IF : 3.62 | IC Value 80.26

Volume-6, Issue-2, February - 2017 • ISSN No 2277 - 8160

Original Research Paper

Gynaecology

Sterological Investigations of Placental Morphology And Birth Weight Of Newborns In South Indian Population

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ABSTRACT A baby's low weight at birth is either the result of preterm birth (before 37 weeks of gestation) or due to restricted foetal (intrauterine) growth. Low birthweight is closely associated with foetal and neonatal mortality and morbidity, inhibited growth and cognitive development,and chronic diseases later in life. Totally, 300 patients were examined after delivery from the pregnant women of age group between 20 and 35 years. The placenta morphometry study namely placental weight (409 ± 59), number of cotyledons (12±4), maternal (152±43) and fetal (159±39) surface area and insertion of umbilical cord at centre (4.8%) of low birth weight babies were significantly ($p<0.001$) reduced when compared with normal birth weight babies placental weight (573±70), number of cotyledons (16±5), maternal (251±44) and fetal (248±46) surface area, insertion of umbilical cord at centre (69%). An early examination of not only the foetus, but also the placenta by non invasive techniques like uitrasonography will be helpful to predict and avoid low birth weight babies with better preventive measures. This study will also make the physicians and researcher to focus on the placenta.

KEYWORDS : Cotyledons, Low Birth Weight, Uitrasonography, World Health Organization.

INTRODUCTION

Low birthweight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams. This is based on epidemiological observations that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies. More common in developing than developed countries, a birthweight below 2,500 g contributes to a range of poor health outcomes [1].

The low birth weight rate for industrialized countries was around 7 per cent, and in less developed countries it ranged between 5 and 33 per cent, with an average of 17 per cent. Around the year 2000, UNICEF and WHO accelerated efforts to estimate global and country rates. The process of monitoring progress towards international goals on low birth weight reduction led to a greater recognition of the limitations of the available data, in particular the relatively small proportion of infants weighed at birth [2-3]. Epidemiological data indicate that placental weight, albeit a crude proxy for placental structure, appears to provide information on the long-term outcome for the baby. The changes in placental growth represent an important link between perturbations in the maternal compartment (such as reduced placental blood flow, altered maternal nutrition and diabetes) and alterations in fetal growth. A lack of a normal increase in maternal placental blood flow, leading to 'placental insufficiency. The placenta constitutes the active interface between the maternal and fetal blood circulations, regulating maternal physiological changes in pregnancy and fetal growth and is thought to play an important role in the development of many pregnancy complications. A link between intrauterine environment and adult disease was pioneered by Barker and co-workers, who reported associations between low birth weight and the risk of developing Type 2 diabetes [4,5] and cardiovascular disease [6,7]

A baby's low weight at birth is either the result of preterm birth (before 37 weeks of gestation) or due to restricted fetal (intrauterine) growth. Low birth weight is closely associated with fetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life. Many factors affect the duration of gestation and foetal growth, and thus, the birth weight. They relate to the infant, the mother, or the physical environment and play an important role in determining the birth weight and the future health of the infant.

The Size of, morphology and nutrient transfer capacity of the placenta determine the prenatal growth trajectory of the foetus 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 the 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 new born babies in and around Pondicherry population.

MATERIAL AND METHODS

The study was conducted in Sri Lakshmi Naryana Institute of Medical Sciences and Research Institute, Puducherry. Subjects who gave informed consent were included in this study. Totally, 300 patients 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. Placenta were collected immediately after delivery and washed with the running tap water. The morphometric determines were performed using standard technique which includes palcenta weight, number of cotyledons, maternal and fetal surface area and site of umbilical cord insertion. The weights of new borns 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. Students t-test was performed to compare the variable.

RESULTS

In the present study, the mean birth weight of normal and low birth weight babies were 2931±209 and 2134±332, respectively. Among them 22% of the babies were born with weight less than 2500 g. The placenta morphometry study namely placental weight (409 ± 59), number of cotyledons (12±4), maternal (152±43) and fetal (159±39) surface area and insertion of umbilical cord at centre (4.8%) of low birth weight babies were significantly ($p<0.001$) reduced when compared with normal birth weight babies placental weight (573±70), number of cotyledons (16±5), maternal (251±44) and fetal (248±46) surface area, insertion of umbilical cord at centre (69%) (Table 1)

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

Birth weight		
Placental Morphometric variable	Normal	Low(=2506 gm)
Palcenta weight(gm)	573±70	12±4
Number of coty ledons	16±5	152±43
Maternal surface area (mm^2)	251±43	159±39
Fetal surface area (mm^2)	248±46	159±39
Umbilical cord insertion at center (%)	69	4.8

Values 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 $p<0.001$

DISCUSSION

A majority of cases present an asymmetric pattern of growth, often associated with abnormalities in placental structure and function. The placenta is a multifaceted organ that plays critical roles in maintaining and protecting the developing fetus. These roles include transferring nutrients from the mother to the fetus and waste secretion from the fetus to the mother, acting as a barrier for the fetus against pathogens and the maternal immune system, and serving as an active endocrine organ capable of synthesizing and secreting a plethora of hormones, growth factors, cytokine and other bioactive products. A link between intrauterine environment and adult disease was pioneered by Barker and co-workers, who reported associations between low birth weight and the risk of developing Type 2 diabetes [4-5] and cardiovascular disease [6-7].

The placenta maintains fetal homoeostasis by performing a wide range of physiological functions, which after birth are carried out by the kidney, gastrointestinal tract, lungs and endocrine glands of the neonate. The primary functions of the placenta are to provide an immunological barrier between fetus and mother, mediate the transfer of respiratory gases, water, ions and nutrients, and produce and secrete a vast array of hormones, cytokines and signaling molecules. Maternal blood supply is established at the end of the first trimester and maternal blood enters the placenta via the spiral arteries, which delivers blood directly to the intervillous space. One of the major challenges in measuring the incidence of low birth weight is the fact that more than half of infants in the developing world are not weighed. In the past, most estimates of low birth weight for developing countries were based on data compiled from health facilities. However, these estimates are biased for most developing countries because the majority of newborns are not delivered in facilities, and those who are represent only a selected sample of all births [8-9].

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 [10]. Variation in the size of the placenta may effects its function, in particular the ability to transfer nutrients to the fetus via changes in the exchange surface area [11], in general, small placentas are associated with small foetuses [12].

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 [13].

In the present study placental weight, number of cotyledons, maternal surface area and insertion of umbilical cord at centre were significantly reduced in the low birth weight babies. Reduction in the morphometry of plasma observed in the present study may association with altered fetal nutrient and hormone supply, which in turn may reduces the foetal weight[14].

A baby's low weight at birth is either the result of preterm birth (before 37 weeks of gestation) or of restricted foetal (intrauterine) growth. Low birthweight is closely associated with foetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life[6]. The present study also that only 48% of umbilical cord insertions were in centre which associated with normal birth weights and 69% were marginal which related to lower birth weights and remaining 26.2% of insertions were median and lateral which indifferently associated with birth weights [15]. 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 [16]. Early evaluation of plasma by sonography, in addition to the routine use of uterine artery Doppler may be a valuable tool help in predicting low birth weight infants in the uterus itself an it might helpful to avoid low birth weight [17].

Birthweight is affected to a great extent by the mother's own foetal growth and her diet from birth to pregnancy, and thus, her body composition at conception. Mothers in deprived socio-economic conditions frequently have low birth weight infants. In those settings, the infant's low birthweight stems primarily from the mother's poor nutrition and health over a long period of time, including during pregnancy, the high prevalence of specific and non-specific infections, or from pregnancy complications, underpinned by poverty. Physically demanding work during pregnancy also contributes to poor foetal growth[18]. More than 20 million infants worldwide, studies epidemiologically representing 15.5 per cent of all births, are born with low birthweight, 95.6 per cent of them in developing countries. The level of low birthweight in developing countries (16.5 per cent) is more than double the level in developed regions (7 per cent)[19].

Conclusion:

While low birthweight continues to be useful in focusing attention on a healthy start to independent life, it has also become increasingly evident that the cut-off value of 2,500 g may not be appropriate for all settings..The low birthweight rate may be high because of a high incidence of preterm deliveries and other complications. On the other hand, hospital data may underestimate the population rate when women who deliver in hospitals come from higher socioeconomic strata than women who deliver at home. An early examination of not only the foetus, but also the placenta by non invasive techniques like uitrasonography will be helpful to predict and 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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