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Original Research Article

Correlation of efficacy of cerebro placental ratio with adverse perinatal outcome in clinically suspected IUGR pregnancies

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ABSTRACT

Background: IUGR is a most common and complex problem in modern obstetrics. Most commonly use methods to assess fetal condition are BPP and NST which are not sensitive for predicting better perinatal outcome. Present study was an effort to evaluate the role of ratio of pulsatility index (PI) of middle cerebral artery and umbilical artery which is called cerebro placental ratio as the most sensitive, specific and accurate predictor of adverse perinatal outcome in clinically suspected IUGR Pregnancies.

Methods: 50 clinically suspected IUGR Pregnancies attending antenatal clinics Muzaffarnagar Medical College and Hospital, Muzaffarnagar were subjected to Doppler ultrasound evaluation Doppler velocity wave form of umbilical artery and fetal middle cerebral artery were obtained. Pulsatility index ratio of MCA and umbilical artery (cerebro placental ratio) was evaluated in each case. Abnormal ratio is defined as CPR<1.08 considered as cut of value. Ratio was coo related clinically with perinatal outcome.

Results: Out of 50 antenatal cases, 63% neonates had birth weight <2.5 kg. There were 6 IUD'S and 44 live births, 9 neonates were admitted to NICU, 7 neonates had 5 min. APGAR score <7 and 13 neonates were born by emergency CS. Of the 6 IUDS, 4 cases had reversal of blood flow umbilical artery and 2 cases had absent diastolic flow. In all cases of reversal Diastolic flow, IUD occurred within 7 days of diagnosis.

Conclusions: CPR is the most sensitive, specific and accurate parameter in prediction of adverse perinatal outcome and thus can help in decreasing perinatal mortality.

Keywords: Cerebro plecentral ratio, Color doppler, IUGR, Pulsatility index

INTRODUCTION

IUGR is a common condition affecting about 10-15% of the general maternity population.¹ It is associated with increased risk of perinatal mortality, morbidity and impaired neurological development.² Before the advent of U/S, assessment of fetal growth during pregnancy was limited by measuring the uterine size, assessing the fetal size by palpation and looking at the infant after delivery but now-a-days, Doppler velocimetry provides a sensitive, non-invasive and safe method for surveillance

of fetal hemodynamics and fetomaternal circulation. This modality is based on the premise that an insufficient uterine, placental or fetal circulations results in adverse perinatal outcome. UA Doppler is the most evaluated tool among non-invasive tests of fetal well-being. It serves as both a prognostic and diagnostic tool in assessment of IUGR fetus.³ An abnormal waveform of umbilical artery. (Absent or reversed end diastolic flow) has been demonstrated to predict fetal compromise. 12 days prior to acute fetal deterioration.⁴ In pregnancies with prolonged fetal hypoxia, there is redistribution of blood

volume towards vital organs (i.e. heart, adrenal glands, spleen, brain and kidney), which causes vasodilation of the MCA, with an increase in diastolic flow hence decrease in its PI.⁵⁻⁸

Thus, in asymmetrical IUGR, there is a high UAPI and low MCA PI as a result CP ratio is lower than normal in growth retarded fetuses. CP ratio remains constant during last 10 weeks of gestation and so it is having a better diagnostic accuracy.⁹

The purpose of this study was to assess the efficacy of CP ratio to predict IUGR in clinically suspected IUGR cases and its correlation with perinatal outcome.

Objectives of this study were to evaluate the role of umbilical artery Doppler and MCA Doppler indices in growth restricted foetuses, to evaluate the significance of Doppler flow velocimetry in prediction of adverse perinatal outcome in clinically suspected IUGR pregnancy and to establish the role of color Doppler in management of IUGR pregnancy.

METHODS

Present study was a hospital based cross-sectional observational study conducted on clinically suspected IUGR pregnancies attending antenatal OPD of Obstetrics and Gynaecology Department of Muzaffarnagar Medical College and Hospital, Muzaffarnagar. This study was approved by the ethical committee of our Institution. Study size included 50 singleton pregnancies

Inclusion criteria

- Singleton pregnancies
- Fetal gestational age of 30-40 weeks with clinically suspected
- IUGR pregnancies
- Absence of preexisting maternal disease.

Exclusion criteria

- Multiple gestations
- Documented major congenital abnormality

Methodology

Study was done on antenatal women (30-40 weeks of gestational age) attending antenatal clinic of Muzaffarnagar Medical College and Hospital, Muzaffarnagar.

On the basis of detailed clinical history and examination, 50 clinically suspected IUGR cases were selected and subjected to ultrasound (including ultrasound biometry, assessment of amniotic fluid and placental maturity) and Doppler studies in the Department of Radio Diagnosis of

Muzaffarnagar Medical College and Hospital, Muzaffarnagar.

Examination was conducted on PHILIPS Clear VUE 650 with the help of multi frequency convex probe, two or three times.

- PI of both arteries were observed
- MCA: UA PI ratio was calculated
- Doppler study was considered abnormal if
 - a. UAPI > 95th percentile for gestational age
 - b. MCA PI < 5th percentile for gestational age
 - c. MCA/UA PI ratio < 1.08

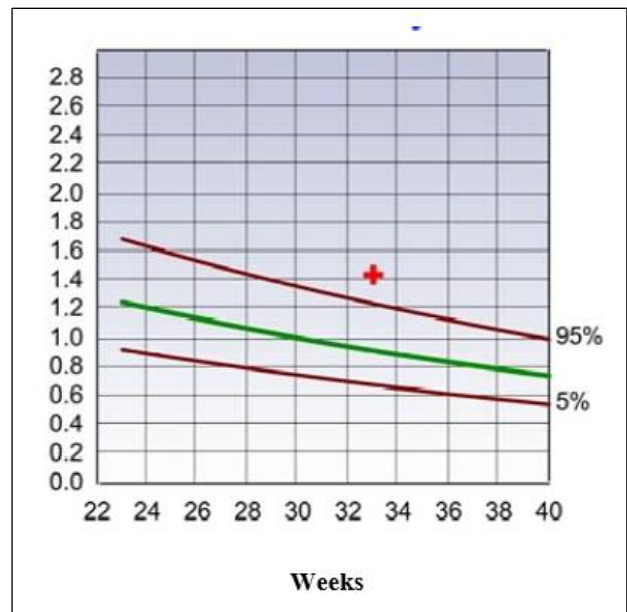


Figure 1: Distribution of normal UAPI with gestation.

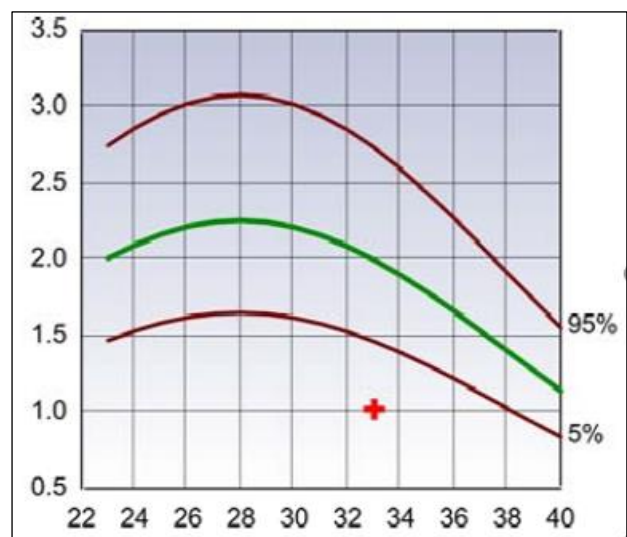


Figure 2: Distribution of normal MCA PI with gestation.

Pulsatility indices for gestational age: the normal range is shown in 5th, 50th and 95th percentiles

Adverse perinatal outcome includes intrauterine death, emergency LSCS, low APGAR score at 5 min. <7, admission to NICU.

RESULTS

50 antenatal women between 30 to 40 weeks of gestation who were clinically suspected as having IUGR pregnancies based on clinical history of previous child with growth retardation, anemia, high blood pressure, reduce abdominal fundal height for gestational age (30 to 40 weeks) were evaluated using screening ultrasound and then Doppler velocity waveforms were obtained from umbilical artery and fetal middle cerebral artery. Out of 50 patients, 44% were between gestational age of 30 to 32 weeks, 20% were between 35 to 37 weeks and 36% were between 37 to 40 weeks (Table 1).

Table 1: Gestational age distribution in study group.

GA (Weeks)	Number	Percentage
30-32	22	44
35-37	10	20
37-40	18	36
Total	50	100

62% of patients were primi gravida and 38% were multigravida (Table 2).

Table 2: Parity distribution of study group.

Parity	Number. of cases	Percentage
Primi	31	62
Multi	19	38

Out of 50 patients 68% had PIH, 22% had anemia, 4% had BOH and 2% had diabetes mellitus and 4% had chronic renal disease at first Doppler ultrasound (Table 3).

Table 3: Maternal complications of study group.

Complication	No. of cases	Percentage
PIH	34	68
Anemia	11	22
BOH	2	4
DM	1	2
Chronic renal disease	2	4

Table 4: Distribution characteristics of placental maturity.

Grade	No. of cases	Percentage
Grade II	11	22
Grade III	39	78

On ultrasound 78% of cases show grade 3 placental maturities, 22% had grade 2 placental maturity (Table 4). 76% had oligohydroamnios and 24% had normal amniotic fluid (Table 5).

Table 5: Amniotic fluid distribution in study group.

	No. of cases	Percentage
Normal	12	24
Oligohydroamnios	38	76

Out of 50 antenatal cases, 63% neonates had birth weight <2.5 kg. There were 6 IUD'S and 44 live births, 9 neonates were admitted to NICU, 7 neonates had 5 min. APGAR score <7 and 13 neonates were born by emergency CS (Table 6).

Table 6: Adverse perinatal outcome.

Adverse perinatal outcome indicator	No. of cases	Percentage
IUD	6	12
Emergency LSCS	13	26
Low APGAR Score	7	14
Admission To NICU	9	18

Out of 6 IUD's, 4 cases had reversal of diastolic flow and 2 had absent diastolic flow. In all cases of reversal of diastolic flow, IUD of the fetus occurred within 7 days of diagnosis- S/O 100% mortality and all the 3 cases were less than 32 weeks. In the present study, sensitivity and specificity of cerebro-placental ratio was 93.2% and 89% respectively which was more than sensitivity and specificity of UA PI and MCA PI (Table 7).

Table 7: Performance characteristics of Doppler indices.

Doppler Index	Sensitivity	Specificity
UA PI	88.6%	81%
MCA PI	80.0%	70%
CPR (MCAPI/UAPI)	93.2%	89%

The diagnostic accuracy in prediction of adverse in clinically suspected IUGR cases CP ratio has the diagnostic accuracy of 91.6%, and MCA PI was 72.6% and UA PI was 79.6% (Table 8).

Table 8: Diagnostic accuracies of doppler indices.

Doppler index	Diagnostic accuracy
UA PI	79.6 %
MCA PI	72.6 %
MCA/UA PI ratio	91.6 %

Present study results in evaluating the usefulness of MCA PI /UA PI ratio as strong predictor of adverse outcome in IUGR and thus it helps in decreasing perinatal mortality and morbidity.

DISCUSSION

IUGR is a pathological condition characterized by fetal weight <10th percentile for that gestational age.¹⁰ It is strongly related to uteroplacental insufficiency.

In normal pregnancy, the indices PI decrease with advancing gestation in UA. But in IUGR first there is decrease in diastolic flow of UA due to increase in the resistant that occurs in small Artery and arterioles of tertiary Villi.¹¹ This raises the S/D ratio and PI of umbilical Artery. As the placental insufficiency Worsen the diastolic flow decreases, then become absent and later reverse flow pattern noted in umbilical artery.^{12,13}

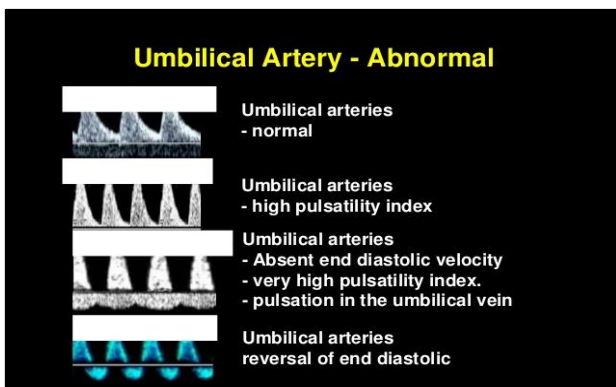


Figure 3: Umbilical artery waveforms.

Fetal MCA is a low resistance circulation throughout pregnancy and account of 7% of cardiac output. In fetal hypoxia and ischemia, increase in diastolic flow with decreased pulsatility.^{14,15} Index shows the brain sparing taking place in compromised fetuses.¹⁶ Fetal hypoxia results into adverse fetal outcome.

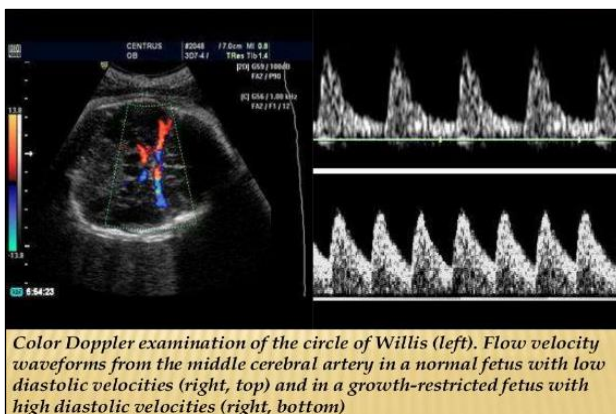


Figure 4: Middle cerebral artery waveforms.

MCA/UA PI ratio reflects not only the circulatory insufficiency of the umbilical velocimetry of the placenta manifested by alteration in umbilical S/D ratio but also the adaptive changes resulting in modification of the middle cerebral artery S/D ratio.¹⁶ MCA/UA PI ratio reflects both placental status and fetal response. So, this

gives additional information. Doppler velocimetry is an important non-invasive technique for fetomaternal surveillance in high risks pregnancies.

In the present study diagnostic accuracy of MCA/UA PI was 91.6%, and UA PI was 79.6% and MCA PI 72.6% for adverse perinatal outcome. The values are comparable with Gramillini et al and Bano et al.^{16,17}

We choose 50 clinically suspected IUGR pregnancies and majority of the neonates were between 1.5 to 2 kg birth weights; we select incidences of IUD, Emergency, Cesarean section for fetal distress, NICU admission for complication of low APGAR score as outcome variables in concurrence with previous studies.

CP ratio has high sensitivity, specificity and diagnostic accuracy in predicting adverse perinatal outcome. This result is comparable with Lakhar et al, Fong KW et al, Bahado et al.^{15,18,19}

Present study evaluates the efficacy of umbilical artery and cerebro placental ratio in prediction of adverse perinatal outcome in IUGR and indicates that both abnormal umbilical artery and CP ratio are strong predictors of adverse outcome in IUGR.

CONCLUSION

In fetal growth restriction, CP ratio reflects both circulatory insufficiencies of placenta and also adaptive changes that occurs in middle cerebral artery, so it appears to be a valuable non-invasive modality for fetomaternal surveillance in IUGR.

Abnormal CP ratio is a better predictor of adverse perinatal outcome in IUGR. Doppler ultrasound plays a significant role in the management of growth restricted fetuses by early identification and thus helps in line of management, obstetrical surveillance.

Hence, Doppler ultrasound especially CP ratio (MCA/UI PI Ratio) should be an integral component of routine evaluation of a suspected IUGR pregnancies and thereby improving adverse perinatal outcome.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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