

# Role of doppler velocimetry in determining the prognosis and management of intrauterine growth restricted fetuses

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## Abstract

**Objectives:** The intrauterine growth retardation (IUGR) takes second position after premature births as a cause for neonate with smaller weight for its gestational age. Perinatal mortality is eight times higher than normal weighted neonates. In India the incidence of low birth weight varies from 15 to 25% and more than 50% of them are IUGR. **Methods:** The present study was done in department of Radiology between JAN 2018 to DEC 2018. A total of 100 cases of intrauterine growth restricted foetus were studied, Detail history was taken. General and Obstetrical examination was done along with routine haematological and urine investigations. Ultrasound examination was done for growth, AFI (Amniotic fluid Index) and placental localisation. Foetal well being was assessed with doppler study of umbilical artery, uterine artery and Middle cerebral artery. **Results:** In the present study abnormal colour doppler flow of umbilical, uterine and middle cerebral artery was seen in 82%, 76% and 68% respectively. 22% of foetus with IUGR had normal doppler study. 11% of pregnancies with abnormal doppler flow ended in the form of foetal demise compared to normal doppler flow where foetal demise was only 2.8%. Surgical intervention in the form of caesarean section was require in 76% of pregnancy with abnormal Doppler flow and 48% of pregnancies with normal doppler flow. Cerebro-placental ratio (CPR<1) is associated with 16% foetal demise in contrast to CPR>1 where foetal demise is 2%. Incidence of AEDF/REDF in IUGR was 10% that resulted in 55% loss of foetus. **Conclusion:** Colour Doppler is a useful mode to predict foetal outcome in IUGR. Colour doppler allows better understanding of hemodynamic changes in fetoplacental and uteroplacental circulation. The cerebroplacental ratio (CPR) is now the most powerful parameter for assessment of IUGR and hypoxia.

**Key Word:** IUGR- Intrauterine growth restriction, AEDF- Absent end diastolic flow, REDF- Reverse end diastolic flow, CPR- Cerebroplacental ratio.

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## INTRODUCTION

IUGR (Intra uterine growth restriction) is an important and challenging problem for obstetricians, paediatricians and radiologists. Foetal growth restriction is a failure to reach genetically predetermined growth potential and is clinically suspected if sonographic estimates of foetal weight, size or symmetry are abnormal. Investigation of foetal anatomy assessment, amniotic fluid dynamics, uterine, umbilical and foetal middle cerebral artery doppler is the most effective approach to differentiate potentially manageable placenta based foetal growth restriction from aneuploidy, non aneuploid syndrome and viral infection. Once placenta based foetal growth restriction is diagnosed, integrating multivessel doppler and biophysical profile

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score provides information on longitudinal progression of placental dysfunction and degree of foetal aciduria, respectively IUGR is a leading contributor in perinatal morbidity and mortality affecting 23.8% newborns around the world and 75% are born in Asia alone. Perinatal mortality is 4.8% higher for growth restricted infants and morbidity is present in 50% of surviving infants. In India the incidence of low birth weight varies from 15 to 25% and more than 50% of them are IUGR. Doppler velocimetry helps in early detection, prompt follow up and timely decision in the management of IUGR. The most useful diagnostic criteria are umbilical artery PI (pulsativity index) and cerebro-placental ratio (CPR). Abnormal uterine artery waveforms is that with S/D ratio > 2.7 and persistence of diastolic notch beyond 26 weeks of gestation predicts developing IUGR later in pregnancy<sup>3,4,5</sup>. Umbilical artery Doppler waveforms reflect the placental circulation and there is increase in end diastolic flow with advancing gestation. Middle cerebral artery doppler provides an opportunity to assess the brain sparing effect in IUGR babies. This causes increased diastolic flow during foetal asphyxia. Normally, diastolic component in cerebral arteries is longer than in umbilical arteries at any gestational age. So, that cerebral vascular resistance is higher than placental resistance and CPR >1.0<sup>7</sup>. Major advantage of using CPR instead of RI or PI values is that the effect of increased heart rate is nullified.<sup>8</sup> The aim of the study is to identify the high risk patients likely to have IUGR foetuses and to select appropriate mode and time of delivery under optimal conditions of foetus at risk. To evaluate outcome of pregnancy in cases of established IUGR in terms of perinatal morbidity and mortality.

**METHODS**

The present study was done in department of Obstetrics and Radiology, JLNMCB, Bhagalpur, Bihar between JAN 2018 to DEC 2018. A total of 100 cases of intrauterine growth restricted foetuses were studied. Detailed history was taken. General and obstetric examinations were done along with routine haematological and urine investigation. All the patients had first trimester ultrasound from which exact gestational age could be decided and IUGR was possible to diagnose. Foetal well being assessment was done in terms of daily foetal movement count, non stress test serial ultrasound and colour Doppler, mode of delivery was decided on conditions of foetus. Neonates were examined in terms of weight, height APGAR score at 1 min and 5 min and perinatal morbidity was noted.

**RESULTS AND DISCUSSION**

Possible etiologies of IUGR are placental disorders, maternal disorder and foetal disorders.

**Table 1:**

1. MATERNAL	
-	Pre-eclampsia
-	Chronic hypertension
-	Chronic renal disease
-	Connective tissue disorder
-	Diabetes with vascular lesions
-	Sickle cell Anaemia
-	Cardiac disease class –III or IV
-	Multiple gestation
-	Severe malnutrition
-	Smoking
-	Alcohol ingestion
-	Hemoglobinopathies
2. PLACENTAL	
-	Abnormal placentation
-	Chronic villitis
-	Placental infarcts
-	Placental praevia
3. FOETAL	
-	Chromosomal abnormalities.
-	Multifactorial defects
-	Inborn error
-	Infections

**Doppler study:** Uterine artery and umbilical artery doppler velocimetry studies enable the assessment of uteroplacental and fetoplacental unit. In this study about 59% IUGR foetus have abnormal colour doppler study of umbilical artery, 76% have abnormal study of uterine artery doppler and 34 % with abnormal middle cerebral artery doppler. Only 41% of foetus with IUGR had normal Doppler.

**Table 2:** Abnormal Doppler flow in relation with oligomydramnios (AFI < 5 cm) (n= 200).

AFI	DOPPLER	
	Normal (41)	Abnormal (59)
>5	25	28
<5	16	31

About 31 % of foetus with abnormal doppler have AFI <5 and 28 % of IUGR foetus with abnormal doppler have AFI >5 i.e. normal AFI and 16% of IUGR foetus with normal doppler have decreased AFI and only 25 % of IUGR foetus with normal doppler have AFI >5.

**Table 3:** Doppler indices and Route of Delivery (n = 100).

Doppler	Vaginal route	Caesarean section	Total
Abnormal	19	40	59
Normal	24	17	41
Total	43	57	100

About 61 % of foetuses with abnormal doppler were delivered by caesarean section and 32 % with abnormal doppler were delivered vaginally. Among 41 IUGR foetuses with normal doppler findings 58% were delivered vaginally and 36 % by caesarean section. These results are comparable with Lakhakar *et al* showing 62% of caesarean

rate in abnormal doppler flow and 38% vaginal birth in their study.<sup>11</sup> As immediate delivery is must in patient with severely compromised foetus in utero, the incidence of operative intervention is higher in this group. 11% of pregnancies with abnormal doppler flow ended in the form of foetal demise compared to normal doppler flow, where foetal demise is 2.8%. Thus Doppler plays a crucial role in reducing perinatal mortality if timely decision is taken.

**Table 4:** Perinatal outcome and absent / reverse end diastolic flow in umbilical artery (n=200).

Perinatal outcome	AEDF/ REDF	Percentage
Live	11	55 %
Expired	09	45 %
Total	20	100 %

AEDF- Absent end diastolic flow.

REDF- Reverse end diastolic flow.

Absent or reversed end diastolic flow is associated with adverse foetal outcome in 45% of cases. It cause increase in death of foetuses in utero or in early neonatal period. This finding is comparable to the study by Battaglia *et al* having 50% mortality with absent / reverse end diastolic flow.<sup>12</sup> 65% IUGR foetus with CPR <1 landed in NICU admission compared to 32% when CPR > 1. CPR< 1 is responsible for 16% perinatal death in contrast only 2% when CPR>1. This finding is compatible with Embrashy A. Azmy, U.Ibrahim (2005) who showed CPR < 1 identifies new born at risk of increased morbidity.

## CONCLUSION

Although IUGR is probably a physiologic adaptive response to various stimuli, it is associated with distinct short and long term morbidities. Colour Doppler is a useful mode to predict foetal outcome in IUGR. Changes in uterine and umbilical artery strongly correlate with pregnancy outcome. State of umbilical artery is more predictive than that of uterine artery circulation in terms of neonatal outcome. The cerebroplacental ratio (CPR), which measures the proportion of flow supplying the brain and placental is now the most powerful parameter for assessment of IUGR and hypoxia. There is a strong association between AEDF / REDF in umbilical artery and

adverse perinatal outcome. There is not only high risk rate of perinatal loss, but the surviving fetus demonstrates signs of profound compromise. Thus, doppler analysis is the most important tool to grade the severity of foetal disease.

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