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COLOUR DOPPLER INDICES FOR PREDICTION OF PERINATAL OUTCOME IN INTRAUTERINE GROWTH RESTRICTED FETUSES IN A TERTIARY CARE HOSPITAL

Radiology

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ABSTRACT

Background: FGR is defined as a failure to achieve the endorsed growth potential. The diagnosis of fetal smallness is currently performed on the basis of an estimated fetal weight below a given threshold, 10th centile. As a whole, this group of foetuses is associated with poorer perinatal outcome, and with advent of Doppler technology, opportunities for preventing cases of intrauterine fetal death, perinatal brain injury and severe intrapartum fetal distress. **Objective:** 1. To determine the role of umbilical artery, middle cerebral artery, bilateral uterine artery Color Doppler in detection of IUGR. 2. To evaluate the pulsatility index (PI) of the umbilical artery and that of the middle cerebral artery , as well as the ratio of the MCA PI to the UA PI (C-P ratio) , in the diagnosis of small- forgestational-age fetuses and in the prediction of adverse perinatal outcome. **Methods:** 50 patients with singleton pregnancies were included in the study. Doppler examination was done in all patients. **Result:** Out of total 50 cases, 32% were normal babies, 10% were IUFD's, 28% had IUGR and 30% were small for gestational age . The mean MCA PI in grade 2 placental maturity babies was 1.86±0.448 and in grade 3 placental maturity babies was 1.41±0.503, there was a statistically significant difference between the two (p=0.002). The mean UA PI in grade 2 placental maturity babies was 1±0.385 and in grade 3 placental maturity babies was 1.18±0.395, but there was a no statistically significant difference between the two (p=0.11). The mean CP ratio in grade 2 placental maturity babies was 1.79±0.995 and in grade 3 placental maturity babies was 1.05±0.213, there was a statistically significant difference between the two (p=0.001).

KEYWORDS

IUGR, Doppler indices

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 USG, 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]

The purpose of this study was to evaluate the diagnostic performance of fetal middle cerebral artery (MCA) and umbilical artery (UA) by Doppler ultrasonography in high risk mothers with IUGR and correlation with perinatal outcome.

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

- The LMP (Last menstrual period) of the patient -well known.
- Maternal age of 18-40 years.
- Singleton pregnancy.
- Patients with baby birth weight of <10th percentile of gestational age.
- Clinically diagnosed case of IUGR (based on findings such as insufficient weight gain, decrease in abdominal girth and decrease or no increase in fundal height.

Exclusion Criteria

- Multiple pregnancies.
- Congenital anomalies in the fetus.
- Refusal of inclusion by the patient.

METHODOLOGY

All patients included in the study signed were made to sign an informed consent form. A standardized work chart was drawn up, which recorded anthropometric data, family history, personal physiological and pathological history, obstetric parameters (gestation, parity, date of the last menstruation, first fetal movements, probable date of birth, history of previous pregnancies and births), ultrasound parameters in the first trimester (measurement of craniocaudal length (CCL), presence of embryonic cardiac activity, Doppler examination of the uterine artery. The basic parameter monitored in this study was the pulsatility index (PI = S- D/Mean). Ultrasonography was performedusing a - ALPINON E-CUBE 8 WITH 1-6 CT Hz Probe and VE 3-10Hz Probe.

Data was collected and subjected to statistical analysis using SPSS software version 24.

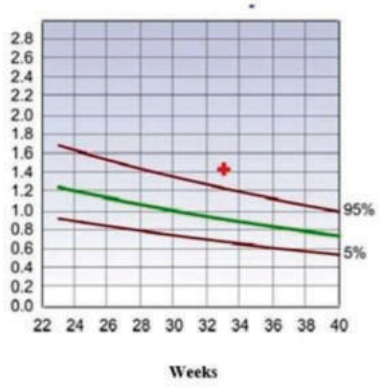


Figure 1: Distribution Of Normal UAPI With Gestation.

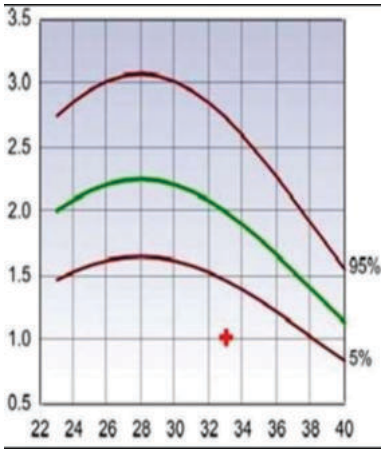


Figure 2: Distribution Of Normal MCA PI With Gestation.

RESULTS

This study was carried out including 50 pregnant subjects with singleton pregnancy recruited from IPD and OPD from the Department of Obstetrics and Gynaecology, suspected for Intra-Uterine Growth Retardation for which predictions for the fetal outcome were to be made on Colour Doppler, after considering the inclusion and exclusion criteria. The written informed consent for clinical examination & lab investigations was obtained either from patient or attendant. Out of the 50 subjects included in study, maximum subjects were from age group 26-30 years (n=26, 52%), followed by 17 subjects (34%) in age range 21-25 years and only 7 pregnant females (14%) were aged between 31-35 years. The age of the women enrolled in the study ranged from 22 to 33 years. (Table 1)

Table 1: Age Distribution Among The Study Subjects

Age Group (in years)	N	%
21-25	17	34
26-30	26	52
31-35	7	14
Total	50	100

Out of 50 patients, 58% (n=29) were between gestational age of 30 to 34 weeks, 34% (n=17) were between 35 to 37 weeks and 8% (n=4) were >37 weeks pregnant. (Table 2)

Table 2: Gestational Age Among The Study Subjects

Gestational Age (in weeks)	N	%
30-34	29	58
35-37	17	34
>37	4	8
Total	50	100

When exploring the different Doppler parameters, mean middle cerebral artery (MCA) pulsatility index (PI) was 1.66±0.519 and ranged between 0.7-2.57. Mean umbilical artery (UA) PI was 1.08±0.396 and ranged between 0.43-2.5. Mean cerebroplacental ratio (CPR) was 1.46±0.838 and ranged between 0.64-2.7. (Table 3)

Table 3: Descriptive Analysis Of Doppler Parameters

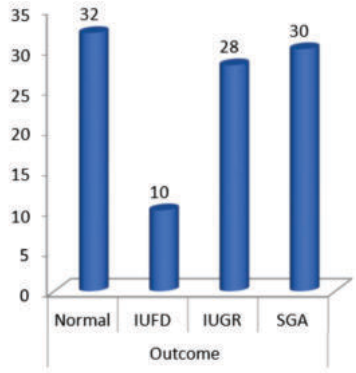
Parameters	Minimum	Maximum	Mean	SD
MCA PI	0.7	2.57	1.66	.519
UA PI	0.43	2.5	1.08	.396
CPR	0.64	2.7	1.46	.838

The diagnostic accuracy in prediction of adverse outcome in clinically suspected IUGR cases CP ratio has the diagnostic accuracy of 92%, and MCA PI was 71.5% and UA PI was 81.20%. (Table 4)

Table 4: Diagnostic Accuracy Of Various Doppler Parameters

Parameters	Diagnostic Accuracy (%)
MCA PI	71.5
UA PI	81.20
CPR	92

Out of total 50 cases, 32% (n=16) were normal babies, 5 (10%) were IUD's, 14 babies (28%) had Intrauterine growth restriction (IUGR) and 15 neonates (30%) were small for gestational age (SGA). (Bar diagram 1)



Graph 1: Fetal Outcome Among The Study Subjects

DISCUSSION

The following are the study's primary inferences:

Age Distribution

In present study the age of the women enrolled ranged from 22 to 33 years. Out of the 50 subjects included, maximum subjects were from age group 26-30 years (52%), followed by 34% subjects in age range 21-25 years and only 14% pregnant females were aged between 31-35 years.

According to study done by Raj K, Sheela SR (2020)[9] Out of the 89-study population, the mean of age was 25.13±4.33 years in the study population, minimum age was 18 years and maximum age was 36 years.

Gestational Age

In present study 50 antenatal women between 30 - >37 weeks of gestation were clinically suspected as having IUGR pregnancies. Out of 50 patients, 58% were between gestational age of 30 to 34 weeks, 34% were between 35 to 37 weeks and 8% were >37 weeks pregnant.In study done by Raj K, Sheela SR (2020)[9] the mean of gestational age was 38.54±1.11 weeks in the study population, minimum gestational age was 37 weeks and maximum age was 41 weeks.

Doppler Parameters

When exploring the different Doppler parameters, mean middle cerebral artery (MCA) pulsatility index (PI) was 1.66±0.519 and ranged between 0.7-2.57. Mean umbilical artery (UA) PI was 1.08±0.396 and ranged between 0.43-2.5. Mean cerebroplacental ratio (CPR) was 1.46±0.838 and ranged between 0.64-2.7.

According to D'Antonio F et al., (2020)[10] the mean MCA PI was 1.09 ± 0.19, CPR was 1.35 ± 0.39 and uterine artery PI was 0.84 ± 0.16 in pregnancies experiencing composite adverse outcomes.

Fetal Outcome

The mean weight of the new born was 1.86±0.808, weight of the new born babies ranged between 0.87-2.8 kg. Out of total 50 cases, 32% (n=16) were normal babies, 14 babies (28%) had Intrauterine growth restriction (IUGR) and 15 neonates (30%) were small for gestational age (SGA). 5 (10%) were IUFD's and rest 45 were live birth.

In study done by Singh G et al., (2018)[11] out of 50 antenatal cases, 63% neonates had birth weight <2.5 kg. There were 44 live births and 6 had intrauterine fetal demise (IUFD).

Placental Sonographical Grading

On ultrasound 56% of cases (n=28) showed grade 2 placental maturities and 44% (n=22) had grade 3 placental maturities.

In study done by Singh G et al., (2018)[11] on ultrasound 78% of cases show grade 3 placental maturities and 22% had grade 2 placental maturities.

Sensitivity, Specificity Of Doppler Parameters

In the present study, sensitivity and specificity of cerebro-placental ratio was 94.5% and 88.4% respectively which was more than sensitivity and specificity of MCA PI and UA PI. Sensitivity and specificity of MCA PI was 81.70% and 72.5%. Sensitivity and

specificity of UA PI was 87.95% and 81.6%. These findings were in accordance to findings of Singh G et al., (2018)[11] who found that sensitivity and specificity of CPR was 93.2% and 89% respectively which was more than sensitivity and specificity of UA PI (88.6%, 81%) and MCA PI (80.0%, 70%).

Diagnostic Accuracy Of Doppler Parameters

The diagnostic accuracy in prediction of adverse outcome in clinically suspected IUGR cases CP ratio has the diagnostic accuracy of 92%, and MCA PI was 71.5% and UA PI was 81.20%. this suggest that CPR has high sensitivity, specificity and diagnostic accuracy in predicting adverse perinatal outcome. Present study results evaluate the usefulness of CP ratio as strong predictor of adverse outcome in IUGR and thus it helps in decreasing perinatal mortality and morbidity. These findings were comparable with result of Singh G et al., (2018)[11]

Placental Sonographical Grading According To Doppler Parameters

In present study, the mean MCA PI in grade 2 placental maturity babies was 1.86±0.448 and in grade 3 placental maturity babies was 1.41±0.503, there was a statistically significant difference between the two (p=0.002). The mean UA PI in grade 2 placental maturity babies was 1±0.385 and in grade 3 placental maturity babies was1.18±0.395, but there was a no statistically significant difference between the two (p=0.11). The mean CP ratio in grade 2 placental maturity babies was 1.79±0.995 and in grade 3 placental maturity babies was 1.05±0.213, there was a statistically significant difference between the two (p=0.001). This suggest that CPR and MCA PI can be used to assess the placental maturity which in turn will help to predict pregnancy outcomes and complications, leading to less fetal morbidity and mortality.

Study Limitation

The only limitation of the present study was the small sample size and that all patients included were from a single hospital, so to validate the results of this research work, further multi centre studies with larger sample size are required.

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