COLOR AND PULSE WAVE DOPPLER ASSESSMENT OF CEREBRAL, UMBILICAL AND UTERINE ARTERIES AND ITS USEFULNESS IN PREDICTION OF PERINATAL OUTCOME

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Abstract

Background: The aim of our study was to evaluate the usefulness of the doppler parameters of the umbilical artery (UA), middle cerebral artery (MCA) and uterine arteries in the prediction of adverse perinatal outcome.

Materials and Methods: The study population comprised of 92 pregnancies of 28-40 weeks gestation of whom 64 cases had been diagnosed clinically as intrauterine growth retardation (IUGR). The UA, MCA and uterine arteries doppler parameters such as PSV, RI, PI, S/D Ratio were calculated. Result: Totally the sample includes 92 antenatal cases. 64 cases are in experimental (IUGR) group. 28 cases are in control group. In this, 55/92 Cases are delivered by LSCS and 31/92 cases are associated with abnormal perinatal morbidity. 9 cases died during neonatal period. 50/92 cases were low birth weight. Absent diastolic flow in Umbilical artery is seen in 1 case and reversed diastolic flow is seen in 2 cases. The results were correlated with parameters of fetal outcome. Conclusion: Inferences drawn from the study were: (1) The Umbilical artery RI and PI are better predictor adverse perinatal outcome. (2) The umbilical artery RI, PI and SD Ratio (Systolic diastolic ratio) shows significant role in the diagnosis of the Intra uterine growth retardation.

INTRODUCTION

Utero placental circulation is essential for the normal growth of the fetus. Intra uterine growth restriction (IUGR) is diagnosed when the growth parameters of the fetus is less than 10th percentile. USG biometry is used to evaluate heterogenous group of small for gestational age fetuses. The common duplex Doppler parameters studied include Umbilical artery [UA], Middle Cerebral arteries [MCA] and Uterine arteries. The values studied include peak systolic velocity [PSV], Resistive index [RI], S/D ratio, Pulsatility index [PI] and ratios of Resistive (RI) and Pulsatility indices(PI) of Middle Cerebral artery and Umbilical artery. Doppler USG identifies the hemodynamic changes associated with Placental insufficiency. In this study, we study the usefulness of the doppler parameters of the umbilical artery (UA), middle cerebral artery (MCA) and uterine arteries and compare the various Doppler parameters in prediction of abnormal perinatal outcome in fetuses diagnosed as intra uterine growth retardation.

MATERIALS AND METHODS

Growth Assessment

Antenatal cases with Singleton pregnancy in the gestational weeks of 28-40 weeks who had been diagnosed clinically as IUGR and were referred for USG assessment underwent USG duplex Doppler after obtaining consent. Initially fetal biometry was measured and the parameters were plotted in the growth chart. The diagnosis of IUGR was confirmed based on estimated fetal weight. When the fetus biometric measurement are less than 10th percentile, the cases were considered IUGR.

Doppler Study

Umbilical artery [UA], Middle Cerebral arteries [MCA] and Uterine arteries were assessed by USG Doppler. The values studied include peak systolic velocity [PSV], Resistive index [RI], S/D ratio, Pulsatility index [PI] and the ratios of Resistive (RI) and Pulsatility indices (PI) of Middle Cerebral artery and Umbilical artery. All the patients were subjected to a repeat USG colour Doppler examination by second radiologist [blinded to the previous findings]. The findings of the initial study were reconfirmed after 15 days. The pregnancies were
followed-up and the final perinatal outcome of each case was noted. They were followed up for the weeks of delivery, mode of delivery, birth weight of baby, need for neonatal resuscitation and NICU care. Doppler wave forms were obtained from a free loop of umbilical cord. The circle of Willis was imaged with color flow Doppler USG in a transverse plane of the base of the skull. Doppler wave forms were obtained from the proximal MCA immediately after its origin from the circle of Willis.

RESULTS

Totally the sample includes 92 antenatal cases. 64 cases are in experimental (IUGR) group. 28 cases are in control group. In this, 55/92 Cases are delivered by LSCS and 31/92 cases are associated with abnormal perinatal morbidity with ICU admission. 9 cases died during neonatal period. 50/92 cases were low birth weight. The doppler results were correlated with parameters of fetal outcome.

Case 1
25-year Female ANC LMP GA- 31 weeks, USG GA – 27 Weeks

The fetal biomemtry shows growth parameters < 10 the percentile for the age of the fetus. This is indicative of IUGR.

DOPPLER STUDY
Doppler shows uterine notch and abnormal PI ratio and RI ratio. This patient antenatal case was sonographically diagnosed as IUGR. Doppler study shows uterine notch and abnormal Doppler studies.

**FOLLOW UP**

LSCS was done on the next day of Doppler studies for oligohydramnios. Newborn baby needed NICU care for 5 days for observation.

**Case 2**

29-year Female ANC LMP GA - 38 weeks 4 days, USG GA – 34 Weeks.

The fetal biomemtry shows growth parameters < 10th percentile for the age of the fetus. This is indicative of IUGR.
DOPPLER STUDY

Umbilical Artery

Uterine Artery - Notch

IMPRESSION

A case of IUGR with abnormal doppler indices. Uterine artery doppler shows uterine notch.

FOLLOW UP

Baby delivered by LSCS for fetal respiratory distress. Baby New Born required NICU Care for 10 days. New Born developed respiratory distress and intra ventricular haemorrhage.
### DISCUSSION

Intrauterine growth restriction (IUGR) is a failure of the fetus to achieve its optimal growth potential.[1] IUGR is defined as effective fetal weight (EFW) of less than 10th percentile for gestational age during pregnancy.[1]

Intrauterine growth retardation can be diagnosed with routine USG examination with fetal biometric measurements. Fetal growth assessment in second and third trimesters include biparietal diameter (BPD), head circumference (HC), femur length (FL), abdominal circumference (AC). The Placental insufficiency is the most common cause of intrauterine growth retardation.[3] Entire Placental blood flow, thereby fetal blood flow depends on bilateral uterine arteries. Assessment of uterine artery indirectly reflects the placental flow.
Doppler studies of the uterine artery, Umbilical artery and MCA provides the important information about the distribution of fetal blood flow. In IUGR, the distribution of fetal blood flow is altered. There is more redistribution of blood to the brain. This redistribution is assessed by doppler study of umbilical artery and MCA. So it is used to identify the severity of Intrauterine growth retardation and thereby the fetuses at risk for an adverse outcome.\textsuperscript{4,5}

Various studies test the significance of changes in these parameters in diagnosis of IUGR and in prediction of adverse perinatal events so that the obstetrician can decide about the management.

Arduini and Rizzo et al.\textsuperscript{4} studied the characteristics of MCA, Umbilical artery, renal artery PI indices in prediction of adverse perinatal outcome. After the diagnosis of IUGR, the PI ratio was best test than PI indices of MCA, Umbilical artery. The results in that study were specificity of 94\% (91\%, 88\%, 91\%) .98 and sensitivity 89\% . (vs 68\%, 64\%,43\%)

In another study Chan et al.\textsuperscript{2} studied 71 high risk cases. He followed up the cases with weekly Doppler until delivery. There was 15\% perinatal mortality and morbidity. They found RI ratio is more sensitive but less specific than Umbilical artery SD Ratio.

Dangolo Gramellini et al.\textsuperscript{1} studied cerebro umbilical ratio as a predictor of adverse perinatal event. According to his study, specificity and positive predictive value is higher for MCA PI and sensitivity is higher in PI ratio.

In our study, the sensitivity to predict the outcome is higher for umbilical RI, specificity is higher for umbilical artery PI. Positive predictive value are also higher for umbilical PI. In our study Umbilical artery absent diastolic flow is seen in 1 case and reversed diastolic flow is seen in 2 cases. Umbilical artery RI, PI and SD Ratio showed good correlation with fetal outcome.

**CONCLUSION**

1. The Umbilical artery RI and PI are better predictor of adverse perinatal outcome.
2. The umbilical artery RI, PI and SD Ratio (Systolic diastolic ratio) shows significant role in the diagnosis of the Intrauterine growth retardation.

**REFERENCES**