THE ROLE OF UMBILICAL ARTERY DOPPLER IN DETECTION AND MANAGEMENT OF FETAL GROWTH RETARDATION

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The objective of this study was to evaluate the efficacy of Doppler flow study in the umbilical artery in the diagnosis and management of FGR (foetal growth retardation) in small for gestational age (SGA) fetuses. This descriptive study, was carried out in the Department of Obstetrics of Military Hospital Rawalpindi, in collaboration with the Radiology department. The data was collected from Jan 2000 to Dec 2001. Seventy subjects with SGA pregnancies on clinical examination were evaluated for foetal growth retardation. On the basis of umbilical artery doppler flow study the subjects were categorized into normal and abnormal umbilical artery doppler groups. Perinatal outcome of these groups were compared. Out of all SGA foetuses 28 (40%) were found to have abnormal umbilical artery doppler. They were more likely to be delivered by caesarean section (82.1%) and were born more than two weeks earlier. They had poorer Apgar score, higher rate of birth asphyxia (10.7%), hypoglycemia (46%), were twice as likely to be admitted to the newborn nursery (75%) and spent longer in the hospital (68% > 48 hrs) and were smaller in all body proportions than those with normal umbilical artery doppler. There were five perinatal deaths (17.8%), all in babies with abnormal umbilical artery doppler. It is thus concluded that the doppler study allows a noninvasive assessment of uteroplacental insufficiency, and is an accurate method for diagnosis and management of foetal growth retardation.

Key Words: *Umbilical artery Doppler, Fetal growth retardation, perinatal morbidity.*

INTRODUCTION

Intrauterine growth retardation (IUGR) is defined as a birth weight below the 10th percentile for a given gestational age[1]. Small for gestational age (SGA) infants are defined as birth weight < 10th centile for gestational age[2,3]. Small for gestational age (SGA) is also defined as an ultrasound scan measurement of the foetal abdominal circumference below an arbitrary percentile usually between the 2.5th and 10th on charts derived from a representative sample of fetuses[4]. Some people do not use size criteria alone and incorporate abnormal umbilical artery doppler waveform in the diagnosis of IUGR[5,6].

Up to 3-5% of pregnancies result in a neonate that is SGA[7]. Being SGA is a major cause of fetal and neonatal mortality and long-term morbidity; therefore, its effects are important not only to the obstetricians but also to the neonatologists and pediatricians. These children are at a risk of impaired growth and neurodevelopment and increased rates of cerebral palsy[8]. Furthermore, the implications of being SGA are life long, in that, it appears to predispose to adult disease, including maturity onset diabetes and cardiovascular disease[9].

Within the SGA group of fetuses, only a minority will actually be small due to some pathology.

Categorization of decreased size by aetiology is very important, as not every small foetus is at equal risk of adverse sequelae. Umbilical artery doppler studies enables to classify SGA foetuses into groups with varying degrees of risk to the foetus and new-born.

The aim of this study was to assess the efficacy of umbilical artery doppler in the diagnosis and management of foetal growth retardation.

PATIENTS AND METHOD

One hundred patients were selected from the antenatal clinic with clinical suspicion of SGA foetuses on the basis of reduced symphysio-fundal height than gestational age. Detailed history and clinical examination was followed by antenatal ultrasound scan. Eighteen of those foetuses were found to have congenital anomalies on anomaly scan, four were found to have positive TORCH screening, six were found to have more than 10% abdominal circumference and two patients were lost to follow up, making up thirty in total. They were excluded from the study. Doppler flow study in the

umbilical artery was done on the remaining seventy patients, which categorized SGA foetuses into two groups: normal umbilical artery doppler study group and abnormal umbilical artery doppler study group.

In women with SGA pregnancies and a normal doppler study, repeat growth scans and doppler study were performed fortnightly. The women with abnormal umbilical artery doppler were admitted to the antenatal ward for closer monitoring and foetal surveillance. Grossly abnormal doppler dictated emergency delivery irrespective of gestational age. In all SGA pregnancies cardiotocography (CTG) was recorded during labour that facilitated the decision of continued augmentation of labour or emergency abdominal delivery.

The perinatal outcome, NICU admissions, Apgar score, birth measurements of weight, length and head circumference, congenital abnormalities and perinatal deaths were recorded. Data was collected on maternal birth outcomes and mode of delivery.

RESULTS

Small for gestational age babies with abnormal umbilical artery doppler studies were smaller in all body proportions and were born at the mean age of 34 weeks compared to 38 weeks for those with normal umbilical artery doppler studies (Table 1).

Table 1: *Neonatal morphometry.*

	Abnormal Doppler N=28	Normal Doppler N=42
Gestational age at delivery	34 wks	38.1 wks
Birth weight (gm)	1700	2430
Length (cm)	43.0	48.0
Head circumference (cm)	30.5	33.0
Female	18	24

Twenty-one out of 28 (75%) neonates with abnormal umbilical artery doppler studies were admitted to the newborn nursery and spent longer in the hospital, compared to 14 out of 42 (33%) babies from normal doppler group (Table 2). Babies with abnormal umbilical artery doppler were born with poorer Apgar score and were more likely to suffer from asphyxia and hypoglycaemia than those babies with normal umbilical artery doppler. There were five perinatal deaths (17.8%), all in babies with abnormal umbilical artery doppler studies. Four of the five deaths (one still births and three neonatal deaths) occurred in babies of borderline viability (birth weight 600-920g). All of

these had grossly abnormal umbilical artery doppler studies (absent or reversed end-diastolic flow). The fifth case was neonatal death in a foetus with abnormal umbilical artery doppler studies delivered at 36 weeks and diagnosed after birth as having congenital heart disease.

Table 2: *Neonatal morbidity.*

	Abnormal Doppler N=28	Normal Doppler N=42
Admitted to NICU	21 (75%)	14 (33%)
Nursery admission > 48 hrs	19 (68%)	12 (28%)
Perinatal death	5 (17.8%)	0
Birth asphyxia	3 (10.7%)	1 (2.3%)
Hypoglycaemia	13 (46%)	11 (26%)

Table 3: *Maternal birth outcomes.*

	Abnormal Doppler N=28	Normal Doppler N=42
Spontaneous labour	1 (3.5%)	5 (11.9%)
Induction of labor	6 (21.4%)	30 (71.4%)
Caesarean section	23 (82%)	9 (21.4%)
Caesarian section for fetal distress	8 (28.5%)	3 (7.1%)

In mothers of SGA foetuses with abnormal umbilical artery doppler there were 23 out of 28 (82.1%) caesarian deliveries, compared to 5 out of 42 (11.9%) in those with normal umbilical artery doppler. There were six inductions (21.4%) and only one (3.5%) went into spontaneous labour in the abnormal umbilical artery doppler group in contrast to thirty inductions (71.4%) and five spontaneous labours (11.9%) in the normal umbilical artery doppler group (Table 3).

DISCUSSION

Doppler ultrasound provides an evaluation of foetal haemodynamics[10]. Doppler investigations of the umbilical arteries provide information concerning perfusion circulation, while doppler studies of selected foetal organs are valuable in detecting the haemodynamic rearrangements that occur in response to foetal hypoxia and anaemia. When caused by uteroplacental dysfunction, the typical progress begins with increased resistance in the umbilical artery, is followed by decreased resistance in the middle cerebral artery, and is completed with the development of abnormal venous waveforms as cardiac function deteriorates. Even though the failure of a foetus to attain or exceed its expected growth potential may result from

numerous differrent pregnancy complications, the final common pathway most often encountered in practice is via uteroplacental insufficiency[11]. Doppler ultrasound allows a direct estimation of foetal circulation and placental function[12]. The most widely employed indices for arterial flow are the systolic diastolic ratio (S/D ratio) the resistive index (RI) and the pulsatility index (PI). A fall in end diastolic velocity elevates each of the indices and usually indicates increased down - stream resistance. A resistance index of more than 955 for gestation is taken as abnormal umbilical artery study[13].

An abnormal umbilical artery doppler in a SGA foetus shows histological evidence of placental vascular pathology and is at increased risk for perinatal death, iatrogenic preterm delivery and morbidity in the newborn period[14].

In this report umbilical artery doppler studies were performed in all SGA foetuses, this helped us to predict foetal morbidity and mortality in the abnormal umbilical artery doppler group. This along with CTG recording enabled us to intervene at an appropriate time to improve perinatal outcome[15].

As has been shown by others[16] perinatal morbidity and mortality were significantly greater in SGA babies with abnormal umbilical artery doppler. In a large study of neonatal out come in relation to umbilical artery doppler finding by Trudinger et al, babies were grouped by gestational age at delivery and those with abnormal umbilical artery doppler spent significantly longer in neonatal intensive care unit[17]. A number of studies have found that SGA babies with abnormal umbilical artery doppler studies are smaller and their mothers were delivered earlier than those with normal umbilical artery doppler studies[18].

There were no perinatal deaths in SGA babies with normal umbilical artery doppler studies in this series. Whereas, in the abnormal artery doppler study category there were five perinatal deaths, one stillbirth and four neonatal deaths. This group was associated with a higher mortality indicating that abnormal umbilical artery doppler studies reflected disease severity in the SGA fetuses.

In a study on the role of umbilical artery doppler to predict adverse perinatal outcome in women with pre-eclampsia Yoon et al, reported, that when gestational age at birth and pre-eclampsia were controlled for, an abnormal umbilical artery doppler study was still a significant independent predictor of adverse perinatal outcome[18].

CONCLUSION

We conclude that SGA foetuses necessitate categorization into constitutionally normal small foetuses (NSF) and foetal growth retardation (FGR). This categorization helped us to reduce unnecessary apprehensions and intervention in NSF group and enabled us to have closer surveillance and timely intervention in the FGR group.

Doppler ultrasound allows a non-invasive assessment of the degree of uteroplacental insufficiency and thereby categorises SGA foetuses into the FGR group. Once FGR is diagnosed these patients are placed in high-risk pregnancy group requiring vigilant and frequent foetal surveillance.

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