COLOR DOPPLER EVALUATION OF CEREBRAL UMBILICAL PULSATILITY RATIO AND ITS USEFULNESS IN THE DIAGNOSIS OF INTRAUTERINE GROWTH RETARDATION AND PREDICTION OF ADVERSE PERINATAL OUTCOME

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Abstract- OBJECTIVE: The aim of our study was to evaluate the usefulness of the pulsatility index (PI) of the umbilical artery (UA) and that of the fetal middle cerebral artery (MCA), as well as the ratio of the MCA PI to the UA PI (C/U ratio), in the diagnosis of small-for-gestational-age (SGA) fetuses and in the prediction of adverse perinatal outcome.

MATERIALS AND METHODS: The study population comprised 60 pregnancies of 30-41 weeks gestation of whom 30 cases had been diagnosed clinically as intrauterine growth retardation (IUGR). The UA PI and the MCA PI as well as the C/U ratio were calculated.

RESULTS: Totally the sample includes 60 antenatal cases. 30 cases are in experimental group. 30 cases are in control group. 11 experimental cases (11/30) are associated with abnormal MCA PI (<5th percentile) 7 cases are delivered by LSCS and 8 Cases are associated with abnormal perinatal morbidity. 11 experimental cases (11/30) are associated with abnormal UMB PI (>95th percentile). In this, 10 Cases are delivered by LSCS and 8 cases are associated with abnormal perinatal morbidity. 11 experimental cases (11/30) are associated with abnormal PI ratio (Cerebro umbilical PI ratio). All cases were delivered by LSCS and were associated with abnormal perinatal morbidity. The results were correlated with parameters of fetal outcome.

CONCLUSION: Inferences drawn from the study were:
(1) The C/U ratio (Cerebro umbilical PI ratio) is a better predictor of SGA fetuses and adverse perinatal outcome than the MCA PI or the UA PI used alone.
(2) The MCA SD Ratio(Systolic diastolic ratio), MCA PI (Pulsatility index), PI Ratio (Cerebro umbilical PI ratio) shows significant role in the diagnosis of the Intra uterine growth retardation

Keywords: Intrauterine growth retardation; pulsatility index; umbilical artery pulsatility index; middle cerebral artery pulsatility index; middle cerebral artery to umbilical artery pulsatility index ratio

I. INTRODUCTION:

For a successful intra uterine pregnancy, good utero placental circulation is needed. When the growth of the fetus is less than 10th percentile Intra uterine growth restriction (IUGR) is suspected. USG DOPPLER biometry is used to differentiate 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], End diastolic velocity[EDV], Resistive index[RI], Pulsatility index[PI], ratios of Resistive (RI) and Pulsatility indices(PI) of Middle Cerebral artery and Umbilical artery. Doppler USG enables a better identification of the hemodynamic changes associated with Placental insufficiency. In this study, we study the usefulness of the Doppler parameters in the diagnosis of intra uterine growth restriction and compare the various Doppler parameters in prediction of abnormal perinatal outcome in fetuses diagnosed as intra uterine growth retardation.

II. MATERIALS AND METHODS:

Antenatal cases with singleton pregnancy in the gestational weeks of 30-41 weeks who had been diagnosed clinically as IUGR and underwent USG duplex Doppler after obtaining consent. Initially the fetal biometry was done and the parameters were plotted in the growth chart and the diagnosis of IUGR was reconfirmed based on estimated fetal weight.

DIAGNOSIS OF IUGR
BIPARIETAL DIAMETER

HEAD CIRCUMFERENCE

FEMUR LENGTH

ABD CIRCUMFERENCE

GROWTH CHART- Plots the gestational age versus estimated fetal weight.

If the fetus biometric measurement are less than 10th percentile, the cases were considered IUGR.

III. DOPPLER STUDY:
The UA PI (Pulsatility index), RI (Resistive index) and the MCA PI (Pulsatility index), RI (Resistive index) as well as PI Ratio (Cerebro umbilical PI ratio), RI ratio (Cerebro umbilical RI ratio) were also calculated. All the patients were subjected to a repeat USG colour Doppler examination by second radiologist [blinded to the previous findings] after 15 days, when the findings of the initial study were reconfirmed. The pregnancies were followed-up and the final perinatal outcome of each case was noted. They were followed up for the mode of delivery, weeks of delivery, birth weight of baby, need for neonatal resuscitation and NICU care.

30 mothers were included as study group and 30 mothers referred for routine antenatal ultrasound were selected as control group. 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. PI, RI and their ratios were calculated.

IV. ANALYSIS:
Taking less than 1 as normal RI ratio, 8 experimental cases (8/30) were associated with abnormal RI ratio. 7 Cases were delivered by LSCS and 1 had a normal delivery. Of these 7 cases were associated with abnormal perinatal morbidity.
Taking less than 1.08 as cut off for abnormal PI ratio, 11 experimental cases (11/30) were associated with abnormal PI ratio. All cases were delivered by LSCS and were associated with perinatal morbidity.

<table>
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<th></th>
<th>SENSITIVITY</th>
<th>SPECIFICITY</th>
<th>PPV</th>
<th>NPV</th>
<th>DA</th>
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<tr>
<td>MCI PI</td>
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<td>57.9</td>
<td>44.8</td>
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<td>RI RATIO</td>
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<td>52.6</td>
<td>43.7</td>
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</tr>
<tr>
<td>PI RATIO</td>
<td>60.9</td>
<td>63.1</td>
<td>50</td>
<td>82.7</td>
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ROC curve indicates that the sensitivity was more for RI ratio. The specificity positive predictive value, negative predictive value were higher for PI ratio. The diagnostic accuracy of PI ratio was 62%.

V. RESULT:
The MCA SD Ratio (Systolic diastolic ratio), MCA PI and PI Ratio (Cerebro umbilical PI ratio) shows significant role in the diagnosis of the Intra uterine growth restriction.
The PI Ratio is the better predictor of the adverse perinatal outcome than the RI Ratio, MCA PI index.

CASES

25 year FEMALE ANC CASE LMP: 21.9.14 GA- 32 WEEKS

RIGHT MCA

UMBILICAL ARTERY

Antenatal case Sonographically diagnosed as IUGR.

Doppler study:
Uterine notch, abnormal PI ratio and RI ratio.
MCA RI – 0.6, UMB RI- 0.8;
MCA PI – 1.0, UMB PI – 1.6
PI RATIO <1, RI RATIO <1

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

CASE - 2
29 year FEMALE ANC CASE LMP : 1.8.14 GA 38 WEEKS

RIGHT MCA

UMBILICAL ARTERY
IMPRESSION
A case of IUGR with Reversal PI-ratio with normal RI ratio.
Uterine artery doppler shows uterine notch.

FOLLOW UP
Delivered by LSCS for fetal respiratory distress. New Born required NICU Care for 10 days. New Born developed respiratory distress and intra ventricular hemorrhage

REFERENCES: