

Original Research Article

Umbilical Artery Doppler in High Risk Pregnancies

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Abstract: High risk pregnancies present a formidable challenge to obstetricians for effective antenatal care to result in a better perinatal outcome. Doppler usg of fetal umbilical artery can help in prediction of fetal compromise. The main aim is to determine the usefulness of umbilical artery Doppler studies to predict perinatal outcome in high risk cases. It was a hospital based prospective study carried out in the Department of Obstetrics and Gynaecology, Gauhati Medical College from 1st May 2013 to 30th April 2014. A total of 100 women with high risk pregnancies who attended the antenatal OPD were included in the study. In this study we observed that poor umbilical artery Doppler in high risk pregnancies is associated with significant perinatal mortality and morbidity as compared to normal Doppler. Thus Doppler USG of umbilical artery can be helpful in monitoring of antenatal high risk cases.

Keywords: high risk, prospective study, monitoring, foetal, outcome.

INTRODUCTION

A high risk pregnancy is one in which the mother or the developing fetus has a condition that places one or both of them at a higher than normal risk for complications either during the antepartum, intrapartum or post partum period. Such cases pose a challenge for obstetrician as it requires special early and regular prenatal care to result in a healthy pregnancy and delivery with minimal complications. The advent of ultrasound by Professor Ian Donald in 1960[1] opened great dimensions in obstetric diagnosis to usher in better maternal and perinatal care. Doppler ultrasound is a non-invasive and cost-effective method to assess fetal well-being at an early stage even before physical changes in biophysical profile appear. Antepartum Doppler studies may be used to determine the volume and rate of blood flow through maternal and fetal vessels and thus predict haemodynamic complications like IUGR or preeclampsia. Doppler ultrasound has been used in Obstetrics since 1976 to study fetoplacental circulation (umbilical), and since the 1980s to study the uteroplacental (uterine) circulation and fetal circulation [2]. Doppler velocimetry of the umbilical artery assesses the resistance to blood perfusion of the fetoplacental unit. As early as 14

weeks, low impedance in the umbilical artery permits continuous forward flow throughout the cardiac cycle [3]. Maternal or placental conditions that obliterate small muscular arteries in the placental tertiary stem villi result in a progressive decrease in end-diastolic flow in the umbilical artery Doppler waveform until absent and then reversed flow during diastole are evident. Reversed end-diastolic flow in the umbilical arterial circulation represents an advanced stage of placental compromise and has been associated with obliteration of >70% of arteries in placental tertiary villi. Absent or reversed end-diastolic flow in the umbilical artery is commonly associated with severe (birth weight < 3rd percentile for gestational age) IUGR and oligohydramnios [4]. Extreme change in the umbilical circulation may reflect severe fetal anomalies such as major fetal vascular anomalies and cardiac defects, particularly tetralogy of Fallot with absent pulmonary valve syndrome, patent ductus arteriosus, cardiac septal defect and even trisomy 18 or trisomy 13 [5]. Thus umbilical artery Doppler can be used in the surveillances of fetal wellbeing and thus reduce perinatal mortality and morbidity in high risk obstetric situations [6]. The purpose of this study is to understand

the significance of umbilical artery Doppler to predict perinatal outcome in high risk pregnancies.

MATERIALS AND METHODS:

The study was carried out in the Department of Obstetrics and Gynecology of Gauhati Medical College and Hospital over the period from 1st May 2013 to 30th April 2014. It was a hospital based prospective study. A total of 100 women with high risk pregnancies who attended the antenatal OPD were included in the study.

Inclusion Criteria:

- History of pre-eclampsia or eclampsia in previous pregnancy.
- Pre-existing medical disorders like Diabetes, Hypertension, Renal disease, anemia.
- History of IUGR or stillbirth.
- History of recurrent Pregnancy loss
- Pre-eclampsia in current pregnancy.
- Extremes of age (<20 yrs and >35yrs)Exclusion Criteria.
- Patients with multiple pregnancies.
- Patients with congenital anomaly of fetus.
- Patient unreliable to follow up.
- Patients with unreliable LMP and not confirmed by early USG.

Pulse wave Doppler ultrasound examination of the umbilical artery was performed using Color Doppler (GE 700 MR with 3.5 MHz curvilinear transducer). The

umbilical artery was identified and flow velocity wave forms were obtained from free-floating loop of cord. Recordings were accepted for analysis only after a clear steady for two consecutive pulsatile waveform. No waveforms were recorded during fetal movements and breathing. The angle between the ultrasound beam and direction of blood flow was <35 degrees. The following parameters were considered

- Umbilical arterial S/D ratio(SDR): systolic velocity/diastolic velocity
- Pulsatility index(PI)(Gosling index):(PSV - EDV)/TAV
- Resistive index(RI) (Pourcelot index): (PSV-EDV)/PSV
PSV= peak systolic velocity
EDV= end diastolic velocity
TAV= time averaged velocity

The most common in clinical practice are Pulsatility index and Resistance index [7]. The patients were followed up till delivery and details of pregnancy events, labour and delivery and neonatal outcomes were noted. All the data were entered in Microsoft excel sheeth and analysed using SPSS version 16 for windows.

RESULTS:

In our study we enrolled 100 pregnant women who fulfilled the inclusion criteria after obtaining and informed and written consent.

Table 1:- Various prognostic parameters of study population

Parameters	Frequency (n=100)	
Maternal age of patients	Less than 20yrs	8
	20-35 years	82
	More than 35yrs	10
Parity	Primipara	36
	Multipara	64
Gestational age at delivery	<37weeks	34
	>37weeks	66
Umbilical artery Doppler	Normal	60
	Abnormal	40
Mode of delivery	Spontaneous Vaginal	44
	LSCS	56

In our study most of the cases were within the reproductive age group of 20-35 years, however 8 cases were below 19yrs and 10 cases were more than 35 yrs of age. Most of the cases were multigravida (64%) and more than 37 weeks of gestation. However 34% cases were less than 37 weeks of gestation. 60 cases had a

normal umbilical artery Doppler while in the number of cases with abnormal Doppler study was 40. Abnormal Doppler group consisted of cases with low end diastolic flow group(n=35) and absent or reversed end diastolic flow(n=5).Because we included the high risk cases the rate o caesarean sections (both elective and emergency)

were higher 56% compared to vaginal deliveries(44%). Most of the cases i.e. 24 cases of caesarean sections were due to fetal distress. Other causes of caesarean

included oligohydramnios, prolonged labour, elderly primi and breech respectively.

Table 2: Perinatal outcome with umbilical artery Doppler

Parameter		Frequency		P
		Normal Doppler(n=60)	Abnormal Doppler (n=40)	
Gender	Male	27	22	0.32
	Female	33	18	
Birth weight	<2.5kg	22(36.67%)	31(77.5%)	0.0061
	>2.5kg	38(63.33%)	9(22.5%)	
APGAR SCORE at 1min	<7	19(31.67%)	26(65%)	0.001
	>7	41(68.34%)	14(35%)	
NICU admission	Yes	13(21.67%)	13(32.5%)	0.17
	No	47(78.34%)	25(62.5%)	

In our study we found that the number of male births with normal Doppler was 27% and abnormal Doppler was 22%, while the number of female births was 33% with normal and 18% with abnormal Doppler respectively. These were however not significant statistically. Out of the cases with normal Doppler 22(36.67%) had IUGR babies while it was 31 (77.5%) in cases with abnormal umbilical artery Doppler which was statistically significant. The APGAR score was less than 7 for 31.67% cases with normal Doppler and 65% cases with abnormal Doppler which is statistically significant. In cases with reversed end diastolic flow in Umbilical artery Doppler 2 babies were severely depressed and could not be resuscitated. The number of NICU admission were statistically significant in cases with abnormal umbilical artery Doppler(32.5%) as against 21.6% in cases with normal Doppler. Most of the causes of NICU admission were in the form of meconium aspiration, hypoglycaemia, hyaline membrane disease, early onset sepsis and intrapartum asphyxia.

DISCUSSION:

In this study we observed that poor umbilical artery Doppler in high risk pregnancies is associated with significant perinatal mortality and morbidity as compared to normal Doppler. The abnormalities of 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 [8]. In our study patients with

reversed end diastolic flow (REDF) had worst perinatal outcome (2 cases of stillbirth out of 5 cases of REDF) i.e. 40% which is consistent with the studies of Zelop CM et al who found a mortality of 333/1000 cases or 33.3% in cases with reversed end diastolic flow in structurally normal singleton fetuses [9]. In our study the umbilical artery PI in cases with normal Doppler was 0.91 while it was 1.4 in the cases with abnormal Doppler. This is similar to the findings of Seyam YS et al who found the PI of umbilical artery 1.32 in the abnormal Doppler group and 0.85 in the normal Doppler group [10]. In our study 31 out of the 40 cases (77.5%) with abnormal Doppler had IUGR which is slightly higher than the study of Chanprapah *et al* who found a prevalence of 50.9% [11]. Another significant observation of our study was that the perinatal outcome was poorer in cases with abnormal umbilical artery Doppler with 65% babies having APGAR score less than 7 a birth as compared to 31.67% with normal Doppler. The number of NICU admissions was 32.5% for cases with abnormal Doppler while it was 13% for cases with normal Doppler. Various study have already demonstrated that cases with abnormal Doppler have poor perinatal outcome [12-16]. Thus it is seen that abnormal obstetric umbilical artery Doppler velocimetry is a good predictor for predicting poor perinatal outcome like IUGR, NICU admissions, perinatal complications and even neonatal death. High risk pregnancies present a potential challenge for obstetricians for effective care to result in better maternal and perinatal outcome. Thus Doppler ultrasound can serve as a non-invasive, non traumatic, cost effective and easily available

diagnostic tool for antenatal monitoring of high risk pregnancies.

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