

Study of the Placenta in Relation to the Birth Weight of Full Term Neonates Using Morphometric Analysis

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Abstract

Aim: The present study was aimed to explore the morphometric examination of placenta in birth weight of full-term newborn babies.

Methods: The present study was conducted in Department of Anatomy. Total 120 discarded placentae were collected at random from deliveries (both vaginal and caesarian) conducted Anugrah Narayan Magadh Medical College, Gaya, Bihar, India for 8 months. 60 out of the 120 placentae were from controls (birth weight > 2500gms) and 60 from low-birth-weight deliveries (birth weight <2500gms). In the collected placenta, the weight, volume, diameter and thickness of placenta were measured.

Results: The 70% of placenta had birth weight 400-500 gms and followed by 30% >500 gms in group A, and 60 % of placenta had birth weight <400 gms in group B. 45% of placenta had volume 401-499 ml and followed by 28.33% of placenta had volume ≤ 400 ml in group A and 78.33% of placenta had ≤ 400 ml volume in group B. The mean placental weight was 466.88±30.67gms in normal birth weight group and 393.71±57.21 gms in the low birth weight group. The mean placental diameter was 19.13±0.78cm in normal birth weight group and 16.84±2.16cm in the low-birth-weight group. The mean placental thickness was 1.80±0.17cm in normal birth weight group and 1.72±0.17cm in the low-birth-weight group. The mean placental volume in the normal birth weight group was 440.26± 39.83ml and in the low birth weight group it was 377.25±45.88 ml. The mean feto-placental ratio in normal birth weight group was 6.25 whereas in low birth weight group, it was 5.23. All the parameter was found to be statistically significant. In the present study the placental coefficient in normal birth weight group was 0.159 ± 0.014 and in low birth weight group was 0.189± 0.031.

Conclusion: we conclude that the morphometric observation of placenta is associated with foetal weight. So an early examination of not only the fetus, but also the placenta by non-invasive techniques like ultrasonography will be helpful to predict and to avoid low birth weight babies with better preventive measures.

Key words: Birth weight, Placenta, Placental morphometry.

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Introduction

Incidence of low birth weight (LBW) and birth defects in the newborn is a major health problem. This also may cause considerable financial stress to the parents as well as health facilities due to prolonged treatment in neonatal facility. Intrauterine growth retardation or small for gestational age group babies is a complication of many pregnancies. The factors responsible for fetal growth retardation include maternal malnutrition, anemia, preeclampsia, eclampsia, maternal infection, drug abuse, genetic factors and genetic diseases, congenital malformations, multiple gestations, placental and cord abnormalities and maternal smoking. In many cases, specific cause is never identified. Survival and growth of fetus is essentially dependent on formation, maturation and function of the placenta. Low birth weight is well known to be associated with disease in the neonatal and subsequent periods of early life. The risks of hypertension, coronary artery disease and diabetes mellitus are inversely related to birth weight and lower values in anthropometry of the newborn[1]The birth weight of the baby at the time of delivery will have an impact on further consequences in prenatal as well as in adult life. The first study of growth rate of normal human fetuses and their placentae, to ascertain their inter relationship through the stages of intra uterine life, was done by Hendricks[2] and subsequently by Boyd and Hamilton[3]. The placenta is a dynamic organ which maintains fetal homeostasis by performing a wide range of physiological functions, which after birth are carried out by the lungs, gastrointestinal tract, kidney and endocrine glands of the neonate. Placenta undergoes various changes in its weight, surface area, structure, shape and function continuously throughout the gestation to support the growth of fetus in utero. Abnormalities in the placenta eventually result in Low Birth Weight (LBW), Intra Uterine Growth Restriction (IUGR) and still birth which leads to increased rate of

perinatal morbidity and mortality[4,6]. The size, morphology and nutrient transfer capacity of the placenta determine the prenatal growth trajectory of the fetus to influence birth weight. Therefore, examination of the placenta will give valuable information about the state of foetal well being and also helpful in the management of complications in mother and the newborn. If the decidual part of the placenta is healthy, the embryogenesis from germinal period up to the end of fetal period will be healthy. There is a proven direct relationship between placental growth, fetal well-being and finally fetal outcome.

Materials and methods

The present study was the conducted in Department of Anatomy. Total 120 discarded placentae were collected at random from deliveries (both vaginal and caesarian) conducted in Anugrah Narayan Magadh Medical College, Gaya, Bihar, India for 8 months. The cases were studied dividing into two experimental groups. 60 out of the 120 placentae were from controls (birth weight > 2500gms) and 60 from low birth weight deliveries (birth weight <2500gms). In the collected placenta, the weight, volume, diameter and thickness of placenta were measured. The fetoplacental ratio was calculated by dividing the weight of the foetus by weight of the placenta and the placental coefficient was calculated by dividing placental weight by birth weight. The placenta with attached membranes and umbilical cord was collected soon after delivery washed in running tap water to clean all blood. Each specimen was tagged with number before commencement of the study, for the purpose of identity.

Results

The present study was done with 120 placenta which was equally distributed between two groups, group A which included placentae of normal birth weight newborns and group B which included placentae of low birth weight newborns. table 2 show that the 70% of placenta had

birth weight 400-500 gms and followed by 30% >500 gms in group A, and 60 % of placenta had birth weight <400 gms in group B. 45% of placenta had volume 401-499 ml and followed by 28.33% of placenta had volume \leq 400 ml in group A and 78.33% of placenta had \leq 400 ml volume in group B. table 3 show that the mean placental weight was 466.88 ± 30.67 gms in normal birth weight group and 393.71 ± 57.21 gms in the low birth weight group. The mean placental diameter was 19.13 ± 0.78 cm in normal birth weight group and 16.84 ± 2.16 cm in the low birth weight group. The mean placental thickness was

1.80 ± 0.17 cm in normal birth weight group and 1.72 ± 0.17 cm in the low birth weight group. The mean placental volume in the normal birth weight group was 440.26 ± 39.83 ml and in the low birth weight group it was 377.25 ± 45.88 ml. The mean foeto-placental ratio in normal birth weight group was 6.25 whereas in low birth weight group, it was 5.23. All the parameter was found to be statistically significant. In the present study the placental coefficient in normal birth weight group was 0.159 ± 0.014 and in low birth weight group was 0.189 ± 0.031

Table 1: Number of cases

Groups	N=120
Group A (Placentae of normal birth weight)	60
Group B (Placentae of low birth weight < 2500g)	60

Table 2: Relation of birth weight with placental weight and volume

Parameters		Group A (Placentae of normal birth weight)=60		Group B (Placentae of low birth weight < 2500g)=60		Total=120	
		No.	(%)	No.	(%)	No.	(%)
Weight of placenta (gms)	<400	0	0	36	60	36	30
	400-500	42	70	24	40	66	55
	>500	18	30	0	0	18	15
Volume of placenta(ml)	\leq 400	17	28.33	47	78.33	64	53.33
	401-499	27	45	9	15	36	30
	\geq 500	16	16.67	4	6.67	20	16.67

Table 3: Comparison of mean of various variables.

Variable	Group A (Placentas of normal birth weight)		Group B (Placentas of low birth weight < 2500g)		p Value
	Mean	SD	Mean	SD	
Birth weight	2888.46	210.24	2012.55	367.23	<0.001**
Placental weight	466.88	30.67	393.72	57.21	<0.001**
Placental volume	440.26	39.83	377.25	45.88	<0.001**
Placental diameter	19.13	0.78	16.84	2.16	<0.001**
Placental thickness	1.80	0.17	1.72	0.17	<0.001**
Placental coefficient	0.159	0.014	0.189	0.031	<0.001**
Feto-placental ratio	6.25	0.28	5.23	0.71	<0.001**

Discussion

The etiology of low birth weight is multifactorial; with genetic, placental, fetal and maternal factors interplaying with each other. Despite the observed link between maternal health, placenta and newborn health, any kind of placental study is not routinely performed in hospitals. However a study focused at least on the placenta of low birth weight babies will shed light on the causative factors and will help in the better understanding of the etiology. Hence the present study is undertaken to analyze the spectrum of morphometric changes in placenta and its relation with birth weight of full term newborns. Placenta plays a key role in the development of fetus in the utero but still it receives less attention throughout the pregnancy in contrast to the foetal weight. Though many factors like race, genetic and health problems of the pregnant women determines the placental and fetal growth but still the morphometry examination of placenta will give a valuable information about the status of the foetal well being and also helpful in the management of complications in mother and the newborn. In the present study that the mean placental weight was 466.88 ± 30.67 gms in normal birth weight group and 393.71 ± 57.21 gms in the low birth weight group and was found to be statistically significant. Placental weight and thickness has been taken as an indicator of placental function. Surya Babu et al studied 50 placentae of low birth weight babies and found that the placental parameters like weight and size of the placenta were significantly less than normal in low birth weight deliveries[7]. In a larger population size from Mexico (n: 300 live newborns) Sanin established a model to relate birth weight with placental weight[8]. Placental weight was found to be significantly related to birth weight. For each gram increase of weight of placenta, the birth weight increased by 1.98 gms ($p < 0.01$). The placenta however was shown to have a nonlinear relation to birth weight and could be used as a useful noninvasive

predictor of birth weight. The mean placental diameter was 19.13 ± 0.78 cm in normal birth weight group and 16.84 ± 2.16 cm in the low birth weight group. It was found to be statistically significant. According to a study by Habib FA a “warning limit” of a placental diameter of 18 cm and placental thickness of 2 cm at 36 weeks gestation were calculated to predict low birth weight infants[9].

The mean placental thickness was 1.80 ± 0.17 cm in normal birth weight group and 1.72 ± 0.17 cm in the low birth weight group. It was found to be statistically significant. The mean thickness of term placenta reported by Gunapriya et al., was 2.1cm, in other study by Hatti AM it was 2.21cm whereas, in the study of Rupa L Balihallimath et al. the mean placental thickness was 2.1 cm, 5th and 95th percentiles of placental thickness varied from 1.5 to 3.0 cm, with no significant relationship with birth weight[10,12]. In the present study, the mean placental volume in the normal birth weight group was 440.26 ± 39.83 ml and in the low birth weight group it was 377.25 ± 45.88 ml which was statistically significant.

In the study by Rupa L Balihallimath et al., the mean placental volume was 366.08 ± 1.10 ml, with a significant positive correlation between the weight of the baby and the placental volume ($r = 0.662$ ml; $p < 0.001$).¹² This result is consistent with the other studies[13,14]. In a study by R.D. Virupaxi et al. morphometric parameters of placenta like weight and volume were significantly lower in small for gestational age group babies as compared to full term normal group babies, these values were statistically significant ($p < 0.0001$)[15]. Foeto-placental ratio is the ratio of fetal weight to placental weight. The normal ratio is 1:7. The mean foeto-placental ratio in normal birth weight group was 6.25 whereas in low birth weight group, it was 5.23. The difference between two groups was statistically significant ($p < 0.001$).

Placental coefficient is defined as the ratio of placental weight to fetal weight. Normally it is 0.10 to 0.18[16]. This correlated well with the present study. In the present study the placental coefficient in normal birth weight group was 0.159 ± 0.014 and in low birth weight group was 0.189 ± 0.031 . The placental coefficient falls as the placental weight increases and high placental coefficient is seen if the placental weight decreases. Placental coefficient outside the normal range is shown to be associated with perinatal adverse effects[16].

Conclusion

We conclude that the morphometric observation of placenta is associated with foetal weight. So an early examination of not only the fetus, but also the placenta by non-invasive techniques like ultrasonography will be helpful to predict and to avoid low birth weight babies with better preventive measures.

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