VOLUME-7, ISSUE-6, JUNE-2018 • PRINT ISSN No 2277 - 8160

Original Research Paper

Radiology

EVALUATION OF ULTRASOUND PARAMETERS TO STUDY CORRELATION BETWEEN PLACENTAL THICKNESS MEASUREMENT FOR ESTIMATING FETAL GESTATIONAL AGE AND WEIGHT IN 2nd & 3rd TRIMESTERS.

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ABSTRACT

Accurate knowledge of the fetal gestational age is crucial for optimum antepartum care as well as successful deliveries of the babies. It is not only important for deciding about when a complicated pregnancy can be terminated but also for carrying out various diagnostic procedure which needs to be performed within a specific window of gestational age. While fetal biometry is being widely used for estimation of gestational age and fetal weight alternative means like measurement of placental thickness may be used for confirmation of gestational age and fetal weight when in doubt in situations like wrong dates or differentiate from at risk gestation-IUGR. We conducted this study to find out whether placental thickness can be used for estimation of gestational age and fetal weight in second and third trimester.

Materials And Methods: This was a retrospective observational study in which 101 pregnant women in their second and trimester were included on the basis of a predefined inclusion and exclusion criteria. Gestational age and fetal weight was determined on the basis of bio-physical parameters. The placental thickness was measured at the level of umbilical cord insertion and maximum thickness was noted in the cross section. Statistical analysis was done using SSPE 16 software. P value less than 0.005 was taken as statistically significant.

Results: In this study of 101 women the mean age was found to be 27.94 +/- 5.9 years. There was a linear relationship between gestational age and placental thickness and Placental thickness and fetal weight. A placental thickness of more than 30 mm was found to be associated with a fetal weight of more than 2000 kg. The mean placental thickness, mean fetal weight and mean gestational age was found to be 24.96mm, 959.40 gms and 24.03 weeks respectively. The mean placental thickness was found to be having a linear relationship with fetal weight and gestational age and statistical association between placental thickness and fetal weight as well as gestational age was found to be highly significant ($P < 0.0001$).

Conclusion: There is a strong linear relationship between placental thickness and fetal weight as well as gestational age in second and third trimester. The relation was found to be statistically highly significant.

KEYWORDS : Placental thickness, Second and third trimester, fetal weight, gestational age.

Introduction:

Accurate knowledge of the gestational age is crucial for optimum antepartum care as well as successful deliveries of the babies. The biggest question faced by treating obstetrician in relation to induction of labor is whether continuing a pregnancy complicated by maternal (pre-eclampsia/eclampsia) or fetal (fetal distress) complications will outweigh the risk of a premature delivery[1]. As it is well known that premature deliveries are fraught with the danger of neonatal hypoglycemia, hypothermia, hyaline membrane deficiency due to surfactant deficiency, intracranial hemorrhage and hypoxic ischemic encephalopathy[2]. In this situation the importance of accurately measuring gestational age can not be overemphasized. In addition to making a decision about termination of pregnancy or induction of labor gestational age is also important in deciding whether the levels of certain biological markers (HCG, Alfa fetoprotein, estrogen and progesterone) are appropriate or abnormal for that particular gestational age[3]. Knowing the values of these biological markers without accurately knowing the gestational age is of no use because the levels of these markers change according to gestational age. Moreover, there are certain procedures and investigations (chorionic villous sampling, amniocentesis and glucose tolerance test for gestational diabetes) which needs to be done in window of specific gestational age and hence determination of gestational age is also crucial for correctly performing these tests[4].

Determination of gestational age from the date of last menstrual period is not reliable. Moreover, many patients are unable to recall their LMP while some others may not be knowing LMP because of irregular menstrual cycles. Hence accurate measurement of it by ultrasound examination becomes an important part of obstetric and radiology practice[5]. In early pregnancy (up to 12 weeks) crown to rump length can be used for estimation of gestational age and in 2nd and 3rd trimester parameters like head circumference (HC), biparietal diameter (BPD) abdominal circumference (AC) and femur length (FL)[6]. The limitations of estimation of gestational age by these parameters depends upon the skill of radiologist, proper position of the fetus and amount of liquor. Moreover, there are situations when there is discrepancy in various parameters used for estimation for gestational age and various pathologies affect parameters which are routinely used for determination of gestational age[7]. A classic example would be reduced abdominal circumference in case of IUGR or reduced femur length in cases of skeletal dysplasia.

All these factors point towards the fact that there is a need to have some alternative method, other than usual fetal biometry, of determination of gestational age which may be used to confirm the gestational age in selected cases[8]. Since placenta is closely related to fetus and the mother it is reflective of conditions related to mother as well as the fetus[9]. Various studies have found that the placental thickness not only reflects the gestational age of the baby but also may be used for diagnosing conditions such as IUGR (placental thickness < 25mm) or gestational diabetes (Placental thickness > 40mm)[10].

We conducted this retrospective observational study of pregnant women in their 2nd and 3rd trimester to assess relationship of placental thickness with the gestational age & weight as determined by fetal-biometry.

Materials And Methods:

This was a retrospective observational study done at Diagnostic Radiology Clinic. 101 Pregnant women who were referred for Level II obstetric ultrasound scan (in their 2nd and 3rd trimester) performed on premium segment ultrasound-color-Doppler machine; with inbuilt standard Reference fetal-growth charts incorporated software were used for evaluation, were included in this study. Patients were included in this study after taking their informed consent and depending upon a predefined inclusion and exclusion criteria. Previous scans, if already done, were referred to and any abnormality detected in previous scan was noted down. Routine obstetric scan was performed to rule out congenital anomalies using a transabdominal scanner with patients in supine position and with full bladder. Gestational age was determined on the basis of bio-physical parameters like head circumference, bi-parietal diameter, abdominal circumference, humeral length and femur length. The placental thickness was measured at the level of umbilical cord insertion and maximum thickness was noted in the cross section.

Statistical analysis was done using software SSPS 16.0. Microsoft office was used for preparation of charts and graphs. P value less than 0.05 was taken as statistically significant.

Inclusion criteria:

1. Patients giving informed consent.
2. Patients in their II and III trimesters of pregnancy.
3. No known maternal and fetal chromosomal /structural abnormalities.
4. No history of pregnancy induced hypertension, pre-eclampsia, maternal diabetes, overt thyroid problems.

Exclusion criteria:

1. Pregnant females not knowing their LMP.
2. Patients with irregular menstrual cycle.
3. First trimester gestations, twins and those with adverse pregnancy outcomes during study period.
4. Known fetal or maternal structural/chromosomal anomalies, factors severely affecting study parameters or outcomes.

Results:

In this study of 101 women the mean age was found to be 27.94 +/- 5.9 years. The most common age group of the studied cases was found to be 21-25 years (55.44%) followed by =< 20 years (21.78%) and 26-30 years (20.79%).

Table 1: Age Distribution of the studied cases.

Age	N	%
=/<20 years	22	21.78 %
21-25 years	56	55.44 %
26-30 years	21	20.79 %
> 30	2	1.98 %
Total	101	100 %

The distribution of the cases on the basis of whether they belonged to second or third trimester showed that out of 101 cases 72 (71.28%) patients belonged to second trimester while 29 patients (28.71%)belonged to 3rd trimester.

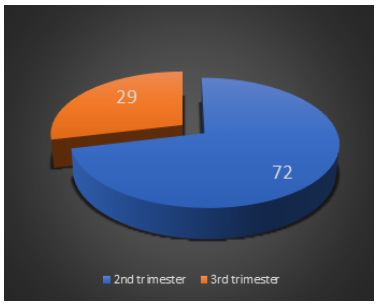

Figure 1: Gestational age (2nd or 3rd trimester) of the studied cases.

Out of 101 studied cases 62 women were primigravida, 30 patients were second gravida, 6 patients were 3rd gravida and remaining 3 patients were 4th gravida.

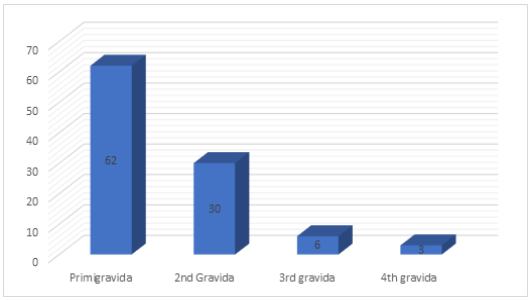

Figure 2: Details of studied cases in terms of gravidity.

The analysis of placental thickness and its correlation with gestational age showed there was a linear relationship between gestational age and placental thickness. With advancing gestational age there was a gradual increase in the placental thickness. One of the important finding noted was that the placental thickness didn't vary with the location of placenta and placental thickness was independent of placental location.

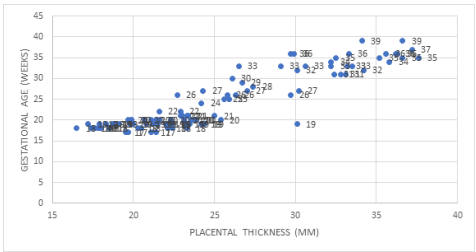

Figure 3: Correlation between placental thickness and gestational age.

The analysis of placental thickness and fetal weight as determined by fetal biophysical profile showed that there was a linear correlation between placental thickness and fetal weight. A placental thickness of more than 30 mm was found to be associated with a fetal weight of more than 2000 kg.

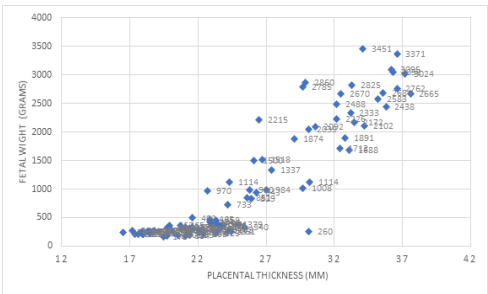

Figure 4: Correlation between placental thickness and fetal weight.

The mean placental thickness and mean fetal weight for each gestational age was found out along with standard deviation. There was a linear relationship in between mean placental thickness and mean fetal weight as well as gestational age. Increase in placental thickness was found to be associated with increase in gestational age and fetal weight.

Table 2: Mean Placental thickness at different gestational ages.

Gestational age (weeks)	No of Patients	Mean Placental thickness (in mm)	Mean Fetal weight (in grams)
17	4	20.43 +/ -0.92	184 +/- 8.98
18	13	19.29 +/- 2.18	223.7 +/- 14.6
19	24	21.2 +/- 2.86	270+/- 19.89
20	14	22.16 +/- 1.80	342.1 +/- 22.81

21	5	23.52 +/- 0.85	410.2 +/- 32.06
22	2	22.25 +/- 0.75	478.5 +/- 15.59
23	-	-	-
24	1	24.2	733
25	2	25.75 +/- 0.17	840 +/- 12.7
26	4	26.13 +/- 2.86	975.3 +/- 26.85
27	3	27.63 +/- 2.58	1053 +/- 70.74
28	1	27.4	1337
29	1	26.7	1518
30	1	26.1	1500
31	3	32.83 +/- 0.30	1751 +/- 94.33
32	2	32.15 +/- 2.362	2071 +/- 36.37
33	6	30.85 +/- 2.69	2152 +/- 157.2
34	2	34 +/- 2.07	2463 +/- 28.87
35	4	35.48 +/2.21	2670 +/- 73.16
36	6	33.5 +/- 3.06	2884 +/- 159.1
37	1	37.2	3024
39	2	35.35 +/- 1.44	3411 +/- 46.19

The mean placental thickness was found to be 24.96 mm while mean fetal weight was found to be 959.40. The statistical analysis of placental thickness and fetal weight showed that the value of R (Pearson coefficient) was 0.9064 indicating a strong positive correlation which means increase in placental thickness was strongly associated with increased fetal weight. The coefficient of determination (R^2) was found to be 0.8216. By appropriate statistical analysis (Sperman's rank correlation coefficient) the association between placental thickness and fetal weight was found to be statistically highly significant.

Table 3: Association of Placental thickness and fetal weight.

		R	R^2	P
Mean Placental Thickness (mm)	24.96	0.90	0.82	P < 0.0001 Significant
Mean Fetal Weight (weeks)	959.40			

The analysis of correlation between placental thickness and gestational age showed that the mean placental thickness was 24.96. statistical analysis of placental thickness and gestational age showed that the value of R (Pearson coefficient) was 0.9141 indicating a strong positive correlation which means increase in gestational age was strongly associated with increase in placental thickness. the coefficient of determination (R^2) was found to be 0.8356. By appropriate statistical analysis (Sperman's rank correlation coefficient) the association between placental thickness and gestational age was found to be statistically highly significant.

Table 4:Association of Placental thickness and gestational age.

		R	R^2	P
Mean Placental Thickness (mm)	24.96	0.91	0.83	P < 0.0001 Significant
Mean Gestational Age (weeks)	24.03			

Discussion:

Placenta is vital to pregnancy and is an important materno-fetal organ. It has the vital function to provide nutrition and oxygen. The common method of estimation of gestational age and weight of the fetus consist of fetal biometry which takes into consideration the factors such as crown to rump length, biparietal diameter, head circumference, abdominal circumference, humeral length and femur length depending upon the gestational age of the fetus[11]. In some cases, estimation of these parameters may be erroneous due to presence of pathologies such as intrauterine infections, IUGR fetus and fetuses with skeletal dysplasias. In all these situations fetal biophysical profile may not reflect the true gestational age and weight of the baby. Estimation of placental thickness for estimation of gestational age and fetal weight had been a topic of interest amongst many researchers and many randomized controlled trials has been conducted to know whether placental thickness can be used for estimation of gestational age and fetal weight[12].In our study we found that placental thickness has a linear relationship with gestational age of fetus and gestational age advances there is a gradual increase in the thickness of placenta irrespective of the site of placenta. We found that there is strong correlation between placental thickness and gestational age. Similar findings were reported by Jain A et al who reported that placental thickness correlates well with gestational age and can be used for determination of gestational age[13].

Estimation of fetal weight is crucial as low birth babies are at risk of development of morbidities such as hypoglycemia, hypothermia and sepsis. They many times face difficulty in accepting feeds and may need NICU care and parenteral feeding. Unfortunately, many times these babies are not identified antenatally. Measurement of placental thickness can be used for estimation of fetal weight in second and third trimester. Afrakhteh M et al conducted a prospective study of 205 women and measured placental thickness and fetal weight in all the patients. The authors found that birth weight has a positive correlation with both second and third trimester placental thickness[14]. Similar findings were seen in studies conducted by Mathai BM et al[15] and Ahn KH et al et al[16].

Mital P et al measured placental thickness at the insertion of the umbilical cord, as a parameter for estimating gestational age of the fetus. The ultrasound study was conducted on 600 normal antenatal women of all gestational ages. After estimating the fetal age by CRL, BPD, HC, AC, and FL, the placental thickness with standard deviation was calculated for all gestational ages. It was observed that the placental thickness gradually increased from 15 mm at 11 weeks of gestation to 37.5 mm at 39 weeks. From the 22nd week to the 35th week of gestation the placental thickness coincides almost exactly with the gestational age in weeks. The authors concluded that the measurement of the placental thickness was an important parameter for estimation of fetal age along with other parameters especially in the late mid trimester and early third trimester, where the exact duration of pregnancy was not known[16]. Similar strong correlation between placental thickness and gestational age was reported by authors like Karthikeyan et al[17] and et Agwuna KK et al[18]. In addition to estimation of gestational age and fetal weight the placental thickness can also be used for predicting fetal and adverse pregnancy outcome as reported by Raio L[19] and Ichito Miwa[20] et al respectively.

Conclusion: -

The placental thickness is found to have a linear correlation with gestational age and fetal weight and the association between these parameters have been found to be highly statistically significant. The estimation of placental thickness can be extremely helpful in determining gestational age and fetal weight specially in second and third trimester in cases where the duration of pregnancy is not reliably known.

Conflict Of interest: None.

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