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RESEARCH ARTICLE

Ultrasonographic measurement of placental thickness and its correlation with gestational age – a cross-sectional ultrasonographic study.

Mumal Nagwani[1], P.K. Sharma[2], Urmila Singh[3], Anita Rani[4], Seema Mehrotra[5],

1. Assistant Professor, Department of Anatomy, Era's Lucknow Medical College, U.P., India
2. Professor, Department of Anatomy, King George's Medical University, Lucknow, U.P., India
3. Professor, Department of Obs & Gyne, King George's Medical University, Lucknow, U.P., India
4. Professor, Department of Anatomy, King George's Medical University, Lucknow, U.P., India
5. Associate Professor, Department of Obs & Gyne, King George's Medical University, Lucknow, U.P., India

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Corresponding Author

Dr. Mumal Nagwani

Abstract

Introduction: Determination of placental size is a part of the overall assessment of intrauterine environment. Placental growth can be estimated by either measuring the thickness or estimating its volume. Placental thickness is directly related to the gestational age of the foetus till certain weeks of pregnancy. Thus, thickness can be used to determine the gestational age rather than using the BPD,AC,HC and FL.

Objectives: The purpose of the present study was to determine the normal range of placental thickness in our population in third trimester of pregnancy and its correlation with gestational age of the foetus.

Methods:100 cases were recruited for the study who came for routine antenatal checkup to Department of Obstetrics and Gynecology at Queen Marry's Hospital, King George's Medical University, Lucknow. Subjects who had any obstetrical, gynecological, medical and surgical illnesses were excluded. Placental thickness was measured at the level of umbilical cord insertion by two dimensional ultrasonography.

Result: Mean thickness of the placenta was 3.90±1.1cm which increased till 38 weeks of gestation, thereafter decreased.

Discussion: It may give an indication of the amount of substances (nutrients, gases) that is exchanged between the foetus and the mother. Thin placenta may be due to intrauterine growth retardation, placental infarction and pregnancy with essential hypertention and pre-eclampsia. The thinnest placenta was 1cm in thickness and thickest placenta was 7.5cm in thickness and these were not associated with any maternal or fetal complications

INTRODUCTION

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 Gonadrotrophin, Alfa Foeto protein and the oestrogen and progestrone 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 .When an anomaly is detected, the interventional modality which is used, is influenced by the gestational age. Virtually, all the

important clinical decisions, which include caesarean section, elective labour induction, etc, depend on the knowledge of the gestational age. (Editor, 2002).

Ultrasonography (USG) is commonly used to estimate the gestational age by measuring the foetal dimensions like the Biparietal Diameter (BPD), the Abdominal Circumference (AC), the Head Circumference (HC) and the Femur Length (FL). An ultrasonograph is prone to observer bias, as it depends on the observers' technical skills. Also, the foetal parameters, the different techniques of measurement and the positional problems may diminish the accuracy of the gestational age estimation (Editor, 2002). Mitra et al. showed that the biparietal diameter was not reliable in the foetuses which had a premature rupture of the membranes (Mitra & Kumar, 1999). There are some drawbacks in those above said parameters in estimating the gestational age. So, there is a need of another parameter for supplementing the gestational age estimation with minimal error.

Placental size is expressed in terms of thickness in the mid-portion of the organ. In human beings, the placenta averages 22 cm (9 inch) in diameter and 2–2.5 cm (0.8–1 inch) in thickness with greatest thickness at the center and become thinner peripherally. Determination of placental size is a part of the overall assessment of intrauterine environment.

Placental thinning has been described in systemic vascular and hematologic diseases that result in micro infarctions. Thicker placentae are seen in fetal hydrops, ante partum infections, maternal diabetes, and maternal anemia. Placental thickness and volume have been used to predict chromosomal anomalies and diseases such as preeclampsia (Hafner et al, 2006)., thalassemia (Chen et al, 2006) and other complications of pregnancy (Kinare et al, 2000, Schuchter et al, 2001).

So, the purpose of this study was to collect the recent information regarding normal and variant placental thickness by ultrasonography in third trimester of pregnancy in our (Indian) population and its correlation with fetal age.

MATERIAL AND METHODS

The present prospective cross-sectional study was conducted on 100 pregnant women attending antenatal clinics in the Department of Obstetrics and Gynecology in collaboration with Department of Anatomy. Women with uncomplicated, singleton pregnancy of more than 26 weeks, who gave their written informed consent, were taken as subjects and the gestational age was confirmed by previous ultrasonography reports of first trimester. Exclusion criteria followed has been shown in Table 1.

Ultrasound examinations were performed in the department of Obstetrics and Gynecology with model LOGIQ^{TM} α 200 ultrasound machine and in the Department of Anatomy with the help of L&T Medical, Sonata (version 3.1) machine , with a curvilinear 3.5 –MHz with a curved array transducer.

Detailed history was taken to rule out medical and surgical illnesses which could affect our study. Thorough general physical and obstetrical examinations were done.

Scanning Technique: During scanning, the pregnant woman was made to lie in the supine position with the protruding abdomen facing upwards; the probe was placed on the skin and a layer of ultrasonic gel was applied to the skin above the pubic area. To rule out oligohydramnios and polyhydramnios, amniotic fluid volume was measured by taking Amniotic Fluid Index (AFI). AFI was obtained by adding the vertical lengths of deepest fluid pockets in four uterine quadrants (Jain et al, 2001). Adnexa were looked for the presence of any mass. Fetus was also seen for the presence of any major congenital anomaly. Fetal lie and position were identified by moving the probe all over the abdomen and following fetal parameters were taken to rule out intrauterine growth restriction - Biparietal diameter (BPD), Abdominal circumference (AC), Head circumference (HC), Femur length (FL) and Effective fetal weight (EFW). Fetal weight was calculated using the Shepard formula. (Shepard et al, 1987).

The placenta was identified as a hyper echoic area separated from fetus by a hypo echoic area of amniotic fluid.

The two edges of the placenta were focused in a single ultrasonographic field in transverse and longitudinal sections. The probe was moved all over the localized placenta and the level of cord insertion was identified over the fetal surface. A straight line was drawn from the level of cord insertion up to the maternal surface of the placenta and thus **thickness** (T) was measured **(**Fig.1), the maximum thickness was noted in the cross section. 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.

The comparison among >2 groups was done by one way analysis of variance or Kruskal Wallis test for normally distributed or otherwise respectively. Data were analyzed using statistical software package, STATA 11.2 and the difference was considered to be significant if 'p' value was found to be <0.05.

The ethical committee clearance was obtained from the Institution Ethical committee.

RESULTS

100 pregnant females belonging to third trimester gestational period were divided into four gestational groups. The different gestational groups and the number of subjects in each group has been shown in Table-2. The mean values of thickness of placenta were 3.56±0.8cm, 4.01±1.2cm, 4.05±1.3 and 3.73±0.8cm for each group of gestation respectively. Composite mean of thickness for all gestations was 3.90±1.1cms.The mean values showed the increasing trend of thickness uptill 38wks of gestation and thereafter decreased upto 42wks of gestation. The minimum thickness was 1.0cm and the maximum thickness was 7.5cm. As the p- value was non- significant (> 0.05), therefore no significant difference was observed in thickness of placenta among different gestational groups. (Table -3, Fig.2).

Table –1: List of maternal complications to exclude the subjects from study population.

Medical complications	Pregnancy induced hypertension, severe anaemia(Hb<7gm%), Diabetes mellitus, Tuberculosis, any heart disease.
Obstetrical complications	Congenital anomalous fetus, oligohydramnios and polyhydramnios, rupture of membranes, Rh negative mothers, history of vaginal bleeding 1 month before the study, intrauterine growth retardation.
Gynecological complications	Presence of fibroid, any adnexal mass.

Table -2: Distribution of study population according to gestational age .

Gestational age(wks)	No. of cases (n)	Percentage (%)
26 -30	21	21
30^{+} -34	26	26
34^{+} -38	41	41
38^{+} -42	12	12

Table –3: Distribution of Placental thickness according to gestational age in study population.

Gestational Age (wks)	No. of cases (n)	Thickness(cm) Mean± S.D.	Range (cm) (Min – Max)
26 – 30	21	3.56±0.8	2.2 – 5.5
30^{+} -34	26	4.01±1.2	2.3 – 6.4
34^{+} -38	41	4.05±1.3	1.0 -7.5
38^{+} -42	12	3.73±0.8	2.5 -5.7
Total	100	3.90±1.1	1.0 -7.5

Test used: Kruskal-Wallis. p= 0.3533
chi-squared with ties = 3.2599 with 3 d.f.

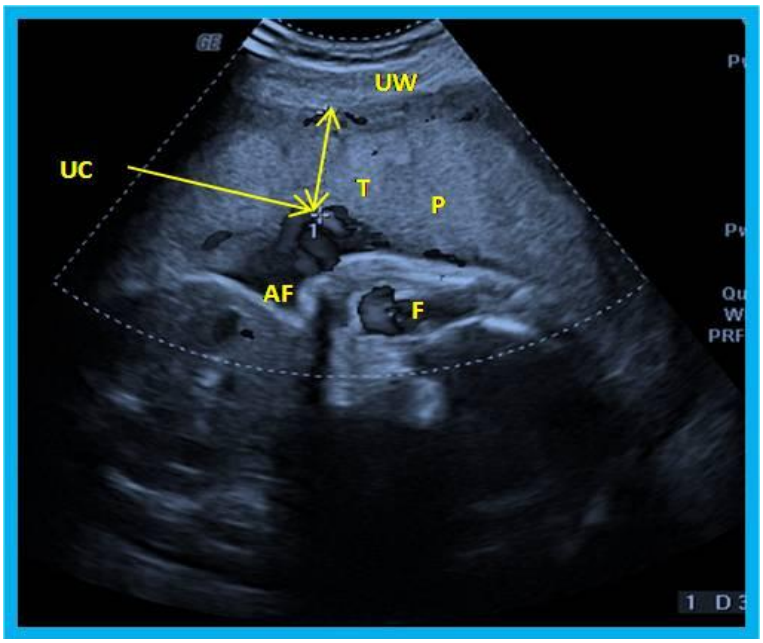

Fig.1. Ultrasonogram showing landmarks for measuring thickness of placenta. (P= Placenta, UW= Uterine wall, T= thickness of placenta, UC= Umbilical cord, AF= Amniotic fluid, F= Foetus).

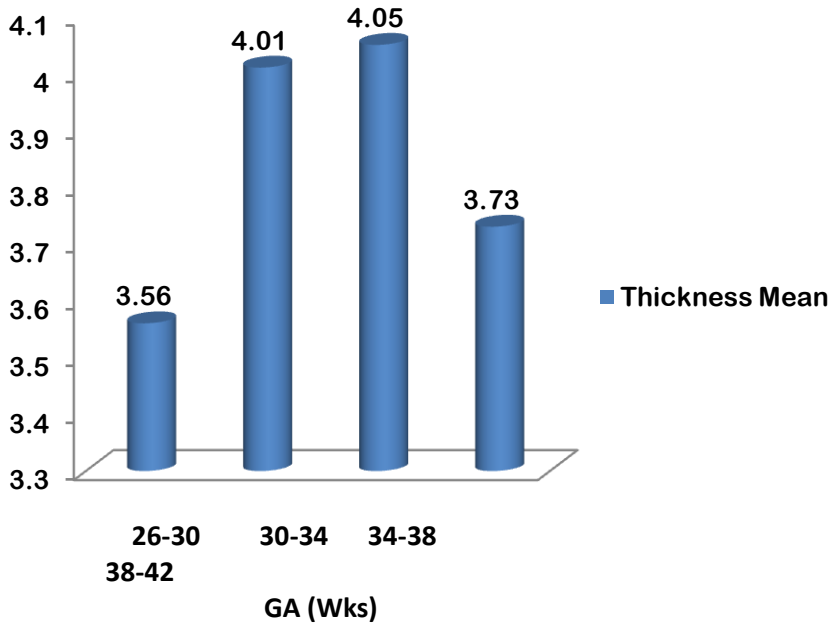

Fig.2. Bar diagram showing distribution of Placental thickness according to gestational age in study population.

DISCUSSION

The placenta is a foeto-maternal organ which forms a little later than the foetus; it nourishes and protects the foetus and it dies out after the delivery of the baby. Since it is closely related to the foetus and the mother, it acts like a mirror, reflecting the statuses of both the mother and the foetus. Kulman and Warsoff stated that a PT of < 25 mm at

term was associated with Intra Uterine Growth Retardation (IUGR) (Kunlmann et al, 1996). A placental thickness of > 40mm at term is associated with gestational diabetes, intra uterine infections and hydrops foetalis (Benrishke et al., 1998). La Torre opined that at no stage of the pregnancy placental thickness exceeded 40 mm indirectly, thus indicating the cut off value for the upper limit (La Torre et al, 1979). Among the pregnant women with CMV infections, the placental thickness was increased in about 93.3% of the subjects (Tongsong et al, 1999). In this study which was done on normal singleton pregnancies, the mean placental thickness of the corresponding gestational weeks was 3.9±1.1cms.

Placenta being a fetal organ shares the same stress and strain, to which the fetus is exposed. Thus any disease process affecting the mother and fetus also has a great impact on placenta. The thickness of the placenta may give indirect information on the foeto-placental ratio. It may give an indication of the amount of substances (nutrients, gases) that is exchanged between the foetus and the mother. Thin placenta may be due to intrauterine growth retardation, placental infarction and pregnancy with essential hypertention and pre-eclampsia. In the present study, the mean thickness of the placenta was 3.90 ± 1.1cm.These findings were comparable with the findings of Fawzia and Habib (Habib,2002) ; Meèëjus (Meèëjus, 2005) ; Appiah (Appiah ,2009) and Dudley et al. (Dudley et al., 1993), who also reported approximately similar placental thickness in the third trimester.

In the present study, we observed the thinnest placenta as 1cm in thickness, whereas thickest placenta was 7.5cm in thickness and these were not associated with any maternal or fetal complications. An increase in thickness of placenta was observed with progression of gestational age only up till 38 weeks, thereafter, surprisingly thickness of the placenta decreased. Hellman et al. (Hellman et al.,1970) , also accepted that the placenta becomes thinner in the last 4 weeks of gestation and explained that as the growth of the placenta does not take place beyond 37th week of gestation, thus any further placental growth must be resultant of increased surface area. He proclaimed that probably this could result into decrease in thickness of placenta. Grannum's et al. (Grannum's et al.,1979) , also found that placental thickness gradually decreases after 32 weeks of gestation and correlated this with the placental maturity.

Nyberg and Finberg (Nyberg et al,1990) , reported that placental thickness in millimeter parallels gestational age in weeks. These findings were consistent with the observations made by Jain et al. (Jain et al., 2001). They reported that the value of mean placental thickness increases with advancing gestational age and almost matches from 27 to 33 weeks**.** Mittal et al. (Mittal et al., 2001) , measured placental thickness at the level of cord insertion and found that thickness gradually increased from 15 cm at 11 weeks of gestation to 37.5 mm at 39 weeks of gestation. From 22 nd to 36 th weeks of gestation, the thickness coincided with the gestational age in weeks. Karthikeyan et al,(Karthikeyan et al, 2012) , measured the maximum mean PT in 3rd trimester as 35.81 mm and reported a significant correlation of it with the gestational age of the fetus. Appiah,(Appiah,2009) , observed no significant correlation between the placental thickness and the gestational age ($r = 0.09$, $p>0.05$). Thus, an increase in gestational age did not influence the thickness of the placenta significantly.

LIMITATIONS

This was a cross sectional study and we measured the placental thickness only once in each subject during the study. The sample size was small and there was only a single observer. Since a USG measurement was done, there was a chance for an observer bias (intra observer variability), an instrumental bias, etc.

CONCLUSIONS

From our study, it can be concluded that PT can be used as a predictor of the GA, in the women in whom the LMP is unreliable or is not known. The substitution of any abnormal foetal parameters like BPD in hydrocephalus with PT in USG in the GA estimation can be ventured into. In abnormal PT for the corresponding GA, the disease conditions which cause an increased or decreased PT should be addressed. The regression equation can be used to calculate the GA from the other foetal parameters, with minimal error. Mean thickness of the placenta was 3.90±1.1cm which increased till 38 weeks of gestation, thereafter decreased.

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