



ORIGINAL RESEARCH PAPER

Obstetrics & Gynaecology

CORRELATION OF PLACENTAL MORPHOLOGY WITH FETAL OUTCOME IN SINGLETON PREGNANCIES IN CENTRAL INDIA

KEY WORDS: placenta, umbilical cord, fetus, cotyledon

Dr. Naziya Noor*	Assistant Professor, Department of Anatomy, Index Medical College Hospital and Research Centre, Indore.*Corresponding Author
Dr. Namrata Shrivastava	Associate Professor, Department of Obstetrics and Gynecology, Index Medical College Hospital and Research Centre, Indore.
Dr. Avantika Bamne	Professor, Department of Anatomy, Index Medical College Hospital and Research Centre, Indore.

ABSTRACT **Background:** Growth and development of fetus is dependent on growth and development of placenta. This study aimed to assess the effect of placental morphology on birth weight. **Materials and methods-** Study was done on 200 pregnant females and their newborns at index medical college hospital and research centre Indore, M.P.it was an observational cross sectional study. **Results-** In our study placental weight varied between 200 to 700 gms. The mean weight was found to 466.98±76.12 gms. Fetal weight in our study ranged between 1.99 to 3.74kg with a mean of 2.72±0.32.fetal weight was found to be positively correlated with placental weight, placental volume, thickness of placenta, no. of cotyledons and cord diameter. Placental weight and thickness increases with increasing fetal weight. **Conclusion-** We found a strong relationship between the placenta and the fetus, so this theory can be applied in detection of low birth weight babies before delivery and also measures can be taken to reduce low birth weight babies and its complications and ultimately the perinatal morbidity and mortality.

Introduction

Placenta is a feto-maternal organ. It has an interface between the mother and the fetus. It supports the fetus in respiration, nutrition and excretion. ¹ Placenta is necessary for fetal development, it safeguards the growing fetus, and supports the pregnancy. Careful examination of the placenta can provide useful insights into clinically significant conditions that may affect fetus. Adequate growth and development of placenta will depends on transfer of nutrients from mother to fetus through a normal functioning placenta. Previous studies have shown that diminished placental size precedes fetal growth restriction ^{2,3}

The placenta is derived its name from its appearance (plakuos in Greek, referring to "flat cake"). The mature human placenta is a roughly discoid in shape and has a mean diameter of measuring 22 cm. Its thickness at the centre is around 2.5cm, and weight of about 0.5kg. The placenta comprises of parenchymal tissues, umbilical cord, and membranes. The placenta consists of two membranes the amnion and the chorion. At 5th post fertilization day embryo is divided into the inner cell mass and trophoctoderm. ⁴ At about the 7th or the 8th developmental day of the embryo, amnion can be identified engulfing the developing embryo. The placental parenchyma consists of a stromal compartment occupied by vascular and lymphatic channels. Eventually, the stroma becomes fairly raised, having convex areas known as placental lobes, these lobes are separated by the grooves. The total number of these lobes ranges between as few as 10 to as many as 38 and the number doesn't change throughout the pregnancy. The surfaces of the placenta includes the chorionic plate facing the fetus (and holding the umbilical cord attachment), and the basal plate abutting the maternal endometrium. The intervillous space is a space between, the chorionic and basal plates, and having 30-40 deeply divided fetal villous sheet. The fetal wellbeing is dependent on many factors and placenta is one of the important factor. Hence any impairment in the placental development, also affects the fetus and pregnancy outcome.

The present study was aimed to correlate morphology of placenta with birth weight, as there is limited information on this relationship from central India.

Methods

Study was conducted at Index Medical College Hospital and Research Centre, Khudel, Indore, Madhya Pradesh from august 2018 to august 2021.It was an observational cross sectional study.

A total of two hundred full term placenta were randomly

collected over a period of one year, from the mothers who delivered either vaginally or by caesarean section. We have used gross inspection method for conducting this study. Placentas were collected from the labour room of obstetrics and gynaecology department. After collection we washed them under running tap water to remove the blood and clots and kept on absorbable cloth to make them dry. After drying the specimens were brought to the department of Anatomy for further study. Before transportation all the necessary and relevant medical history including history of present and past history, menstrual and obstetric history] and blood investigations of mother were collected from the hospital record in labour room. After then the details of neonate were collected from the paediatric department for further study and correlation. A total of two hundred freshly delivered placenta with umbilical cord were collected with the consent of mother. The specimens were collected soon after their expulsion from normal deliveries and caesarean section. The placenta is also called the mirror image of intra uterine fetal experience so this study is an attempt to observe and compare the morphometric measurements of placenta and its correlation with fetal outcome. Patients with normal uncomplicated singleton pregnancy between 37 to 42 weeks with normal delivery or caesarean section included in the study. Women with obstetric complications of pregnancy like hypertensive disorders of pregnancy, gestational diabetes, fibroids, thromboembolism, chronic illness and congenital malformations, multifetal gestations were excluded from study. All the maternal details like age, parity, gestational age and amount of amniotic fluid are collected from the hospital records from labour room. Gestational age were calculated from the Naegeles formula derived from a German obstetrician by adding 9months and 7 days in last menstrual period .The amount of amniotic fluid is taken from the latest obstetric ultrasound finding and only the cases having adequate amount of amniotic fluid were enrolled in the study. Oligohydramnios and polyhydramnios cases were excluded to avoid bias. All the neonatal details including sex of baby, birth weight, head circumference, abdominal circumference and APGAR score at one minute and 10 mins after birth collected from the paediatric department initially, the vernier calliper was set for zero error with jaws closed. The either jaw of calliper were placed on either side of the peripheral margin of the placenta with firm pressure on the placental surface. After setting both the jaws callipers were tightened, the calliper was removed from the placenta. The readings were recorded. Placental weight was recorded using a weighing scale. Length of umbilical cord was measured using measuring tape. All the parameters were recorded by the same observer to minimize the observer error. Various observations on gross appearance of placenta were recorded. The placenta was weighed in grams using an

electronic weighing scale after cutting the cord and membranes. Largest diameter of placenta were measured using a measuring tape and was considered as length of placenta ,then the diameter perpendicular to the largest diameter were also measured and considered as breadth of placenta. Central thickness of the placenta was measured using a graduated needle in cm. Placental shape was obtained by the difference of largest diameter and smallest diameter. A difference of 3 or more cm was considered as oval, whereas a difference of less than 3 cm as round placenta. For counting the cotyledons the placenta was placed on fetal surface with maternal surface facing upwards. Counting was started from the left side of the one end of placenta and then going to the right and again turning back to the left making a loop and so on .finally the total number of the cotyledons were calculated and recorded. The volume of placenta is calculated by the formula $\frac{1}{2} \times 4/3\pi ABH$.⁵ The placenta was kept flat on table, the largest radius and height of each placenta was calculated. We calculated placental volume using the formula for a dome shaped volume. All the data collected from labour room and paediatric ward was plotted on specially designed data sheet for analysis. All the parameters were correlated using correlation coefficient, kruskal Wallis test, mann whitney test and box whisker plot. P value of less than 0.05 was considered statistically significant.

Results

There were 200 antenatal women included in the study with an age distribution between 18 to 37 years. The mean age was 24.64±4. In present cohort of 200 women who included in study 75(37.5%) were primigravidae, 77(38.5%) were second gravidae, 37 (18.5%) were third gravidae, 9(4.5%) and 2(1%) women were fourth and fifth gravidae respectively. Primigravidae and second gravidae formed the main cohort of study (76%). Gestational age at which women delivered ranged between 37 to 42 completed weeks with a mean of 38.69±1.39. Out of 200 subjects 63.50% (127) delivered vaginally and 73(36.50%) were undergone caesarean section. The mean birth weight and placental weight from normal delivery and caesarean section were comparable. Fetal weight ranged between 1.99 to 3.74 kg with a mean of 2.72±0.32, and there was no statistically significant difference of fetal weight in both sexes (p=0.587), (Table: 1).

DISCUSSION

The placental weight gives an idea of the amount of substance that is exchanged between the mother and foetus. In our study we found a significant correlation of foetal weight with placental thickness, placental volume, no of cotyledons and placental weight. And all were found to have a significant correlation with foetal weight (p<0.0001) (table.2). Placental weight also used to calculate foeto- placental ratio. Panuganti P K et al⁶ observed the range of placental weight between 321 to 534 gm in their study .They have observed weight of 453 gm in 8% cases and 452 gms in 6% cases. Maximum weight of 534 gms was observed in 2% cases and least weight of 321 gms observed in 2% cases by them. Tiruneh S T⁷ observed the mean placental weight was 497.95±89.1. They observed that placental weight is directly proportional to birth weight. When birth weight increases, placental weight and size also increases to accommodate it. In our study we observed the mean placental weight in gms was 466.98±76.12 with a range of 250 – 700 gms. Our finding was comparable to their study. Luz, 2001,⁸ found that for every 1gm increase in placental weight the foetal weight increases by 1.98gms. Chronic uteroplacental insufficiency can lead to a small placenta and small placentae are associated with intra uterine growth restrictions, small for date fetus, pre-eclampsia and still birth.⁹ Maternal diabetes, chronic intrauterine infections, foetal malformations, congenital neoplasm etc. are some causes of placental enlargement.

The result of our study has shown significant correlation of birth weight with placental thickness. In a study of correlation of placental thickness using ultrasonography with foetal weight by Muraliswar Rao et al.¹⁰ There was significant correlation of placental thickness with estimated fetal weight. This one is comparable to our study.

Afadhali D et al¹¹ studied effect of placental weight and cotyledon count on birth weight .In their study the number of cotyledons ranged between 11 and 26 with a mean count of 17.8±4.0. Out of 102, 52 neonates were 3.72 kg, mean cotyledon count of 20.8.the cotyledon count was positively correlated with fetal weight. Fetoplacental ratio is the ratio between birth weight and placental weight and can serve as a

marker for small for gestational age .A small fetoplacental ratio can be associated with higher incidence of small for gestational age .Lurie S et al¹² found that the mean fetoplacental ratio was 5.6±0.96.the ratio didn't differ significantly in male and female infants. In our study the mean fetoplacental ratio was 5.92±0.92 which was comparable to other studies. Disproportionately small placentas may be seen in maternal hypertension and may result in fetal distress.¹³

CONCLUSION

Our study found that birth weight is positively correlated with placental weight, placental thickness, placental volume and no. of cotyledons .Since different conditions affect the placenta and its morphology differently, studying them may contribute to understand perinatal outcomes better

TABLE 1: Association of fetal weight (kg) with fetal sex.

Fetal weight(kg)	Female(n=93)	Male(n=107)	Total	P value
Mean ± SD	2.72 ± 0.3	2.73 ± 0.35	2.72 ± 0.32	
Median(25th-75th percentile)	2.7 (2.5-2.8)	2.7 (2.5-3)	2.7 (2.5-2.9)	0.587*
Range	2-3.74	1.99-3.7	1.99-3.74	

TABLE 2: Correlation of fetal weight with placental weight (grams), placental volume (cm³), number of cotyledon, cord diameter (cm) and placental thickness (cm).

Variables	Placental thickness(cm)	Placental volume(cm ³)	Number of cotyledon	Placental weight(grams)
Fetal weight(kg)				
Correlation coefficient	0.642	0.347	0.582	0.524
P value	<0.0001	<0.0001	<0.0001	<0.0001

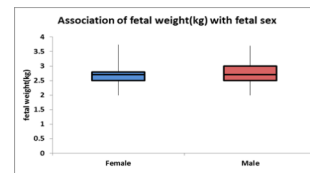


Figure 1:-Association of fetal weight (kg) with fetal sex. (Non-parametric variable, Box-whisker plot)

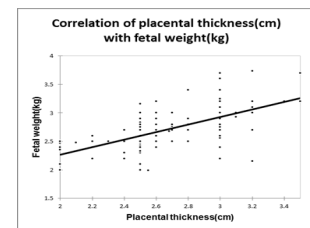


Figure 2.1:-Correlation of placental thickness (cm) with foetal weight (kg).

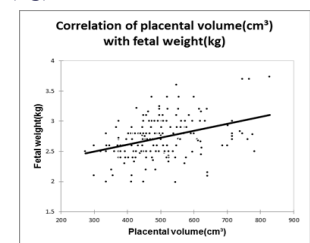


Figure 2.2:-Correlation of placental volume (cm³) with fetal weight (kg).

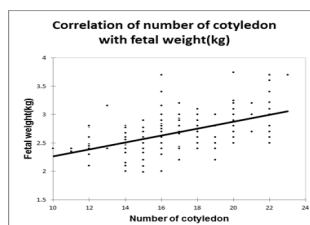


Figure 2.3:-Correlation of number of cotyledon with fetal weight (kg).

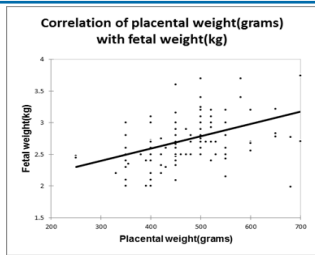


Figure 2.4:-Correlation of placental weight (grams) with fetal weight (kg).

REFERENCES

- 1) Croft Long E. (1963).The placenta in lore and legend.51:Bull.Med.Lib. Assoc.233-241.
- 2) Wolf H, Oosting H, Treffers PE. Second –trimester placental volume measurement by ultrasound: prediction of fetal outcome. Am J Obstet Gynecol.1989;160(1):121-6.
- 3) Mayhew TM, Wijesekara J, Baker PN, Ong SS. Morphometric evidence that villous development and fetoplacental angiogenesis are compromised by intrauterine growth restriction but not by preeclampsia. Placenta.2004;25(10):829-33.
- 4) Boyd, J.D. Hamilton, W.J. (1970). The Human Placenta. w. Heffer and Sons Ltd.
- 5) Azpurua H, Funai EF, Coraluzzi LM, Doherty LF, Sasson IE, Kliman M, et al. Determination of placental weight using two dimensional sonography and volumetric mathematic modelling. Am J Perinatol 2010; 27:151-5.
- 6) Panguti P K, boddeti R K .Morphology & Morphometric Anatomy of the Placenta. International journal of Biological&Medical Research.2012; 3 (3):2165-2168.
- 7) Tiruneh ST. (2018).Correlation between gross morphology of the human placenta and birth weight in normotensive and pre-eclamptic pregnancies in Northwest Ethiopia. An International Journal of Experimental and Clinical Anatomy, 12(1):27-32.
- 8) Luz, HS, Lopez S R, Olivares ET, Terrazas MC, Silva M.A.R. and Carrillo M.L. (2001) Relation between birth weight and placental weight. Neonatology, Biology of the Neonate, 80:113-117.
- 9) Hoogland HJ, de Haan J, Martin Jr CB. Placental size during early pregnancy and fetal outcome: a preliminary report of a sequential ultra-sonographic study. Am J Obstet Gynecol. 1980; 138(4):441-3.
- 10) Muraliswar Rao J, Kallepally A K. (2019). Correlation of placental thickness in relation to gestational age and fetal weight by using ultrasonography. International journal of contemporary medicine surgery and radiology.4 (3):c135-c140.
- 11) Afdhali D, Kelvin Modest Kaziri (2017).the effect of placental weight and cotyledon count to the fetal birth outcome at a regional referral hospital in Tanzania. International Journal of Anatomy and Research. 5 (4.2):4538-42.
- 12) Lurie S, Feinstein M, Mamet Y. Human fetoplacental weight ratio in normal singleton near term pregnancies. Gynecol Obstet Invest. 1999; 48:165-7.
- 13) Molteni RA. Placental growth and fetoplacental ratio throughout gestation –their relationship to pattern of fetal growth. Semin Perinatol 1984; 8:94-100.