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Research Article

TO STUDY THE RELATIONSHIP BETWEEN 2 -D ULTRASONOGRAPHIC PLACENTAL VOLUME AND FETAL WEIGHT IN THIRD TRIMESTER OF UNCOMPLICATED PREGNANCY IN INDIAN FEMALES

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A B S T R A C T

Background: Placenta serves as a direct link between mother and fetus. Normal growth of the fetus is mainly dependent on normal placental function, with normal structure.
Objectives: The purpose of this study is to prepare nomogram charts (baseline data) of placental volumes and estimated fetal weight for our population as well as to assess the correlation between these two parameters.
Methods: 200 cases were recruited for the study who came for routine antenatal checkup to Department of Obstetrics and Gynecology. Subjects with uncomplicated, singleton pregnancy belonging to third trimester (> 26weeks) were included. Placental Volume was estimated using 2-D ultrasound technique and correlation coefficient was obtained with fetal weight.
Results: The mean±S.D. placental volume in third trimester of pregnancy was noted to be 439.27±282.4ml. A linear, non-significant relationship between placental volume and fetal weight was observed.
Conclusion: Placental volume estimation can be used as a predictor for fetal weight to identify the high risk cases.

INTRODUCTION

The placenta is regarded as a fetal organ. It provides an indirect link between the maternal circulation and that of the fetus.[1] Normal placental morphometry (size, shape, weight and volume) reflects more or less normal placental function. Normal growth of the fetus is mainly dependent on normal placental function, with normal structure. [2]

Thus, there are obvious advantages of antenatal assessment compared to postnatal assessment of placenta volumes to get relevant information which can be applied to the current pregnancy, newborn or future pregnancies. It can allow the clinician to tailor monitoring- and intervention strategies to reduce the risk of adverse outcomes. [3]

During routine investigations during pregnancy such as ultrasound, the obstetricians as well the sonologists are mainly concerned with the fetus, no one shows interest in placental assessment. Thus, unfortunately, literature regarding the clinical relevance of antenatal assessment of placental morphometry is still scarce.

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The previous ultrasonographic studies reporting the methods of measurement of placental volumes provided various 3-D methods which is again a time consuming procedure. Thus, through this study we have tried to provide a baseline data and a possible correlation between placental volume and fetal weight with the help of less time consuming 2-D ultasonographic methods.

MATERIALS AND METHODS

MATERIALS

For the present prospective cross-sectional study, 200 pregnant women attending antenatal clinics were recruited from the Department of Obstetrics and Gynecology. The study was designed in the department of Anatomy for the duration of two years. Clearance of institutional ethical committee and written informed consent from the patient were obtained before starting the work. Recruited women were carrying uncomplicated, singleton pregnancy and belonged to third trimester of pregnancy (> 26weeks). The gestational age was confirmed by previous ultrasonography reports of first trimester. Ultrasound examinations were performed in the department of Obstetrics and Gynecology with model LOGIQTM α 200 ultrasound machine.

Detailed history was taken to rule out complicated pregnancy. Thorough general physical and obstetrical examinations were done.

METHODS

Normal morphology of the placenta with the help of ultrasonography was recorded. Placental morphometry in the form of width (W), maximum height (H), thickness (T) and volume (V) were measured. The distance between two edges of placenta was taken as width (Fig.1). A perpendicular line drawn between point of maximum convexity over the maternal surface of placenta and previous line (line joining the two edges of the placenta) was taken as the **maximum height** (Fig.1). Placental thickness was measured at the level of cord insertion (Fig.2).

The volume of placenta was calculated by using three variables i.e. width (W) , thickness (T) and height (H) put in the following concavo-convex shell formula-

Volume (V) = (π *T/6)* [4H (W-T) + W (W- 4T) + $4T^2$] [4] (Fig.3).

Fetal lie and position were identified by moving the probe all over the abdomen and following fetal parameters were taken to calculate the estimated Fetal weight and to rule out intrauterine growth restriction - Biparietal diameter (BPD) , Abdominal circumference (AC) , Head circumference (HC), Femur length (FL).[5] Fetal weight was calculated using the Shepherd formula. [6]Adnexa were looked for the presence of any mass. Fetus was also seen for the presence of any major congenital anomaly.

Data Collection

Ultrasound films were saved, measurements were recorded and transferred to MS excel sheet. 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.

OBSERVATIONS AND RESULTS

The recruited subjects were categorized into four groups on the basis of gestational age (Table 1). The mean±S.D. placental volume in third trimester of pregnancy was noted to be 439.27±282.4ml. An increasing trend of fetal weight was observed. We observed a linear relationship of placental volume with fetal weight . The following equations were obtained after applying regression analysis:

Fetal Weight = 2107.0 + 0.15* Vol.
p = 0.535.

where Vol = volume of the placenta. According to above equation, if volume of the placenta was increased by one unit, then fetal weight increased by 0.15 units (p- value was >0.05) showing that placental volume do affect the fetal weight. (Table-1).

Table 1 Correlation of volume (V) of placenta with Fetal weight.

Gestational age (weeks)	Volume (cm^3) Mean±S.D.	Fetal weight (gms) Mean±S.D.
26 – 30	453.61±369.8	1245± 317.3
30^+ – 34	529.52±315.8	2001.35 ±318.4
34^+ – 38	505.77±244.1	2552.10± 378.9
38^+ – 42	441.43±126	2927.33 ±342.1
Total	493.27±282.4	2179.44 ±660.2

Fig 1 showing measurement of placental width and placental height

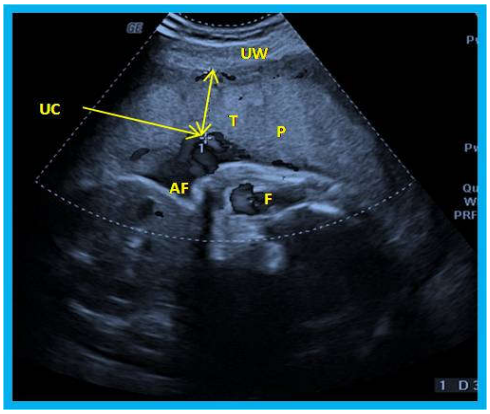

Fig 2 showing measurement of placental thickness. UC- Umbilical cord, AF- Amniotic Fluid, UW- Uterine wall

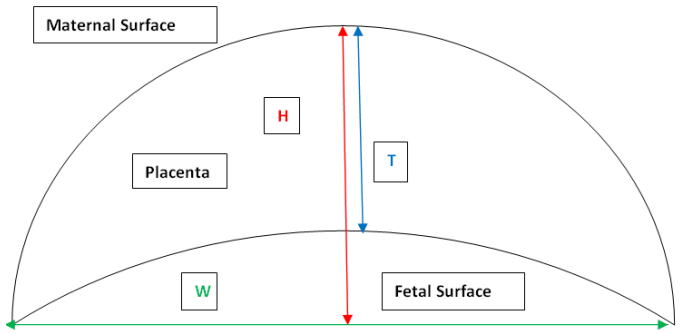

Fig 3 showing the parameters for calculation of placental volume

H (Red)- Height, T (Blue)- Thickness, W (Green)- Width.

DISCUSSION

Placental volume and Fetal measurements are useful parameters to predict birth weight. Placental volume measurement can be useful in the early diagnosis of fetal growth retardation.

In the present study, placental volume increased till 34weeks. In other studies mentioned above, the placental volume showed increasing trend till term. The reason behind the difference between the two findings may be the maturity and aging process of the placenta. At present we are unable to hypothesize, why such differences were observed, but these findings definitely require a study on larger sample population and also warrants Indian obstetricians and radiologists to refer data on volume specific for our environmental scenarios.

In the present study, we observed a positive linear correlation between placental volume and fetal weight. These observations were in accordance with the results of Adair and Thelander[7], 1925 and Thame *et al*[8] . 2001.

de Paula CF [9] *et al* noted an increasing trend of placental volume from second trimester till term as well as a statistically significant positive correlation of placental volume with estimated fetal weight. ($r = 0.505$; $P < 0.001$).

Thickness of the placenta in turn will affect the placental volume. Thin placenta, for a specific gestational age can suggest reduced placental volume and thus a reduced foetal weight and may be a reliable guide for risk estimation.

Leon R L *et al* [10]observed normative data on placental volumes by MRI and fetal weight. They noted a positive correlation between placental volume and fetal weight.

Langhoff L *et al*[11] investigated normal human placental growth longitudinally throughout the second and third trimesters using MRI. All pregnancies were carried to term, resulting in the delivery of healthy infants with good correlation between placental size and birth weight ($R = 0.56$, $p = 0.009$).

Katherine H *et al* [12]concluded that Estimated Placental Volume provides a new effective predictor of Small for Gestational Age fetus which significantly improves predictive ability of traditionally used Estimated Fetal Weight.

Suranyi A.[13] *et al* noted the gestational age-specific estimated fetal weight and placental volume-to-fetal weight ratio was significantly higher in Diabetic pregnancies, whereas placental volume was similar compared to control data.

CONCLUSION

A positive linear correlation between placental volume and fetal weight was observed. This study will provide a relevant, appropriate and a cheap diagnostic tool to detect the abnormal placental volumes and in turn the compromised foetuses so that a timely intervention will decrease the risk of adverse outcomes.

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