Original Article

Significance of umbilical artery Doppler velocimetry in the perinatal outcome of the growth restricted fetuses

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Abstract

Objectives: To evaluate the role of umbilical artery Doppler in growth restricted fetuses. Methods: In a prospective observational study, 100 pregnant women with growth restricted fetuses confirmed by ultrasound were evaluated by umbilical artery Doppler velocimetry after 28 weeks of gestation. Outcome of the pregnancy was recorded for the normal Doppler group (n=54) and abnormal Doppler group (n=46). Abnormal Doppler group consisted of low end diastolic flow group (n=29) and absent or reversed end diastolic flow (REDF) group (n=17). Results: Fetuses with abnormal umbilical flow velocimetry had higher incidence of oligohydramnios and abnormal NST compared to the fetuses with normal umbilical flow. The average birth weight and gestational age at delivery were lower in the abnormal Doppler group. Neonates with abnormal umbilical artery velocimetry had increased incidence of caesarean delivery, low Apgar scores at birth, increased NICU admissions, increased requirement of positive pressure ventilation, and higher perinatal morbidity and mortality. Conclusion: Umbilical artery Doppler velocimetry should be used in the management of the intrauterine growth restricted fetuses, as it helps in differentiating fetus with pathological growth restriction at risk for perinatal complications from small and healthy fetuses.

Key words: perinatal outcome, intrauterine growth restriction, Doppler, umbilical artery velocimetry.

Introduction

Identification of the pregnancies at risk for preventable perinatal morbidity and mortality is a primary goal of the obstetric care provider. Intrauterine growth restriction (IUGR) is a clinical sign of chronic fetal hypoxemia. IUGR is associated with significant morbidity in the form of meconium aspiration syndrome (MAS), hypoglycemia, hyaline membrane disease (HMD), early onset sepsis (EOS), intrapartum asphyxia and stillbirth in extreme cases. The perinatal mortality rate for these infants is 6 to 10 times greater than that for a normally grown population. This can be lowered by timely identification and management of growth restricted fetuses.

Assessment of the umbilical artery Doppler velocimetry provides information on the blood perfusion of the fetoplacental unit. Normally there is very little impedance against blood flowing through the umbilical arteries. As the placenta matures and the pregnancy advances, more tertiary villi is formed, which directly
leads to an increase in the end diastolic flow. Umbilical artery Doppler reflects downstream placental vascular resistance, strongly correlated with intrauterine growth restriction and the multisystem effects of placental deficiency. Abnormalities in the umbilical artery waveforms are progressive with reduction, loss and finally reversal of the diastolic flow. Reversed flow is associated with high incidence of perinatal and overall mortality and severe IUGR compared to absent end diastolic flow$^1$.

**Material and Methods**

The study population consisted of 100 women who had singleton pregnancies with small for gestational age (SGA) fetuses. These women either attended the antenatal clinics with us or were referred from the peripheral hospitals in view of IUGR over a period of two years (2005-2007).

The pregnancies were dated by the combination of last menstrual period and first trimester dating scan. The diagnosis of IUGR was made clinically and confirmed subsequently on ultrasound when the fetal abdominal circumference was less than 2SD (standard deviation) from mean value. A detailed anomaly scan was performed on all fetuses and dysmorphic fetuses were excluded from the study. All women included in the study were subjected to umbilical artery Doppler measurements in addition to growth parameter, liquor and placental grading. For the purpose of analysis, the study population was distributed into two groups - a normal Doppler group (Group I) and an abnormal Doppler group. Abnormal Doppler group was subdivided into diminished end diastolic flow group (Group II), and an absent or reversed diastolic group (Group III).

Doppler examinations were repeated weekly or biweekly according to the severity of the reduction of the end diastolic flow in the umbilical artery. Patients with S/D ratio equal to or more than three and those with absent diastolic or reversed diastolic flow were admitted for further evaluation and delivery. Steroids were administered as single dose to women between 28 and 34 weeks of gestation to enhance fetal lung maturity. Decision to deliver was taken in situations as–

- Gestation age of 37 weeks
- Absent end diastolic flow, Reversed end diastolic flow (Abnormal umbilical artery Doppler)

# Abnormal fetal heart rate pattern
# Worsening of maternal condition eg. preeclampsia.
# Severe IUGR with amniotic fluid index (AFI) <5

Induction of labor was performed with prostaglandin E2 gel or oxytocin in those planned for vaginal delivery. A group of women with associated obstetric indications were scheduled for elective cesarean section. Those developing fetal distress during labor were delivered by emergency cesarean section. Outcome data were collected including gestational age at birth, birth weight, apgar scores, admission to neonatal intensive care unit, need for positive pressure ventilation and neonatal mortality.

In order to establish the statistical significance, the data were compared by applying the student's 't' test and chi-square test. The probability 'p' value less than or equal to 0.05 was considered statistically significant.

**Results**

The average age of patients in the study group was higher (27.2 years), 58% of the mothers having IUGR babies were primigravida, 70% of these patients had hypertensive disorders, just 34% had anemia. This low incidence of anemia in the study population was due to the higher incidence of hypertensive disorders leading to hemoconcentration in these patients. Nine percent of the women had bad obstetric history (BOH), 2% of the mothers having IUGR babies had renal dysfunction and 3% had anti-cardiolipin antibodies (ACA) positive.

Out of the total IUGR babies 96% had live birth, 4% were still born and 14% had neonatal death. Average gestational age at delivery was 34.4 weeks and 52% of the IUGR babies were delivered by cesarean section. Average birth weight of these IUGR babies was quite low i.e. 1.61 kg.

Forty five of the 100 (45%) pregnancies with IUGR had abnormal Doppler waveforms in the umbilical arteries. Doppler waveform of the umbilical artery was considered abnormal if S/D ratio was equal to or more than three or diastolic flow was absent / reversed in fetuses above the gestational age of 28 weeks$^{1-4}$. The mean for the normal S/D ratio group (n=55) was 2.53