

Original Research Article

ULTRASONOGRAPHIC MEASUREMENT OF PLACENTAL THICKNESS AND ITS CORRELATION WITH GESTATIONAL AGE IN NORMAL PREGNANCY

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ABSTRACT

Background: Ultrasonography is the most effective method to estimate the gestational age. Placenta is a materno-foetal organ which is a reflection of health and size of the fetus. PT can be used as a new parameter to estimate the gestational age of the fetus. In our present study we measured the placental thickness at the level of umbilical cord insertion to determine its relationship with GA of foetus, BPD & FL in normal singleton pregnancy between 12 – 24 weeks.

Materials and Methods: This was a cross sectional study consisting of 201 normal antenatal women who were referred to the Department of Radio diagnosis from antenatal clinic, Department of OBG, Shri B.M. Patil Medical College Hospital and Research Center, Bijapur from October 2014 – June 2016. All the subjects were enrolled with detailed oral and written consents. Normal singleton pregnancies of gestational ages from 12 to 24 wks were included in the study. PT, in mm, was calculated by averaging the three best measurements for each case at the level of umbilical cord insertion. Correlation of mean PT with GA, BPD & FL was calculated. Data was compiled in MS excel sheet and analyzed using online statistical calculator, chi square test and Pearson's correlation coefficient were applied with value of P <0.05 was considered statistically significant.

Results: In the total study group of 201 normal singleton pregnancies from 12 to 24 wks of gestation, age ranged between 18 yrs to 37 yrs with mean age was between 20 and 25 yrs. Anterior placenta was noted to be the most common location amongst the study sample. Lateral location of the placenta was found to be more accurate in measuring the placental thickness, however anterior, posterior & fundal locations also showed significant correlation. PT taken at individual weeks of gestation almost matched with GA, BPD & FL with few negative correlation in some weeks in which PT was less than 1mm w.r.t, gestation in wks. To prove that there was a correlation between PT with GA, BPD & FL the Pearson correlation coefficient was found to be $r = 0.98$ and the p value was <0.001, thereby establishing a positive correlation between the variables.

Conclusion: It was observed that PT (in mm) correlated well with GA, BPD & FL (in weeks) from 12 to 24 wks of gestation. And also the thickness of the placenta and growth pattern did not vary relative to the placental locations.

Keywords: Placental thickness; Gestational Age; BPD; FL; Umbilical Cord; Ultrasonography.

INTRODUCTION

The criteria of a normal pregnancy are delivery of a single baby in good condition at term (between 38 and 42), with fetal weight of 2.5 kg or more and with no maternal complication. As such, a normal pregnancy is a retrospective term.^[1] The best possible ante partum care and the successful deliveries of babies always revolve around the accurate knowledge of the Gestational Age (GA). The gestational age is of utmost importance in the interpretation of biochemical tests such as the screening for the expanded maternal serum biomarkers (Human Chorionic Gonadotrophin, Alfa Foeto protein, oestrogen and progesterone levels) for the risk assessment of various foetal anomalies, in evaluating the foetal growth by distinguishing the normal from the pathological foetal development. This allows obstetrician to institute measures that will optimize the foetal outcome.^[2]

UltraSonography has provided a safe and non-invasive means to evaluate the placenta whose normal and abnormal size, appearance and growth pattern can have significant antenatal implications. Role of USG in the evaluation of morphology and detection of placental abnormalities in clinical conditions such as non-immune hydrops, gestational diabetes and intra-uterine growth restriction has been well established.

The placenta is a fetal organ which provides the physiologic link between a pregnant woman and the fetus with important metabolic, endocrine and immunologic functions besides being responsible for nutrition, respiration and excretion for the fetus, acting as a barrier; it has a role in protecting the fetus from noxious agents.^[3] Ultrasonography (US) enables the evaluation of the placenta and the detection of placental abnormalities using different parameters such as placental thickness and volume or especial techniques like three-dimensional (3D) power Doppler.^[3-5]

Placental thickness appears to be a promising parameter for estimation of gestational age of the fetus because of increase in placental thickness with gestational age. It seems reasonable that serial evaluation of placental thickness in second trimester could help to determine normal development and functional placenta and deserve as a good predictor of fetal growth and birth weight. Diseases and abnormalities affecting fetus; can be indicated by an abnormal size of the placenta during the second trimester.

Placental thickness measured at the level of the umbilical cord insertion can be used as a new parameter to estimate gestational age of the fetus. The present study was undertaken to evaluate the relationship between placental thickness and gestational age of the fetus.

MATERIALS AND METHODS

It was a Cross sectional study in the Department of Radio diagnosis from antenatal clinic, Department of Obstetrics and Gynaecology, Shri B.M. Patil Medical College Hospital and research center, Bijapur. October 2014 – June 2016

Sample Size: With 95% confidence level and Pearson correlation coefficient between placental thickness and gestational age as 0.98. The minimal sample size is 200. The sample size is calculated by plotting the sample size against estimated lower bound confidence interval.

Inclusion Criteria

Normal singleton pregnancies from 12 to 24 weeks of gestation.

Exclusion Criteria

1. Maternal Disease
 - a. Gestational Diabetes.
 - b. Hypertension (Systemic hypertension and Pregnancy induced hypertension)
 - c. Anaemia
2. Foetal anomalies.
3. Placenta previa, posterior placenta, placental anomalies and poor visualization of the placenta.
4. Twin pregnancy.
5. Last menstrual period (LMP) not known or irregular.
6. Intrauterine growth restriction

Scanners and Transducers Used: The grey scale real time ultrasonographic examinations were performed using PHILIPS HD 11XE and SEIMENS ACCUSON X 700.

Philip's transducer: C5-2 Hz convex array and L12-3 Hz linear array transducers were used.

Seimen's transducer: 4C1 Hz convex probe and VF12-4 Hz linear transducers were used.

Detailed history, consent, general physical and obstetrical examinations were done the USG.

- Patient was made to lie in the supine position.
- Fetus will be examined for viability, fetal congenital abnormalities and various growth parameters.
- To rule out oligohydramnios and polyhydramnios, amniotic fluid volume is measured by taking Amniotic Fluid Index (AFI).
- Adnexa were looked for the presence of any mass.
- The fetuses were observed for gestational age estimation using bi-parietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL) in the second trimester. The composite average of the gestational age estimated by the various growth parameters were taken for each fetus and was computed by the ultrasound machine based on Hadlock tables by using regression equations from combination of measurements (computation software package).^[6]
- Fetal parameters were taken to rule out intrauterine growth restriction.

- The placenta was identified as a hyper echoic area separated from fetus by a hypo echoic area of amniotic fluid.
- At the level of cord insertion, straight line was drawn up to the maternal surface of the placenta and thus thickness will be measured the maximum thickness was noted in the cross section.
- Umbilical artery color Doppler was used for further reconfirmation of the site of insertion.
- Each placenta was measured to a 1 mm precision, at its greatest thickness, which was perpendicular to the uterine wall.
- The uterine myometrium and the retroplacental veins were excluded.

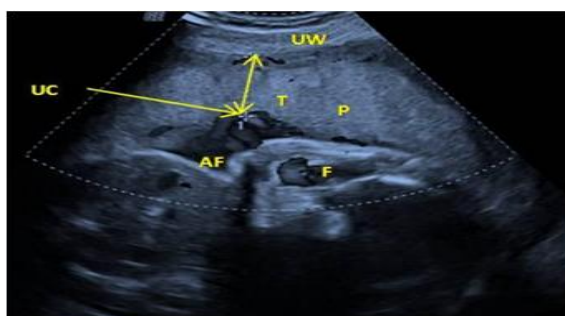


Image 1: Ultrasonogram showing landmarks for measuring thickness of placenta (P = placenta, UW = uterine wall, T = thickness of placenta, UC = umbilical cord, AF = amniotic fluid, F = foetus)(48)

Statistical Analysis: All characteristics were summarized descriptively. For continuous variables, the summary statistics of N, mean, standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Bivariate correlation analysis using Pearson's correlation coefficient (r) was used to test the strength and direction of relationships between the interval levels of variables. For continuous data, the differences of the analysis variables were tested with the t-test. If the p-value is > 0.05, then the results will be considered to be not significant. The mean values of placental thickness (mm), Bipareital Diameter (mm), Head Circumference (mm), Head Circumference (mm), Abdominal Circumference (mm) and Femur Length (mm) along with respective standard deviation (SD) were computed for each Gestational age from 12 weeks to 24 weeks. The Correlation analysis has been carried out to quantify the relationship between the gestational age in weeks and Placental thickness in mm. Data were analyzed using SPSS software v.20.0 and Microsoft word and Excel have been used for DTP work.

RESULTS

[Table 1] Shows significant strong positive correlation of Bipareital Diameter with Placental Thickness by location of Placenta.

Table 1: comparison of mean bipareital diameter and placental thickness by placental location

Placental Location	Bipareital Diameter		Placental Thickness		t test p value	Correlation	p value
	Mean	SD	Mean	SD			
Anterior	18.35	3.30	18.48	3.46	0.075	0.99	<0.001*
Posterior	18.43	3.29	18.60	3.46	0.074	0.97	<0.001*
Fundal	17.93	3.42	18.02	3.84	0.453	0.98	<0.001*
Lateral	15.14	3.02	14.96	2.85	0.286	1.00	<0.001*

Table 2: comparison of mean head circumference and placental thickness by placental location

Placental Location	Head Circumference		Placental Thickness		t test p value	Correlation	p value
	Mean	SD	Mean	SD			
Anterior	18.32	3.37	18.48	3.46	0.019	0.99	<0.001*
Posterior	18.34	3.31	18.60	3.46	0.004*	0.98	<0.001*
Fundal	17.92	3.52	18.02	3.84	0.387	0.98	<0.001*
Lateral	14.92	2.31	14.96	2.85	0.888	1.00	<0.001*

Shows significant strong positive correlation of Head Circumference with Placental Thickness by location of Placenta.

Table 3: comparison of mean abdominal circumference and placental thickness by placental location

Placental Location	Abdominal Circumference		Placental Thickness		t test p value	Correlation	p value
	Mean	SD	Mean	SD			
Anterior	18.39	3.37	18.48	3.46	0.221	0.98	<0.001*
Posterior	18.38	3.27	18.60	3.46	0.015	0.98	<0.001*
Fundal	17.69	3.56	18.02	3.84	0.003*	0.98	<0.001*
Lateral	14.58	1.96	14.96	2.85	0.418	0.99	0.001*

Shows significant strong positive correlation of Abdominal Circumference with Placental Thickness by location of Placenta.

Table 4: comparison of mean femur length and placental thickness by placental location

Placental Location	Femur Length		Placental Thickness		t test p value	Correlation	p value
	Mean	SD	Mean	SD			
Anterior	18.26	3.40	18.48	3.46	0.001*	0.99	<0.001*
Posterior	18.22	3.41	18.60	3.46	0.001*	0.98	<0.001*

Fundal	17.76	3.81	18.02	3.84	0.016*	0.98	<0.001*
Lateral	15.00	2.86	14.96	2.85	0.740	1.00	<0.001*

Shows significant strong positive correlation of Femur Length with Placental Thickness by location of Placenta.

Table 5: comparison of mean gestational age and placental thickness by placental location

Placental Location	Gestational Age (Wks)		Placental Thickness		t test p value	Correlation	p value
	Mean	SD	Mean	SD			
Anterior	18.37	3.35	18.48	3.46	0.055	0.99	<0.001*
Posterior	18.34	3.32	18.60	3.46	0.003*	0.98	<0.001*
Fundal	17.88	3.72	18.02	3.84	0.078	0.99	<0.001*
Lateral	14.94	2.46	14.96	2.85	0.920	1.00	<0.001*

Shows significant strong positive correlation of Gestational age in weeks with Placental Thickness by location of Placenta.

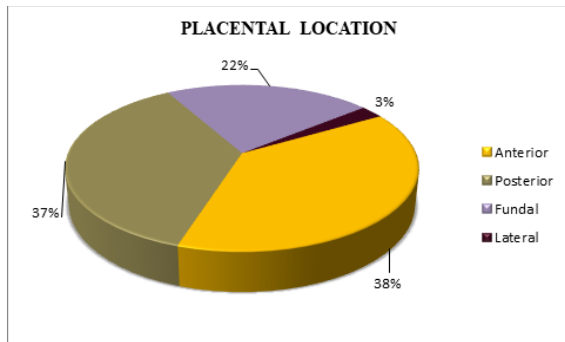


Figure 1: placental location in cases

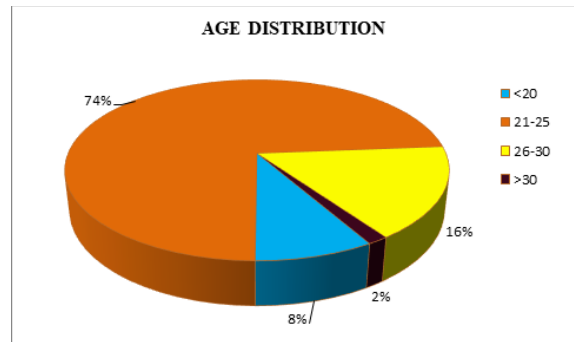


Figure 3: age wise distribution of cases

Shows anterior placental location in 38% cases, posterior in 37% cases, fundal in 22% Cases and lateral in 3% cases.

Shows age distribution of cases among 201 antenatal women with majority in 21-25 yrs age group (74 %) & very few in >30 yrs age group (2%).

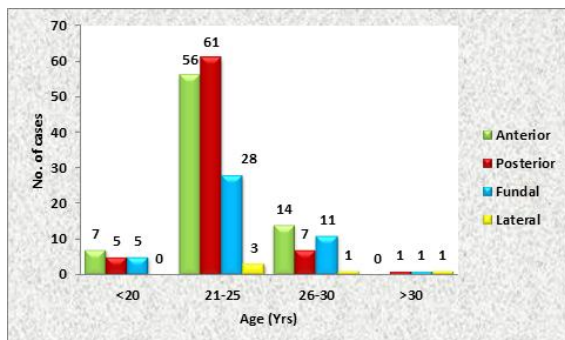


Figure 2: placental location in different age groups

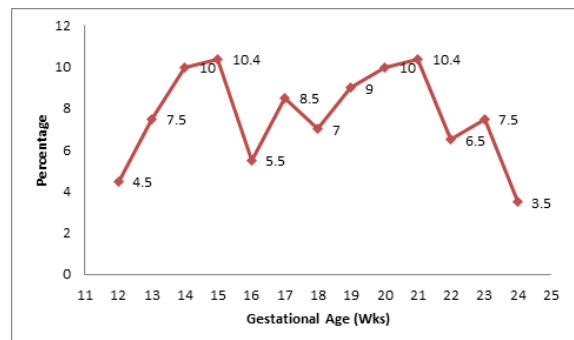


Figure 4: gestational age (wks) wise

Shows anterior location (42.4%) of the placenta is most common in 26 – 30 yrs age group, followed by posterior (41.2%) in 21 – 25 yrs age group, fundal (33.3%) in 26 – 30 & >30 yrs age groups and lateral (33.3%) in >30 yrs age group.

Among the study subjects of 201 singleton pregnant women from 12 to 24 weeks, majority of cases were in 14, 15 and 21 weeks of gestation. Least were in the case of 24 weeks of gestation.

Table 6: correlation and comparison of mean parameters (BPD, HC, AC, FL & GA) with mean placental thickness

Parameters	Mean	SD	t test p value	Correlation	p value
Bipareital Diameter	18.21	3.33	0.014	0.98	<0.001*
Head Circumference	18.15	3.39	<0.001*	0.98	<0.001*
Abdominal Circumference	18.13	3.39	<0.001*	0.98	<0.001*
Femur Length	18.05	3.50	<0.001*	0.98	<0.001*
Gestational Age (Wks)	18.16	3.43	<0.001*	0.99	<0.001*
Placental Thickness	18.33	3.56			

Shows that means of Bipareital Diameter, Head Circumference, Abdominal Circumference, Femur Length and Gestational Age were significantly different with the mean of Placental Thickness. These parameters also show significant positive correlation with Placental Thickness.

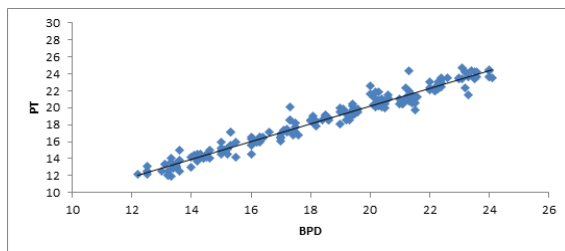
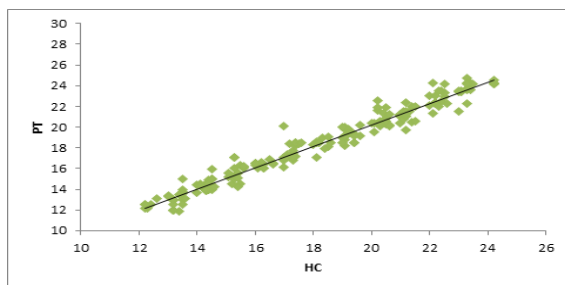
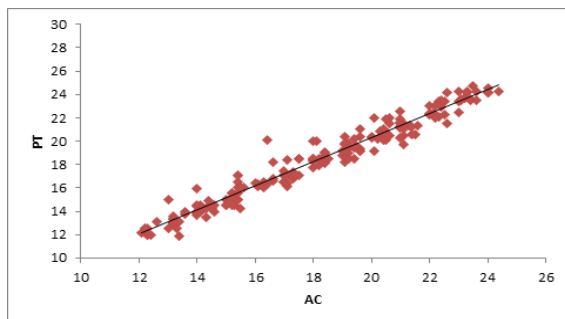


Figure 5: (A,B,C,D,E) correlation and comparison of mean parameters (BPD, HC, AC, FL & GA) with mean placental thickness

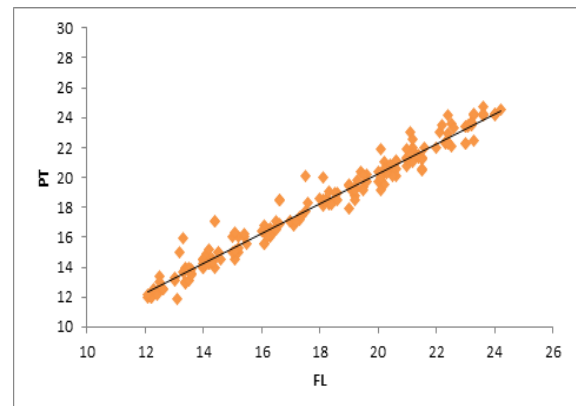
Shows that mean of Bipareital Diameter was significantly different with the mean of Placental Thickness and showing significant positive correlation with Placental Thickness.



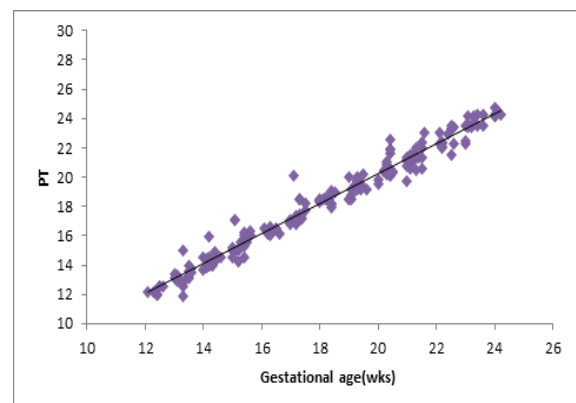
Shows that mean of Head Circumference was significantly different with the mean of Placental Thickness and showing significant positive correlation with Placental Thickness.



Shows that mean of Abdominal Circumference was significantly different with the mean of Placental Thickness and showing significant positive correlation with Placental Thickness.



Shows that mean of Femur Length was significantly different with the mean of Placental Thickness and showing significant positive correlation with Placental Thickness.



Shows that mean of Gestational age (in wks) was significantly different with the mean of Placental Thickness and showing significant positive correlation with Placental Thickness.

Table 7: comparison of mean bipareital diameter and placental thickness by gestational age (in WKS)

Gestational Age (Wks)	Bipareital Diameter		Placental Thickness		t test p value	Correlation	p value
	Mean	SD	Mean	SD			
12	12.83	0.40	12.27	0.23	0.013*	-0.34	0.365
13	13.38	0.33	13.27	0.70	0.591	0.08	0.783
14	14.40	0.33	14.32	0.47	0.361	0.59	0.006*
15	15.53	0.51	15.54	0.78	0.955	0.35	0.118
16	16.45	0.37	16.35	0.20	0.462	-0.07	0.836
17	17.30	0.24	17.62	0.88	0.155	0.06	0.829
18	18.29	0.46	18.50	0.34	0.173	0.12	0.677
19	19.12	0.55	19.27	0.55	0.179	0.68	0.002*
20	20.21	0.46	20.67	0.78	0.027*	0.10	0.668
21	21.26	0.51	21.27	0.70	0.930	0.29	0.210
22	22.35	0.39	22.57	0.60	0.314	-0.03	0.930
23	23.28	0.75	23.58	0.58	0.215	0.11	0.698
24	23.36	0.30	24.34	0.19	0.001*	0.21	0.652

Shows positive correlation of Bipareital Diameter with Placental Thickness in majority of weeks of

gestation except in 12th, 16th & 22nd weeks which showed negative correlation of less than 1mm.

DISCUSSION

In our study we adopted a cross sectional design and did not follow the patients longitudinally. Placenta was first identifiable at 8 – 9 menstrual weeks as a focal thickening of the chorio-decidual reaction. Correct identification of the placental – myometrial interface should also preclude the illusion of placental thickening induced by focal myometrial thickening. Since the placenta is passive structure lacking the capacity to expand focally, measurement of the placental thickness at any point, except near its edge yields the same results.

In our study the majority of the placenta was anterior in location. Anterior located placenta was reliable in measurement as the placental – myometrial surface was clearly delineated. Length of the placental insertion is also one of the factor for placental thickness to be thick and thin in nature. If the length of the placental insertion is long then the placenta is usually extended from one endometrial surface to another (antero-fundal, antero-lateral) while the short placental thickness were limited to one endometrial surface (anterior).^[6] Anterior placenta showed significant correlation with the placental thickness from 12 – 24 weeks of gestation with the p value of <0.001.

In our study next common location of the placenta was posterior. Care was taken at the time of the measurement to reduce the reverberation artefact from the fetal spine, changing the fetal position and taking the measurements, proper technique of visualization was done.^[6]

Hoddick et al,^[6] study showed that the placental location was irrelevant for estimating the GA. In the study conducted by Dr. P. Pranesh et al,^[7] in 200 antenatal women of all gestational ages from 11 weeks to 40 weeks of gestation in Department of Radiodiagnosis, Rajah Muthiah Medical College & Hospital, Annamalai University, Annamalaiagar. They observed 36% anterior location of the placenta, 24% in fundal position, 22.5% in posterior & 17.5% of the cases lateral position and showed no significant variation in placental thickness with respect to location of the placenta.

Lovely Kaushal et al,^[8] studied 199 normal antenatal women in Department of Radiodiagnosis, Gandhi medical college and Hamidia hospital, Bhopal. This cross-sectional study showed 30% anterior placenta, 29% posterior placenta, 23% fundal placenta and 18% lateral placenta.

Hoddick et al,^[6] studied 200 normal singleton pregnancies in Department of radiology, University of California school of medicine, San Francisco, California. This retrospective study showed 46% cases of posterior placenta and showed no significant variation in placental thickness with respect to location of the placenta.

Ridhi Adhikari et al,^[9] studied 150 normal antenatal women in Department of Obstetrics and Gynaecology, College of Medical Sciences &

Teaching Hospital, Bharatpur, Nepal. In this prospective cross sectional study majority of placenta were posterior in location (46%), followed by anterior (36%), fundal (11%), and 7% cases in lateral positions.

In the study conducted by Ridhi Adhikari et al,^[9] on 150 normal antenatal women in Department of Obstetrics and Gynaecology, College of Medical Sciences & Teaching Hospital, Bharatpur, Nepal. They observed significant positive correlation between placental thickness and FL, BPD and AC in the second & third trimesters; with all parameters having identical relationships with placental thickness.

Baghel P et al,^[10] conducted a prospective observational longitudinal study on 100 pregnant antenatal women starting from 24 weeks and were followed up at 32 weeks, 36 weeks in the Department of Obstetrics and Gynaecology in collaboration with the Departments of Radio diagnosis and Pediatrics in Kasturba Hospital, BHEL Bhopal. They observed at 24 weeks of gestation the mean placental thickness was 24.5 mm which is closely correlating with the gestational age. It also showed correlation placental thickness with BPD, FL and AC. They concluded as linear direct relationship of the placental thickness with gestational age in 24 weeks.

In the prospective study conducted by Natwar Lal Agrawal,^[11] on 100 antenatal singleton pregnancies of >15 weeks of gestation, observed significant correlation between placental thickness and Femur Length with gestational age from 21st to 25th week & early 3rd trimester. Their study showed fairly linear relationship between placental thickness and Femur Length with gestational age and provides an accurate parameter for estimating fetal gestational age especially from 21st to 25th week. It also showed linear growth pattern between placental thickness and bipareital diameter in from 21st to 25th week and early 3rd trimester. They concluded as PT is a reliable parameter in assessment of gestational age in cases of unknown LMP.

Bipareital diameter (BPD) correlated well with GA from 12 – 24 weeks except for 12th, 16th & 22nd week which showed negative correlation with decrease in thickness which was less than 1mm. Head circumference (HC) correlated well with GA from 12 – 24 weeks except for 12th, 16th, 23rd & 24th week which showed negative correlation with decrease in thickness which was less than 1mm. Abdominal circumference (AC) correlated well with GA from 12 – 24 weeks except for 19th, 22nd & 24th week which showed negative correlation with decrease in thickness which was less than 1mm. Femur length (FL) correlated well with GA from 12 – 24 weeks except for 14th week which showed negative correlation with decrease in thickness which was less than 1mm.

In the study conducted by Aditi tiwari et al,^[12] which showed placental thickness was higher by 1-4 mm than the GA upto 21 weeks, later from 22 weeks it was lower by 1- 2 mm. In our series also we have

come across similar situation and observed placental thickness (PT) was directly matching the gestational age (GA), bipareital diameter (BPD), head circumference (HC), abdominal circumference (AC) & femur length (FL) with variation of less than 1 mm except in few weeks of gestation which was correlating with Aditi tiwari et al,^[12] from 22 to 24 weeks of gestation.

In our study we concluded that the placental thickness was correlating well with the GA, BPD, AC, HC & FL, with the placental thickness almost matching the gestational weeks with variation of less than 1 mm in diameter.

The present study assessed the relationship of placental thickness (in mm) with ultrasonographic evaluation of gestational age (in weeks) in second trimester (12 to 24 weeks). The study showed that the placental thickness (in mm) correlated with increasing gestational age (in weeks) in a linear & direct fashion, almost matching the gestational age from 12 to 24 weeks of gestation.

CONCLUSION

In our study placental thickness correlated well with the gestational age, BPD & FL in second trimester (12 to 24 weeks) which was linear and direct.

Placental thickness (in mm) is correlating well with estimated gestational age (in weeks) from 12 to 24 weeks of gestation.

The relationship of Placental thickness with bipareital diameter (BPD) is matching from 12 to 24 weeks of gestation.

The relationship of Placental thickness with femur length (FL) is matching from 12 to 24 weeks of gestation.

The thickness of the placenta and its growth pattern did not vary relative to the placental location.

REFERENCES

1. DC Dutta. Textbook of Obstetrics. 8th edition. Konar H, editor. New Delhi: Jaypee Brothers Medical Publishers Private Ltd; 2015. 106 p.
2. Mary E. Norton, Scoutt L, Feldstein VA. Ultrasonography in Obstetrics and Gynaecology. 5th ed. Callen P W, editor. Philadelphia, PA: Elsevier, a division of Reed Elsevier India Limited; 2002. 225–65 p.
3. Daftary SN, Chakravathi S. Holland and Brews- Manual of obstetrics. 16th ed. New Delhi: B.I Churchill Livingstone Pvt Ltd; 1998. 23-32 p.
4. Elsayes KM, Trout AT, Friedkin AM, Liu PS, Bude RO, Platt JF, et al. Imaging of the placenta: a multimodality pictorial review. Radiographics. 2009;29(5):1371–91.
5. Cunningham FG, Leveno KJ, Bloom SL, Hauth JC. Williams obstetrics. 22nd ed. New York, NY: McGraw Hill; 2005. 36-38 p.
6. Mumal N, K SP, Urmila S, Anita R, MehrotraSeema. Ultrasonographic measurement of placental thickness and its correlation with gestational age – a cross-sectional ultrasonographic study . Int J Adv Res. 2014;2(6):354–60.
7. Modn JJ, Revs R. Placental thickness as a sonological parameter for estimating gestational age. 2015;653–6.
8. Kaushal L, Patil A, Kocherla K. Evaluation of placental thickness as a sonological indicator for estimation of gestational age of foetus in normal singleton pregnancy. Int J Res Med Sci. 2015;3(5):1213.
9. Adhikari R, Deka PK, Tayal A, Chettri PK. Ultrasonographic Evaluation of Placental Thickness in Normal Singleton Pregnancies for Estimation of Gestation Age. Int J Med Imaging. 2015;3(6):143–7.
10. preeti baghel. Correlation of Placental Thickness Estimated by – Ultrasonography with Gestational Age and Fetal Outcome. Indian J Neonatal Med Res. 2014;3(3):19–24.
11. Natwar Lar Agrawal . Comparative study between placental thickness and Femur Length for estimation of gestational age of fetus by real time ultrasonographic measurement . Indian J Appl Res. 2015;5(12):299–300.
12. Tiwari A, Chandnani K. A study to evaluate gestational age with the help of placental thickness. Int J Reprod Contraception, Obstet Gynecol. 2013;2(4):503.