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Morphometry Examination of Placenta in Birth Weight of Full-Term Newborns in Puducherry, India

¹V. Kowsalya, ¹R. Vijayakumar, ²G. Valli, ³K.P. Bharath, ⁴R. Srikumar, ¹C. Kishor Kumar,
¹I. Gayathri Fathima and ⁵N. Vanajashi

¹Department of Physiology, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry, 605 502, India

²Department of Pharmacology, Meenakshi University, Chennai- 600078, Tamil Nadu, India

³Department of Anatomy, Asan Memorial Dental College and Hospital, Chennai - 603105, Tamil Nadu, India

⁴Centre for Research, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry, 605 502, India

⁵Department of Obstetrics and Gynaecology, Sri Lakshmi Narayana Institute of Medical Sciences,
Puducherry, 605 502, India

Abstract: Birth weight is an important determinant of child survival, healthy growth and development. Low birth weight is a well-established risk factor for adverse long term health, particularly cardiovascular disease and metabolic syndrome. The ability of the fetus to grow and thrive in utero is presumed to be a function of the placenta. The present study was aimed to assess the morphometry examination of placenta in normal and low birth weight babies in the Union territory of Puducherry. Morphometry examination includes Placenta weight, number of cotyledons, maternal and fetal surface area and site of umbilical cord insertion were measured in normal and low birth weight babies. Result showed among 200 subjects, mean birth weight of normal and low birth babies were 2806 and 2058 g, respectively. The prevalence rate of low birth babies (less than 2500 g) was 22%. The placental morphometry study namely placental weight, number of cotyledons, maternal and fetal surface area and insertion of umbilical cord at centre were significantly ($p < 0.001$) reduced in the low birth weight babies when compared with normal birth weight babies. Study revealed that morphometry analysis of placenta significantly influences the birth weight of new born. In conclusion, study recommends the early measurements of placenta by non-invasive techniques like ultrasonography will be helpful in early prediction of low birth weight fetus in utero itself and for better management to avoid such low birth weight.

Key words: Placenta, morphometry, low birth weight

INTRODUCTION

Children's health is tomorrow's wealth; however, children's health is to a great extent determined by factors that operate in the utero itself, well before they are born. Low birth weight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 g. WHO estimates that more than 20 million infants worldwide, representing 15.5% of total births, are born with low birth weight, 95.6% of them are in developing countries. Among the developing countries, India alone accounts for about 30% (8 million) of low birth weight (UNCF and WHO, 2004). The Low birth weight mortality rate is about 20 times higher than that of the normal birth weight babies. The various interventions like delaying child bearing in adolescents, efforts to improve the nutritional status of women particularly for those anemic

during pregnancy, improving education for the pregnant mother, access to antenatal care were suggested to reduce low birth weight (Sachdev, 2001), but still an early detection in the weight of the fetus before birth will be beneficial to obstetric and neonatal care to avoid low birth weight babies.

Survival, healthy growth and development of foetus in the uterus are mainly dependent on the placenta. 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 (Jansson and Powell, 2007). 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 (Regnault *et al.*, 2002; Mayhew *et al.*, 2003; Sibley *et al.*, 2005).

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.

The present study was aimed to explore the morphometric examination of placenta (which includes placental weight, surface area, number of cotyledons and site insertion of umbilical cord) in birth weight of full-term newborn babies in the union territory of Puducherry, India.

MATERIALS AND METHODS

The study was conducted in Sri Lakshmi Narayana Institute of Medical Sciences and Research Institute, Puducherry and Ashwini Maternity Hospital near Thattanchavadi, Puducherry. Subjects who gave informed consent were included in this study. Totally, 200 placentas were examined after delivery from the pregnant women of age group between 20 and 35 years. Subjects with diabetes mellitus, hypertension, anaemia, vascular diseases and multiple pregnancies were excluded in this study. Placentae were collected immediately after delivery and washed with the running tap water. The morphometric determinants were performed using standard technique which includes Placenta weight, number of cotyledons, maternal and fetal surface area and site of umbilical cord insertion. The weights of newborns were also recorded immediately after delivery.

Statistical analysis: Values of placental weight, number of cotyledons, maternal and fetal surface area were expressed in Mean±Standard deviation and the site of umbilical cord insertion was expressed in percentage. Student's t-test was performed to compare the variables.

RESULTS

In the present study, the mean birth weight of normal and low birth weight babies were 2806±207 and 2058±321, respectively. Among them 22% of the babies were born with weight less than 2500 g. The placental morphometry study namely placental weight (401±58), number of cotyledons (11±3), maternal (146±41) and fetal (152±37) surface area and insertion of umbilical cord at centre (4.5%) of low birth weight babies were significantly

Table 1: Morphometric examination of placenta with birth weight of full-term babies

Placental Morphometric variables	Birth weight	
	Normal	Low (= 2499 gm)
Placenta weight (gm)	567±68	401±58***
Number of cotyledons	15±4	11±3***
Maternal surface area (mm ²)	246±42	146±41***
Fetal surface area (mm ²)	241±44	152±37***
Umbilical cord insertion at center (%)	68	4.5***

Vales of placental weight, number of cotyledons, maternal and fetal surface area were expressed in mean±standard deviation and for umbilical cord insertion values are expressed in percentage. The *** symbols represent statistical significant p<0.001

(p<0.001) reduced when compared with normal birth weight babies placental weight (567±68), number of cotyledons (15±4), maternal (246±42) and fetal (241±44) surface area, insertion of umbilical cord at centre (68%) (Table 1).

DISCUSSION

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. Hence in the present study morphometry examination of placenta which includes weight, number of cotyledons, maternal and foetal surface area, site of umbilical cord insertion of normal and low birth weight babies were carried out in the Union territory of Puducherry, India.

The placenta supplies nutrients to the fetus depend on its size, morphology, blood supply and transporter abundance. During normal pregnancy, the placenta undergoes a variety of physiological changes, regulated by angiogenic factors, hormones and nutrient-related genes, to maximize efficiency for an ever-increasing demand for nutrients (Sibley *et al.*, 2005; Belkacemi *et al.*, 2009). Variation in the size of the placenta may affects its function, in particular the ability to transfer nutrients to the fetus via changes in the exchange surface area (Fowden *et al.*, 2006), in general, small placentas are associated with small fetuses (Roseboom *et al.*, 2011). The size of the placental is affected by maternal factors, such as Body Mass Index, gestational weight gain, smoking, as well as various other medical and socio-demographic factors (Fowden *et al.*, 2008; LAbee *et al.*, 2010).

In the present study placental weight, number of cotyledons, maternal and fetal surface area and insertion of umbilical cord at centre were significantly reduced in

the low birth weight babies (Table 1). Reduction in the morphometry of placenta observed in the present study may associate with altered fetal nutrient and hormone supply, which in turn may reduces the foetal weight (Lahti *et al.*, 2009).

In addition, the present study also showed that only 4.5% of umbilical cord insertions were in centre which associated with normal birth weights and 68% were marginal which related to lower birth weights and remaining 27.5% of insertions were median and lateral which indifferently associated with birth weights (Ruth *et al.*, 2005). The marginal umbilical cord insertion may be due to a primary implantation site having reduced vascular supply which makes the placenta migrate to a site of better nourishment (Heinonen *et al.*, 1996). Early evaluation of placenta by sonography, in addition to the routine use of uterine artery doppler may be a valuable tool to help in predicting low birth weight infants in the uterus itself and it might helpful to avoid low birth weight (Fawzia, 2002).

This study confirms that 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. This study will also make the physicians and researcher to focus on the placenta.

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