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ORIGINAL ARTICLE

ULTRASONOGRAPHIC MEASUREMENT OF PLACENTAL THICKNESS AND ITS CORRELATION WITH GESTATIONAL AGE AND FETAL WEIGHT

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ABSTRACT

Introduction: *Placental thickness (PT) plays vital role when the menstrual age is not known. The present study was undertaken to calculate the Placental thickness at level of insertion of umbilical cord and correlate it with gestational age and fetal weight, subsequently establishing a nomogram for Placental thickness at different age of gestations.*

Materials and Methods: *A total of 300 antenatal women from 12 to 40 weeks of gestation with singleton pregnancy and with no high-risk factor were included in the study from October 2021 to July 2022. Ethical approval was taken from institutional review committee (Ref. F-NMC/541/078-79). A detailed history was taken from all the patients. Basic antenatal investigations, clinical and ultrasonography examination were done.*

Result: *In present study the mean age group of pregnant women was 23.92 ± 4.456 years with mean age of gestation to be 28.18 ± 7.450 weeks. Most common location of placenta is found to be Anterior (32%). There is very strong correlation between placental thickness with gestational age r=0.987 and estimated fetal weight r=0.873. P-value was 0.001 in both.*

Conclusion: *Ultrasonographic measurement of Placental thickness, gestational age and estimated fetal weight play a vital role in antenatal care. Thus, with advancing gestational age; placental thickness measurement can be an additional tool to determine gestational age and fetal weight. Any deviation from normal value can prompt to any developing abnormalities.*

Keywords: *Nomogram gestation, Placental thickness, Ultrasonography, Umbilical cord.*

INTRODUCTION

Knowledge of gestational age and estimated fetal weight are important as they provide vital information regarding the condition of the fetus which directly helps in optimizing the management during the course of pregnancy.[1] The placenta is a fetal organ of pregnancy, responsible for providing metabolic, endocrine and immunological function. Development of placenta occurs from chorionic villi at the implantation site at about the fifth week of gestation and at the end of tenth week the granular echotexture of placenta can be visualized on ultrasonography.[2] Ultrasound is a safe, inexpensive and easily available method for evaluation of both the fetus and placenta.[3] The most important parameters used to evaluate a pregnancy are the BPD, HC, AC and FL. These parameters are considered 'gold standard' as they assess the GA with highest degree of accuracy in conjunct.[4] Wolfson et al. found biparietal diameter not a reliable parameter in the fetuses with premature rupture of the membranes.[5] Nyberg and Finberg suggested an alternative method in such cases to measure placental thickness which is corresponding to the gestational age.[6] Various changes in the placenta during mid-pregnancy

specifically during 17-20 weeks match up well with the fetal development and can help in detecting fetal abnormality as per studies.[7] Campbell S studied that the placental parameters can help in identification of conditions like small for GA and intra uterine growth retardation thus helping in early intervention.[8]

MATERIALS AND METHODS

This is a prospective hospital based Cross-sectional type of study conducted in the Department of Radio-Diagnosis in collaboration with Department of Obstetrics and Gynecology, National Medical college and teaching hospital, Birgunj, Nepal from October 2021 to July 2022. Ethical approval was taken from institutional review committee (Ref. F-NMC/541/078-79). Subject with known obstetrical and medical complication were excluded from the study and inform consent was obtain from all the participants.

A total of 300 pregnant women with normal singleton pregnancies were recruited. All the subjects were apparently healthy at the time of the study.

The patients were scanned by Medison Sonace R7, Canon Xario 100, Canon Xario 200 and Canon Aplio 300 USG machines with 3-5 MHz curvilinear transducer. All the patients were scanned with a moderately distended bladder in supine position. The transducer was placed on the skin surface after applying the couple agent. The placental thickness in mm was measured at the level of umbilical cord insertion site. The transducer was oriented to scan perpendicular to both the chorionic and basal plates as tangential scan will distort the measurement of the thickness of the placenta. All others routine parameters were also measured.

Estimated gestational age and fetal weight were computed by the ultrasound machine based on Hadlock tables by inbuilt computation software.

The Statistical software SPSS 25.0 was used for the analysis of the data with Microsoft word and Excel were used to generate graphs, tables etc. The data was analyzed by calculating the descriptive statistics such as mean and SD for continuous variables. The Pearson's Correlation (r value) was carried out to show the Correlation between gestational age vs placenta thickness and expected birth weight vs placental thickness. P-value ≤0.05 was considered as statistically significant.

RESULT

A total of 300 healthy pregnant women were enrolled in our study with mean age of mother 23.92± 4.456 years and mean gestational age 28.18±7.450 weeks. [Table 1] The placenta was found anterior in location in 96 cases [32.0%], posterior in 83 cases [27.7%] fundal in 71 cases [23.7%] and lateral in 50 cases [16.7%]. Mean placental thickness and estimated fetal weight between 12-40 weeks of gestation were 29.937±5.499 mm and 1532.36±1080.537 mm respectively. [Table 2] Comparison between gestational age with various routine parameter done with p-value =0.001. [Table 3] There was very strong correlation between placental thickness and gestational age with r=0.987, P=0.001 and estimated fetal weight with r=0.873, P=0.001. [Table 4]

Table 1: Frequency and percentage of mother age and gestational age

S.N.	Age	Categories	Frequency (n=300)	%	Mean ± SD
1	Mother Age (years)	< 20	31	10.3	23.92 ± 4.456
		20-24	161	53.7	
		25-29	64	21.3	
		30-35	31	10.3	
		> 35	13	4.3	
2	Gestational Age (week)	≤ 20	57	19.0	28.18 ± 7.450
		21-25	56	18.7	
		26-30	45	15.0	
		31-35	85	28.3	
		36-40	57	19.0	

Table 1 show that means mother age was 23.92 years and gestational age was 28.18 weeks. The majority of mothers belonged to 20-24 years age group and 31-35 weeks gestational age in this study.

Graph: Distribution of Placenta location

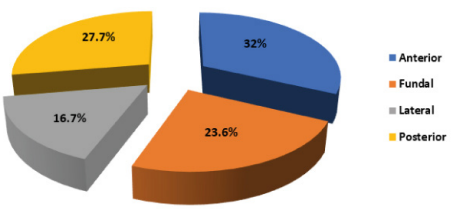

Figure 1: shows that the majority of placenta location belonged to 32.0% anterior, 27.7% posterior, 23.7% fundal, and 16.7% lateral in this study.

Table 2: Descriptive statistics of placental thickness and estimated fetal weight with gestational age wise

SN	Gestational Age (week)	Frequency (n=300)	placental thickness (mm)	estimated fetal weight (gm)
1	12	2	15.035 ± 0.587	56 ± 2.828
2	13	2	17.050 ± 0.283	74.50 ± 3.536
3	14	7	18.246 ± 0.286	84 ± 5.745
4	15	9	18.838 ± 0.259	116.67 ± 7.906
5	16	8	19.809 ± 0.432	141.38 ± 5.344
6	17	7	21.567 ± 0.492	180.14 ± 9.856
7	18	2	22.585 ± 0.431	225.23 ± 21.213
8	19	9	23.793 ± 0.504	287.33 ± 30.745
9	20	11	24.359 ± 0.249	338.45 ± 15.674
10	21	15	25.549 ± 0.537	424.34 ± 28.782
11	22	8	26.792 ± 0.481	481.50 ± 33.836
12	23	14	27.567 ± 0.369	556.50 ± 31.117
13	24	8	27.766 ± 0.391	658.50 ± 33.628
14	25	11	28.024 ± 0.211	765.45 ± 22.362
15	26	9	28.602 ± 0.399	897.11 ± 28.396
16	27	5	29.394 ± 0.087	1056.60 ± 30.517
17	28	12	29.927 ± 0.255	1176.83 ± 36.199
18	29	9	30.658 ± 0.353	1329.22 ± 53.542
19	30	10	30.813 ± 0.464	152643 ± 46.705
20	31	10	32.079 ± 0.920	1688.80 ± 75.489
21	32	17	32.690 ± 0.508	1884.29 ± 75.235
22	33	15	33.424 ± 0.562	2102.20 ± 88.010
23	34	16	34.385 ± 0.387	2358.75 ± 102.487
24	35	27	34.852 ± 0.648	2536.07 ± 126.283
25	36	24	35.275 ± 0.542	2850.29 ± 84.348
26	37	15	35.925 ± 0.364	3075.47 ± 102.753
27	38	12	36.512 ± 1.053	3334.08 ± 121.436
28	39	1	35.970 ± 0.384	335700 ± 101.867
29	40	5	38.560 ± 0.546	3547.20 ± 15.912
30	Total		29.937 ± 5.499	1532.36 ± 1080.537

Table 2 shows that mean placental thickness and mean fetal weight was increasing based on increasing gestational age. Minimum mean placental thickness was 15.035 mm at 12 weeks gestational age and maximum was 38.56 mm at 40 weeks gestational age. Minimum mean fetal weight was 56 gm at 12 weeks gestational age and maximum mean fetal weight was 3547.20 gm at 40 weeks gestational age.

Table 3: Descriptive statistics of BPD, HC, AC and FL with gestational age wise

Gestational Age (week)	Frequency (n=300)	BPD (Mean ± SD)	HC (Mean ± SD)	AC (Mean ± SD)	FL (Mean ± SD)
<20	57	3.635 ± 1.081	13.807 ± 3.974	11.584 ± 3.753	2.391 ± 0.966
21-25	56	5.623 ± 0.753	21.132 ± 2.548	18.398 ± 2.719	4.116 ± 0.740
26-30	45	7.042 ± 0.448	26.160 ± 1.468	23.922 ± 1.507	5.296 ± 0.469
31-35	85	8.275 ± 0.394	30.187 ± 1.132	29.101 ± 1.563	6.491 ± 0.350
36-40	57	9.118 ± 0.309	32.323 ± 3.997	32.700 ± 1.330	7.260 ± 0.243
P-value*		0.001	0.001	0.001	0.001

*One way ANOVA test used at 5% level of significance

Table 3 shows that comparison between gestational age group and there was statistical significance comparison between gestational age and BPD with p=0.001, HC with p=0.001, AC with p=0.001, and FL with p=0.001. All clinical factors had been increased in gestational age group wise. As gestational age increased all other clinical factors means values had increased.

Table 4: Correlation between placental thickness with gestational age and estimated fetal weight

SN	Variables	Placental thickness Correlation coefficient (r)	P-value
1	Gestational Age	0.974	0.001
2	Estimated fetal weight	0.873	0.001

Table 4 shows that there was statistical significance correlation between placental thickness with gestational age and estimated feral weights with p=0.001. There was very strong correlation between placental thickness and gestational age with r=0.974 and estimated fetal weight with r=0.873. Placental thicknesses always change when gestational age and fetal weight will be changed.

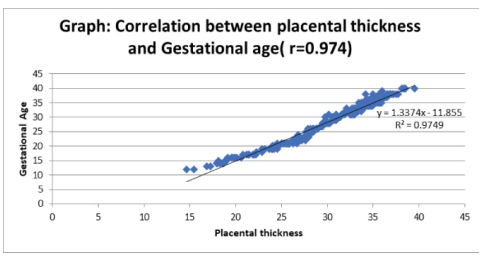

Fig 2: Correlation between placental thickness and gestational age.

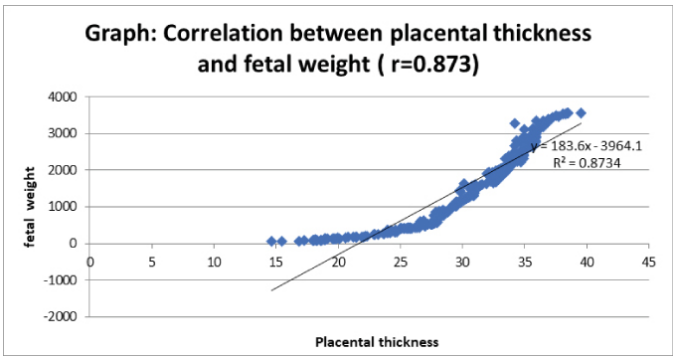

Fig 3: Correlation between placental thickness and estimated fetal weight.

DISCUSSION

Prenatal investigations play an important role for the identification of various parameters related to the growth and development of the fetus. These parameters were very difficult to understand before the advent of various diagnostic techniques. One of the biggest boons for prenatal diagnosis and management that has been widely used at present time is ultrasonography. One such important parameter to see in prenatal ultrasound is Placenta. Long back examination of placenta was just associated with its retrospective examination. Appropriate functioning of placenta and formation of its structure is very necessary for development of normal healthy fetus and subsequently with a normal birth weight.[9]

In our study Anterior Placenta (32.0%) was the most common location followed by posterior (27.7 %) and fundal (23.7%) which is similar with other studies done by Ahmad et al.[10]

Placental thickness appears to gradually increase with gestational age in a linear fashion (~ 1 mm per week), thus the thickness in mm can approximate the gestational age (in weeks).[11]

In our study the relationship between placental thickness and gestational age was found to be linear. Similar findings were reported by Naik et al[12] and Ahmad et al[13] in 2020.

Naik et al studied that the placental thickness increased with the increase in gestational age and increase in thickness was observed in different participants presenting in different trimesters i.e. week 12 to 39.

In first trimester i.e. 12th week the mean placental thickness was 15.035 ± 0.587 which reached 17.050 ± 0.283 at 13th week. In 2nd trimester the placental thickness was observed to be 18.246 ± 0.286 at earliest i.e. 14th week and reached to the thickness of 28.602 ± 0.399 at the end of 2nd trimester i.e. 26th week. The placental thickness in the start of 3rd trimester i.e. 27th week was observed to be 29.394 ± 0.087 which increased to 38.560 ± 0.546 at 40th week. An increase of 15 mm in the thickness of placenta was observed in 1st trimester, increase of 13 mm in thickness of placenta was observed in 2nd trimester whereas in 3rd trimester the increase in placental thickness was observed to be 10 mm. This indicated that the growth rate of placenta was fastest in 1st trimester and it slowed down in 3rd trimester.

In study done by Noor N et al[14] found that The Pearson's correlation coefficient between the two parameters was 0.982, proving the significant positive correlation between placental thickness and estimated fetal birth weight. Thus, justifying the corresponding increase in placental thickness with the estimated fetal birth weight (p-value <0.001) which is similar to our study i.e. r- 0.873 and p value 0.001.

In 211 pregnant women of South India Karthikeyan et al[15] observed and concluded that placental thickness to be a good predictor of the gestational age between 11–40 weeks and on correlating both the parameters there appeared to be linear correlation with a Pearson's correlation coefficient of r = 0.968, which is similar to our study gestational age was r-0.974 and p value 0.001.

In our study mean placental thickness was found to be 29.937±5.499. Similarly in a study conducted by Azagidi et al[16]. On 400 women found a mean placental thickness of 29.6 ± 7.1 mm with a significant positive correlation (Pearson's coefficient of 0.943) between placental thickness and fetal gestational age which imply to use placental thickness as a marker for predicting gestational age.

Prompt diagnosis of any ongoing pathology in placental morphology in the early gestational period helps to guide the management of the patient more accurately.[17]

The result of this study shows a strong positive correlation

between placental thickness with gestational age and estimated fetal weight. So, in few exceptional cases doubt of any parameter like BPD, AC and FL, gestational age and fetal weight can be assigned by placental thickness.

CONCLUSION

Ultrasonographic measurement of estimated fetal weight, gestational age and placental thickness plays vital role in antenatal care. Placental thickness could be very well correlated with gestational age and fetal weight in our study. Thus, with advancing gestational age; placental thickness measurement can be an additional tool to determine gestational age and fetal weight. The linear correlation and statistical compatibility of placental thickness in determination of gestational age and fetal weight. Any deviation from normal value can prompt to any developing abnormalities.

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