

Research Article**Role of Obstetric Doppler in Prediction of Adverse Perinatal Outcome in Intrauterine Growth Retardation and Pregnancy Induced Hypertension**

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Abstract: To determine and compare accuracy of various Doppler parameters for perinatal outcome. Umbilical artery (UA), Middle cerebral artery (MCA) and Ductus Venosus for predicting adverse perinatal outcome in patients of intrauterine growth retardation (IUGR) and pregnancy induced hypertension (PIH). 60 singleton pregnancy with clinically suspicion of IUGR/PIH or both, having gestational age of 30 weeks were included in the study. Serial examination was carried out & perinatal outcome of each cases were noted. In Doppler examination flowmetry of MCA, Umbilical artery & Ductus Venosus were included in the study. Total 60 patients were included in which 28 patients showed abnormal umbilical artery wave form out of these 18 patients has adverse perinatal outcome, while 17 patients showed abnormal MCA flow in which 8 patients had adverse perinatal out come, but all patients with abnormal MCA/UA PI had adverse fetal outcome. In Conclusion, MCA / UA PI is most sensitive & specific index in predicting adverse perinatal outcome than UA & MCA alone. Decrease diastolic flow or reversal of 'a' wave in Ductus has poor outcome.

Keywords: Intrauterine Growth Retardation (IUGR), Pulsatility Index (PI), Umbilical Artery (UA), Middle Cerebral Artery (MCA), Middle Cerebral Artery To Umbilical Artery Pulsatility Index Ratio, Perinatal Outcome,

INTRODUCTION

IUGR is an important disease affecting 15% of pregnancy & is associated with significant short term & long term morbidity [1, 2]. Prediction of risk is the cornerstone of ANC Ultrasound & US is frequently utilized in antenatal period to assess fetal size through serial biometric measurement, amniotic fluid index & the velocitometry analysis of UA & MCA [3, 4].

Doppler USG enables a better understanding of the hemodynamic changes and has therefore become one of the most important clinical tools for fetomaternal surveillance in high-risk pregnancies. It can be credited with causing a significant decrease in perinatal mortality and morbidity [5].

Fetal growth restriction refers to a fetus that has failed to achieve its genetic growth potential, usually because of placental diseases restricting nutritional supply and fetal oxygen partial pressure. SGA are at greater risk of perinatal mortality and morbidity [6]. Fetal umbilical artery is the mainstay of risk assessment in small fetuses and those at risk of compromise [7, 8].

PIH affects 5-10% of pregnancy and one of the major causes of maternal and fetal morbidity and mortality, although there is no proven effective method for prevention of PIH. Routine anti-natal care has the aim to identify women who are at risk, for more intensive anti-natal care [9, 10].

Now days, Doppler ultrasound velocitometry of utero-placental, umbilical and fetal vessels have become established method of anti-natal monitoring. Several studies have reported higher sensitivity and specificity for MCA/ UA PI Doppler ratio compared with umbilical artery velocitometry for prediction of fetal prognosis.

The purpose of our study was to evaluate the usefulness of pulsatility index of the UA and MCA as well as ratio of MCA PI to UA PI in the diagnosis of true IUGR fetuses and prediction of adverse perinatal outcome.

MATERIAL AND METHODS

This was a prospective study in the Department of Radio diagnosis in SAIMS Medical college P.G institute in association with Dept. of Obstetrics and Paediatrics from June 2011 to may 2012 in total period of 1 year. The study population comprised of 60 singleton pregnancies beyond 30 weeks period of gestation age clinically complicated by IUGR and PIH or both.

Gestational age determination was done based on LMP, clinical gestational age or Foetal biometry preferably in first trimester. Pregnancies with multiple gestation and congenital anomalies were excluded from our study. All the patients were followed by serial Doppler assessment. The results of the last Doppler examination within 10 days of the delivery were

considered. The perinatal outcome of each case was noted based on intra partum and neonatal parameters.

Study of various fetal vessels was performed using Philips IU 22 with a 3.5 MHz broadband curvilinear transducer. After taking fetal biometry, spectrum of Umbilical artery, Middle cerebral artery and Ductus Venosus were taken.

RESULTS

Maximum no. of patients in our study was primigravida (33.3%) and age group 18-23 years (35%). Approximately 48% of patients had both IUGR/ PIH, and also 48% of patients had adverse perinatal outcome 28 (46%) out of 60 patients had abnormal Umbilical artery waveform, out of which 18 (30%) had adverse perinatal outcome. All fetuses with absent/ reversal of

diastolic flow in UA had poor perinatal outcome. 28.3% of patients had abnormal MCA waveform out of which 48% had adverse perinatal outcome. 22 patients (36%) out of 60 that showed abnormal MCA/UA PI were SGA babies and had adverse perinatal outcome. PI ratio of MCA & UA is more sensitive & specific index in predicting adverse perinatal outcome than UA PI or MCA PI used alone with sensitivity & specificity as high as 86% and 92% respectively.

All fetuses with decreased diastolic flow or reversal of a wave in Ductus had poor perinatal outcome. D.V waveforms are sensitive marker for acidemia and hypercapnia in I.U.G.R fetuses. Sensitivity and specificity of Ductous venosus was same as ratio of PI of MCA & UA i.e. 88% & 95% respectively.

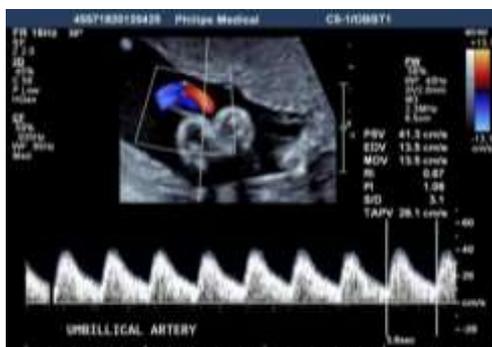


Fig. 1: Normal umbilical artery spectrum was examined in a free floating loop of the cord



Fig. 4: Abnormal reverse flow in umbilical artery with poor perinatal outcome

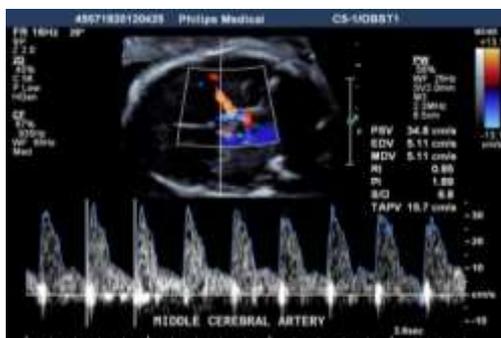


Fig. 2: Normal MCA spectrum was obtained soon after its origin from ICA



Fig. 5: Increase diastolic flow in MCA suggestive of fetal hypoxia

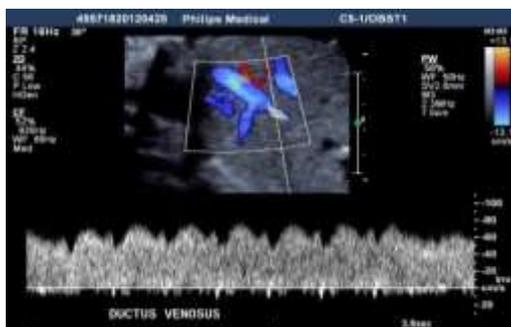


Fig. 3: Normal Ductus Venosus is usually identified on a sagittal section of the fetal torso with its brighter appearance



Fig. 6: Reversal flow of 'a' wave in ductus venosus indicate poor fetal outcome

Table 1: Percentage and no. of pts of UA waveform

Sl. No.	UA waveform	No. of pts.	Percent age
1.	Normal	32	53.3%
2.	Decreased end diastolic flow	18	30%
3.	Absent diastolic flow	6	10%
4.	Reversal	4	6.7 %

Table 2: Percentae and no. of pts of MCA/UA P.I. ratio

Sl. No.	MCA/UA P. I ratio	No. of pts	Percentage
1.	>1	38	63.3%
2.	<1	22	36.7%

Table 3: Percentae and no. of pts of D.V. waveform

Sl. No.	D.V. waveform	No. of pts	Percentage
1.	Normal	49	81.7%
2.	Decreased flow in 'a' wave	07	11.7%
3.	Reversal of flow in 'a' wave	04	6.7%

Table 4: Sensitivity & Specificity of UA, MCA & DV for spectrum of perinatal outcome

Index	Sensitivity	Specificity
UA P.I	53%	82%
MCA P.I	43%	80%
P.I ratio of MCA/UA	86%	92%
DV	88%	95%

DICUSSION

Perinatal Doppler velocimetry can identify those IUGR fetuses before with worst perinatal outcome, But a meta analysis of nine randomized trial showed that length of stay & perinatal mortality were significantly reduced when UA Doppler velocimetry was used as an adjuvant to FHR monitoring , as by the time FHR tracing become abnormal , up to 77% of fetuses are already hypoxic & academic [11,12].

Fetal hypoxia activates a range of biophysical, cardiovascular, endocrine and metabolic responses. Fetal cardiovascular responses to hypoxia, which include variation of the heart rate, an increase in blood pressure and redistribution of the cardiac output towards vital organs, are probably the most important adaptive reactions responsible for maintaining fetal homeostasis. The redistribution of blood flow towards the fetal brain is known as the 'brain-sparing effect'. Doppler assessment of the fetal cerebral and umbilicoplacental circulations can detect fetal blood flow redistribution during hypoxia and quantify the degree of this redistribution. Although the brain-sparing effect attempts to compensate for the reduced oxygen delivery to the fetal brain, it has recently become clear

that this phenomenon cannot always prevent the development of brain lesion [13-15].

In IUGR, umbilical blood flow is significantly reduced, mainly due to changes in the placental vascular resistance. Giles *et al.* [16] have found that a decrease in the number of resistance vessels in the tertiary stem villi in the placenta causes an increase in resistance, leading to decreased flow through the UA and an increase in the UA PI. This is described as umbilical placental insufficiency. Fleischer and Schulman [5] have found that in IUGR complicated by pregnancy induced hypertension, there is inadequate trophoblastic invasion of the spiral arteries, leading to increased resistance in the spiral arteries and decreased blood flow in the placental vascular bed and in the UA, thereby resulting in an increase in the UA PI. This is described as uteroplacental insufficiency. Several blood flow classes (0IIIb) have been defined by Hofer *et al.* [17] to describe abnormal UA waveform patterns. Increasing pathological significance is ascribed to a decrease in diastolic flow (class II), absence of diastolic flow (class IIIa) and reversal of diastolic flow (class IIIb). All these patterns were associated with increased UA PI . Patients with absent end diastolic volume (AEDV) and reverse end diastolic volume (REDV) have the gravest outcome. Fetuses with AEDV require intensive surveillance as fetal wellbeing may deteriorate very fast. Fetuses with REDV are most severely compromised. REDV indicate preterminal fetal state.

Doppler flow velocimetry of the fetal MCA may assist in perinatal diagnosis and management of complicated pregnancies. A low index of pulsatility in the middle cerebral artery associated with fetal compromise has been described [18-21]. Because the MCA/UA ratio incorporates data not only on placental status but also on fetal response, it is potentially more advantageous in predicting perinatal outcome. Doppler data combining both umbilical and cerebral velocimetry provide additional information on fetal consequences of the placental abnormality [22].

Abnormal MCA/UA PI Doppler ratio is strongly correlated with worse fetal prognosis. In normal pregnancies the diastolic component in the cerebral arteries is lower than in the umbilical arteries at any gestational age. Therefore, the cerebrovascular resistance remains higher than the placental resistance and the MCA/UA PI is greater than 1. The index becomes less than 1 if the flow distribution is in favor of the brain in pathological pregnancies. Fetuses with abnormal Doppler MCA/UA PI in our study had a significantly lower birth weight, lower gestational age at delivery [23].

Our study showed high sensitivity for MCA/UA PI to predict the adverse perinatal outcome of 86% and a specificity of 92% which was approximating to the study by Shahina bano *et al.* [24] having sensitivity of

MCA/UA P.I of 83% and specificity of 100%. The specificity for abnormal Ductus (absent/ reversal) flow was 96.9% for predicting the adverse fetal outcome similar to the study by M. Delrio *et al.* [25] which had specificity of 95%.

CONCLUSION

PI ratio of MCA & UA carries better sensitivity and specificity in predicting adverse perinatal outcome. Absent end diastolic flow/reversal in umbilical artery had high positive predictive value in predicting adverse fetal outcome. DV changes seem to be a sign of a severely compromised foetus with poor perinatal outcome. Doppler investigation of the foetal circulation may play an important role in monitoring the growth restricted foetus and thereby may help to determine the optimal time of delivery. Elderly multigravida with abnormal Doppler parameters had high incidence of perinatal morbidity and neonatal mortality rates. Pregnancies complicated by both with I.U.G.R and Pre- eclampsia had high incidence of neonatal deaths.

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