



## ROLE OF COLOUR DOPPLER IN THE PREDICTION OF PERINATAL OUTCOME IN INTRAUTERINE GROWTH RESTRICTIONS

### Gynaecology

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### ABSTRACT

**Background:** Fetal growth restriction (FGR) affects up to 5-10% of pregnancies. It is associated with increased perinatal mortality and morbidity. As doppler can detect abnormal fetoplacental circulation early it can be used to differentiate between normal and compromised small fetuses who are at a risk of adverse perinatal outcome. This study was conducted to evaluate IUGR fetuses by ultrasonography using foetal biometry, doppler flow velocimetry waveform and analysis. Perinatal outcome in terms of baby outcome, birth weight, admission in NICU were analysed.

**Methods:** This study was conducted in the Department of Obstetrics and gynecology in ASRAM college and hospitals .The duration of the study was from October 2015 to September 2017. A total of 70 cases with clinically suspected intra uterine growth retardation(IUGR) from women attending the department of Obstetrics and gynaecology were taken in study .

**Results:** 31 patients had IUGR(intrauterine growth restriction). The patients with abnormal indices had higher incidence of caesarean delivery(66%), low apgar score(49%), need for admission to NICU(67%)and preterm(59%)as compared to those with normal indices

**Conclusions:** The results of present study clearly demonstrated the efficacy of umbilical artery Doppler in predicting the fetal outcome. To improve the predictive value of this tool, a better method is needed to assess the wellbeing of the IUGR fetuses such as integrated antenatal test which combines BPP and Doppler study employing other vessels.

### KEYWORDS

Fetal growth restriction, Doppler

### INTRODUCTION

Fetal growth restriction (FGR) refers to a fetus that has failed to achieve its genetically determined growth potential and affects up to 5-10% of pregnancies. Though there are multiple reasons for fetal growth restriction diminished supply of oxygen and nutrients is an important cause of this condition<sup>1</sup>. There is a high incidence of intrauterine fetal demise, intrapartum fetal morbidity, and operative deliveries. Neonates affected by FGR suffer from respiratory difficulties, polycythemia, hypoglycemia, intraventricular hemorrhage, and hypothermia. In the long-term, cerebral palsy, developmental delay, behavioural dysfunction, adult metabolic syndrome can occur<sup>2</sup>.

FGR fetuses must be differentiated from small for gestational age fetuses (SGA). The World Health Organization defines SGA as a neonatal weight of less than 2500 grams at term.

In antenatal period these small babies can be identified on clinical examination and ultrasonography, but the normal small fetus cannot be distinguished from compromised small fetus. The correct detection of the compromised fetus to allow for timely intervention is a main objective of antenatal care<sup>3</sup>.

Doppler parameters like S/D ratio, RI (Resistance index) & PI (Pulsatility index) of uterine, umbilical and MCA have been in use for long in predicting perinatal outcome<sup>4</sup>. The sequential pattern of flow abnormalities in UA, MCA and DV in that order has been observed in several studies and it has been observed that the UA and MCA are better tools for monitoring fetal well-being and to predict fetal-neonatal outcome in upto 88% of the cases. The cerebro-placental ratio is obtained by dividing MCA PI by UA PI is found to be a better predictor of perinatal outcome than MCA PI or UA PI alone<sup>5</sup>.

### MATERIAL AND METHODS

This study was a longitudinal study done in the Department of Obstetrics and gynecology in ASRAM college and hospitals .The duration of the study was from October 2015 to September 2017.

A total of 70 cases with clinically suspected intra uterine growth retardation(IUGR) patients were included.

### Inclusion criteria:

Singleton pregnancy.  
Pregnant women suspected IUGR  
Gestational age from 28 weeks and above  
Known date of last menstrual period (LMP)/or early ultrasound report to Calculate LMP

### Exclusion criteria:

Intrauterine death (IUD).  
Fetus with congenital anomalies  
Period of gestation less than 28 weeks  
Multiple gestation

All the patients were subjected to ultrasound examination with ultrasonography machine with the facility of Colour Doppler imaging. The foetal biometry included assessment of biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femoral length (FL). HC/AC ratio, FL/AC ratio, foetal heart rate, placental maturity and amount of liquor were noted.

Foetal weight less than 10<sup>th</sup> percentile based on the chart given by Dubilet et al in 1997<sup>6</sup> were taken as small for gestational age (SGA) babies and foetal weight between 10<sup>th</sup> percentile to 90<sup>th</sup> percentile were taken as appropriate for gestational age (AGA) babies.

Other pregnancy disorders like gestational hypertension and gestational diabetes mellitus were evaluated for and noted and treated if diagnosed. Pulse wave Doppler ultrasound examination were then performed in Umbilical artery, Uterine artery and Middle cerebral artery. Flow velocity waveforms obtained from the arteries were computed automatically.

Parameters observed were pulsatility Index (PI), resistance index (RI), systolic/diastolic (S/D) ratio, presence of uterine notch, absent or reversed end diastolic flow in UA, Cerebroplacental index (CPI) and cerebroumbilical indices (CU). UA & UTA PI & RI values were based on chart given by Merz E<sup>7</sup>. 95<sup>th</sup> percentile was taken as the cut off point. UA S/D >3, UTA S/D >2.6 and MCA S/D <4 were considered abnormal<sup>4</sup>.

Those patients with severe FGR and abnormal Doppler abnormalities and could not continue till term gestation, delivered pre-term babies. The pregnancy outcome was studied in terms of period of gestation at birth, mode of delivery, birth weight, Apgar score and NICU admissions were obtained.

Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for qualitative data analysis.

### OBSERVATIONS AND RESULTS

A total of 70 clinically suspected IUGR cases were included in this study. Of 70 IUGR suspected cases, about 56% were actually small for gestational age (SGA) and 44% cases had fetuses appropriate for gestational age (AGA) were found in the study as shown in the pie chart.

**Table 1. Comparison of outcome by Doppler & Ultrasound study.**

|                       | OUTCOME, N% |            | P-VALUE |
|-----------------------|-------------|------------|---------|
|                       | SGA         | AGA        |         |
| <b>DOPPLER NORMAL</b> | 8(20.51%)   | 22(70.97%) | 0.00    |
| <b>ABNORMAL</b>       | 31(79.49%)  | 9(29.03%)  |         |
| <b>FL/AC &lt;23.5</b> | 16(41.02%)  | 21(67.74%) | 0.026   |
| <b>&gt;23.5</b>       | 23(58.97%)  | 10(32.26%) |         |
| <b>HC/AC ≤ 1</b>      | 16(41.03%)  | 24(77.41%) | 0.002   |
| <b>&gt;1</b>          | 23(58.97%)  | 7(22.58%)  |         |
| <b>CPI &gt;1</b>      | 28(71.80%)  | 29(93.54%) | 0.020   |
| <b>&lt;1</b>          | 11(28.20%)  | 2(6.46%)   |         |
| <b>CUI &gt;1.08</b>   | 31(79.48%)  | 30(96.7%)  | 0.031   |
| <b>&lt;1.08</b>       | 8(20.52%)   | 1(3.3%)    |         |

Of 39 SGA cases studied, 31 cases had abnormal Doppler studies and 8 SGA fetuses were likely to have normal Doppler readings and probably are constitutionally small.

Abnormal FL/AC ratio (>23.5) was significantly higher among SGA babies as Compared to AGA babies (p<0.000).

The proportion of abnormal HC/AC ratio (>1) is higher among the SGA babies as compared to AGA babies and the difference was clinically significant (P=0.002).

The proportion of CPI (MCA RI/UA RI) ≤ 1 indicative of brain sparing effect were significantly higher in the SGA fetus group.

The proportion CUI (MCA PI/UA PI) index ≤ 1.08 indicative of brain sparing effect were significantly higher in the SGA fetus group.

**Table 2. Comparison of Gestational outcome by presence of risk factors.**

| RISK FACTORS    | Outcome, N (%) |            | RELATIVE RISK (RR) | CONFEDENCE INTERVAL (CI) |
|-----------------|----------------|------------|--------------------|--------------------------|
|                 | SGA            | AGA        |                    |                          |
| HTN             | 13             | 3          | 3.44               | 1.076 - 11.02            |
| OLIGOHYDRAMNIOS | 11             | 3          | 2.91               | 0.88 - 9.54              |
| ANAEMIA         | 6              | 4          | 1.19               | 0.36 - 3.85              |
| NO              | 11             | 21         |                    |                          |
| PRIMI           | 26(66.67%)     | 11(35.48%) |                    |                          |
| MULTI           | 13(33.33%)     | 20(60.52%) |                    |                          |

Among the risk factors, those patients with hypertension and oligohydranios were more likely to have SGA babies as compared with other risk factors like Anaemia. And the relative risk were 3.44, 2.91 and 1.19 respectively as shown in this table.

In the 70 cases, 37 were primigravidae and 33 were multigravidae. There was significant statistical difference in the pregnancy outcome by gravida of the patients.

**Table 3. Perinatal outcome in SGA and AGA babies (N=70).**

| EVENTS            | SGA(39 CASES) | AGA(31 CASES) |
|-------------------|---------------|---------------|
| PRETERM           | 23            | 6             |
| NICU ADMISSION    | 26            | 7             |
| APGAR SCORE<7     | 19            | 6             |
| MEAN BIRTH WT(Kg) | 2.1           | 2.9           |
| NO.OF CS          | 26            | 13            |

SGA babies with abnormal Doppler had lower birth weight, poor Apgar

score, Higher NICU admission. Caesarean section rate were significantly higher in SGA fetus group as shown acute foetal distress (AFD) was the indication for CS in majority of cases. Out of the 29 preterm fetuses maximum number of the preterms were in the SGA group (58.98%) compared to AGA group (19.35%).

### DISCUSSION

Doppler technology has a significant impact on our ability to assess the physiological status of the fetuses. It can help in identifying the changes in the fetal circulation at a time when other tests are normal and in doing so, identify the truly hypoxic fetuses. Interval changes in doppler values may be useful in determining the optimal time of delivery to reduce the perinatal mortality and any subsequent complications.

Among the 70 suspected cases 56% were SGA babies (39) and 44% were AGA babies (31). Of 39 SGA babies 31 (79.49%) had abnormal Doppler and 8 (20.51%) SGA fetuses were significantly likely to have normal Doppler readings and probably are constitutionally small.

In this study 13 (34%) of SGA fetuses and 3 (9.6%) of AGA fetuses had hypertension as a risk factor. 11 (28%) of SGA fetuses and 3 (9.6%) of AGA fetuses had oligohydranios as risk factor.

Uterine artery mean PI (1.05 vs. 0.77), RI (0.66 vs. 0.52) and S/D (2.89 vs. 2.27) ratio were all significantly raised in SGA fetuses in comparison to AGA fetuses in this study indicating raised impedance to blood flow.

Umbilical Artery Doppler wave forms reflect the status of the fetoplacental circulation its resistance decreases progressively during the second half of pregnancy, with the resistance index being 0.69 in the 22nd week and 0.56 in the 38th week of pregnancy. This decrease does not occur in IUGR pregnancies, which therefore have high values of Doppler indices. In this study mean UA PI, RI and S/D ratio were raised in SGA babies compared to AGA fetuses (1.18 vs. 0.98, 0.69 vs. 0.603 and 3.17 vs. 2.67).

The middle cerebral artery normally has a high resistance flow. A low PI of MCA indicates brain sparing effect. In the analysis of MCA Doppler indices were lower in the SGA group than the AGA group suggesting decrease in impedance and increase in diastolic blood flow in the brain. Mean MCA PI, RI and S/D ratios were also lower in SGA fetuses as compared to AGA fetuses in our studies (1.7 vs. 1.83 and 0.76 vs. 0.81, 5.20 vs. 5.76).

Uterine artery diastolic notching was seen in 6 SGA fetuses, four of them had unilateral notching and two had bilateral notching. And three of them had hypertension.

The proportion of CPI (MCA RI/UA RI) ≤ 1 indicative of brain sparing effect was significantly higher in the SGA fetus. There was a strong correlation between the MCA RI/UA RI and neonatal outcome. They concluded that MCA RI/UA RI < 1.0 may be helpful in the identification of newborns at risk of morbidity, irrespective of whether they are small or appropriate for the gestational age. The proportion of fetuses with CPI < 1 was higher among SGA fetuses in the present study. 11 of 39 (28.20%) SGA fetuses and 2 of 31 (6.46%) AGA fetuses had CPI ratio < 1 when brain sparing effect occurs (CU index < 1.08) and if the prospects for neonatal survival are good, it is better to deliver the fetus. In the present study 8 of 39 (20.52%) SGA fetuses and 1 of 31 (3.3%) AGA fetuses had abnormal CUI index.

The incidence of preterm deliveries was higher among SGA group (58.98%) when compared to AGA group (19.35%). 31 of 39 SGA fetuses (79.49%) and 5 of 31 AGA fetuses (16.12%) had low birth weight babies in this study.

Caesarean section rate noted in this study were significantly higher in SGA fetus group. In SGA group CS rate was 66.66% and in AGA group 41.94%.

Low APGAR score of < 7 and NICU admissions in this study were significantly more in SGA babies in comparison to AGA babies. 19 of 39 SGA fetuses (48.71%) and 6 of 31 AGA fetuses (19.35%) had low APGAR score of < 7. Of 39 SGA fetuses 26 (66.67%) and 7 of 31 AGA fetuses (22.58%) had NICU admissions.

## CONCLUSION

IUGR fetuses tolerate labour poorly, therefore antenatal diagnosis of IUGR is a great importance. The development of dopplervelocimetry has afforded the perinatologist a valuable tool by which insights into fetal growth restriction may be obtained in a non invasive manner. The current study confirmed the superiority of cerebroumbilical ratio over the MCA PI or Umb A PI alone in the detection of early onset of IUGR and adverse perinatal outcome. Neonatal management is most likely to be effective when knowledge of fetal status and an appreciation of the spectrum of fetal consequences of placental insufficiency are integrated to guide evaluation and management. The findings in this study support the conclusion of majority of workers.

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