranged from 30.96±5.15 in cases without retro-placental hemorrhage to 41.22±22.90 in cases with hematoma. Retro-placental hemorrhage was associated with a statistically significant difference in placenta thickness.

In our research, grade II placenta was more common (44%) than grade I (20%), however grade III was reported in 36% of patients with gestational ages beyond 37 weeks. Deopa et al. (201) found that grade II placentas were more common between 32 and 37 weeks, whereas grade III were more common in normal pregnancies after 37 weeks [26]. High-risk individuals had both accelerated and slowed placenta growth. The average placenta thickness was 23.46±2.45 for grade I, 31.56±4.22 for grade II, and 35.24±5.92 for grade III. The mean placenta thickness was much larger in grades II and III than grade I.

In our research, the placenta thickness averaged 31.56±4.22 in the anterior, 28.30±5.42 in the posterior, 35.32±1.90 on the lateral, and 34.28±4.14 at the fundal. The average placenta thickness varied greatly by region.

Research indicates that placenta thickness averaged 31.18±6.42 in those without hypothyroidism and 32.79±1.32 in those with hypothyroidism. Average placenta thickness did not predict hypothyroidism.

CONCLUSION:

There is a significant correlation between placental thickness and gestational age, indicating that changes in placental thickness are closely linked to the progression of gestational age. Consistent monitoring of placental thickness can assist in precisely estimating gestational age and fetal weight, as well as identifying any issues related to fetal growth. Thus, placental thickness could be utilized as a supplementary tool in fetal biometric assessments.

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