



FETAL DOPPLER IN IUGR SUSPECTED CASES

Radiodiagnosis

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ABSTRACT

In this study, out of 200 cases, 100 were clinically suspected IUGR (intra uterine growth retardation) cases & another 100 were normal control cases. Among the 100 suspected cases 68% were SGA (Small for gestational age) babies (n=68) and 32% were AGA (appropriate for gestational age) babies (32). Of 68 SGA babies 64.7% (n=44) had abnormal Doppler. In this study 54% of SGA fetuses (n=37) and 3% of AGA fetuses had hypertension as a risk factor. Out of 60 fetuses with HC/AC (head circumference/abdominal circumference) ratio >1, 80% were SGA fetuses (n=48) and 20% were AGA fetuses (n=12). Out of 48 fetuses with FL/AC (femur length/abdominal circumference) ratio >23.5, 84.4% were SGA fetuses (n=38) and 15.6% were AGA fetuses (n=10). Out of 55 fetuses with oligohydramnios, 63.6% were SGA fetuses (n=35) and 36.4% were AGA fetuses (n=20). PI, RI and SD ratio of uterine & umbilical arteries was significantly raised in SGA babies as compared to AGA babies while PI, RI and SD ratio of MCA were significantly lower in SGA babies as compared to AGA babies. Uterine artery early Diastolic Notch was seen in 10 cases & all of them delivered SGA babies. Hypertension was present in 8 of these 10 cases. Absent Diastolic Flow was detected in two cases and the foetus died in utero. High CS rate, lower gestational age at delivery, low birth weight, low Apgar score, were more frequently observed with SGA babies as compared to AGA babies. CS in mothers with SGA babies were mostly done for acute Foetal Distress (AFD). The findings in this study support the conclusion of majority of workers.

KEYWORDS

IUGR, SGA, AGA, Doppler study, low birth weight, umbilical artery, perinatal morbidity and mortality, fetal and maternal circulation,

An Important goal in contemporary radiodiagnosis is to identify growth retarded fetus at risk for perinatal morbidity and mortality. Doppler provides a non invasive method of assessing fetal and maternal circulations in pregnancy and it can identify fetal growth retardation associated with an abnormal uteroplacental and/or placental fetal circulation.

Our study was an effort at establishing the role of foetal biometry and UTA, UA and MCA Doppler ultrasound in predicting the adverse perinatal outcome in clinically suspected IUGR pregnancies.

Objectives of our study were:

- 1) Timely detection of IUGR fetuses using real-time sonography and doppler velocimetry.
- 2) To compare doppler indices and ultrasound morphometric measurements in normal and IUGR fetuses.
- 3) To compare neonatal outcome in terms of mortality and morbidity between normal and IUGR fetuses.

MATERIAL AND METHODS:

This study was a longitudinal study done in the Radio-diagnosis Department of , Alluri Sita Rama Raju Academy of Medical Sciences college and hospitals .The duration of the study was from may 2018 to june 2019. The population consisted of 200 pregnant women referred from the inpatient ward as well as outpatient department of Obstetrics and Gynaecology Department of ASRAM medical college. 100 cases with clinically suspected intrauterine growth retardation (IUGR) and another 100 cases with clinically normal pregnancy were included.

Inclusion criteria:

- Singleton pregnancy.
- Gestational age from 28 weeks to term
- 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
- Macrosomic babies

After obtaining consent from the patients a detailed history were obtained from each patient with special reference to maternal age, parity, last menstrual and other obstetric history including previous pregnancy outcomes. Medical history including hypertension, diabetes, asthma, renal disease, heart disease etc was also noted. Gestational age was calculated from the last menstrual period and/or early ultrasound examination. History taking was followed by physical examination. 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 amniotic fluid were noted. Amniotic fluid index was calculated by adding the vertical depths of the largest pocket in each of the four uterine quadrants. Foetal weight was estimated according to the Hadlock formulae that uses FL, AC and BPD. Foetal weight less than 10th percentile based on the chart given by Doubilet et al in 1997 were taken as small for gestational age (SGA) babies and foetal weight between 10th percentile to 90th percentile were taken as appropriate for gestational age (AGA) babies. Pulse wave Doppler ultrasound examination were then performed. Uterine artery (UTA) was studied by first identifying the placental site. If the placenta was central, bilateral uterine arteries were studied and the mean were taken. Sampling point for the uterine artery was the point where it crossed the external iliac artery near the cervicouterine junction. For the umbilical artery (UA) flow velocity wave forms were obtained from a free floating loop of cord. The sampling point for the middle cerebral artery (MCA) was taken near its origin from the

internal carotid artery. Flow velocity waveforms obtained from the arteries were computed automatically.

The programme identified individual cardiac cycles and computed peak systolic velocity (S), end diastolic velocity (D), mean velocity and the indices pulsatility index (PI), resistance index (RI) and systolic/diastolic (S/D) ratios.

Results and Discussion :

The present study was done to study the role of ultrasonography in identification of IUGR in clinically high risk mothers to provide adequate prophylactic antenatal care .In our study we included those patients who were high risk for IUGR and also those who had no risk factors .David et al in 1998 remarked that ultrasound biometry is the gold standard for assessment of foetal size. 70% of suspected IUGR cases were SGA and 30% of suspected IUGR cases were AGA babies in the present study .

A total of 200 cases were included in the study, 100 clinically suspected IUGR cases and another 100 with normal uncomplicated singleton pregnancies were included in this study. Of 100 IUGR suspected cases, 68 cases (about 2/3rd) were actually small for gestational age (SGA) and 32 cases had foetuses appropriate for gestational age (AGA)

Comparison of outcome by Gravida

Of these 200 cases, 72 were primigravidae and 128 were multigravidae. There was no significant statistical difference in the pregnancy outcome by gravida of the patients.

Comparison of Gestational outcome by presence of risk factors

Among the risk factors, those patients with hypertension were more likely to have SGA babies as compared with other risk factors like Diabetes mellitus, Anaemia etc. And the difference was found to be statistically significant as shown in table 1 . In this series among the various risk factors hypertension was a very significant risk factor for IUGR compromising 60% of the SGA group which was in agreement with other workers (K Harrington e al 1999 and Coleman et al 2000).

Table 1 Comparison of Gestational outcome by presence of risk factors

Risk factors	Outcome, N(%)		P-value
	SGA	AGA	
Hypertension	37(54%)	2(3%)	0.000
Others	28(40%)	20(15.44%)	

Comparison of Gestational outcome by HC/AC Ratio

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<0.000). David P et al (1998) remarked that between 20-36 weeks of gestation, HC/AC ratio normally drops from 1.2 to 1. In asymmetric IUGR HC/AC ratio is elevated (David P 1998 and Dutta 2004).

Comparison of Gestational outcome by FL/AC Ratio

Abnormal FL/AC ratio (>23.5) was significantly higher among SGA babies as Compared to AGA babies (p <0.000) as seen in table. Dutta DC (2004) mentioned that FL/AC greater than 23.5 from 21 weeks onwards suggests IUGR.

Comparison of Gestational outcome by Mode of AFI Index

SGA babies were significantly more likely to have oligohydromnios as compared to AGA babies. David et al (1998) remarked that a decreased volume of amniotic fluid is closely associated with IUGR. Manning et al studied an extensively prescreened sample and found that oligohydromnios was an exceptionally reliable predictor

Comparison of Gestational outcome by Placental Grade

The proportion of advanced placental grade was also higher among SGA babies as compared to AGA babies in this study and was statistically significant .60 of 68 SGA foetuses (88.2%) and 80 of 132 AGA foetuses(60.6%) had grade III placenta

Comparison of Gestational outcome by Doppler study outcome

Out of total 200 cases, 15 of 132 AGA foetuses (11.3%) had abnormal Doppler readings and 46 of 68 SGA foetuses (67.6%) had abnormal

Doppler readings. In 2000, Ott WJ noted that SGA foetuses with normal Doppler studies most likely represent constitutionally small, not pathologically growth restricted foetuses.

Comparison of Gestational outcome by Uterine artery S/D

Abnormal S/D ratio of >2.6 in uterine artery were significantly more in SGA foetus Uterine artery diastolic notching was seen in 11 SGA foetuses, 8 of them had unilateral notching and 3 bilateral notching. And 8 of them had hypertension.

Uterine artery mean PI (0.64 vs.0.53), RI (0.27 vs.0.22) and S/D (2.84 vs 2.34) ratio were all significantly raised in SGA foetuses in comparison to AGA foetuses in this study indicating raised impedance to blood flow Coleman MA et al (2000) defined UTA RI of > 0.58 as abnormal and an RI of ≥ 0.7 was defined as very abnormal. They concluded that in high risk women, uterine artery Doppler waveform analysis was better than clinical risk assessment in the prediction of pre-eclampsia and SGA babies.

Comparison of Gestational outcome by Umbilical artery S/D (N=100) Abnormal UA S/D ratio > 3 was significantly higher in SGA group. Umbilical Artery Doppler wave forms reflect the status of the fetoplacental circulation. Stuart and Drumm first reported a progressive fall in the value of Doppler indices in the umbilical artery with increasing gestation

Comparison of Gestational outcome by MCA S/D

Abnormal MCA S/D ratio was significantly more in the SGA foetuses. In the analysis of MCA Doppler indices a similar decline was observed in the values of the Doppler indices in both SGA and AGA foetuses .

The values were lower in the SGA group than the AGA group .suggesting decrease in impedance and increase in diastolic blood flow in the brain .

Riza Madazli et al (2001) noted that in growth restriction the main and primary pathology is inadequate uteroplacental perfusion which is reflected as increased umbilical artery impedance, changes in the MCA are a secondary phenomenon. Mean MCA PI, RI and S/D ratio were all significantly decreased in SGA foetuses in this study. Ravi Chandran and co-workers (1993), Manabe et al (1995) noted that MCA PI values in growth retarded fetuses were always lower than those in the normal fetuses, Malhotra et al (2001) noted that those fetuses at highest risk for growth retardation can be identified by PI of the middle cerebral artery.

Comparison of Gestational outcome by Cerebroplacental index (CPI=MCA RI/UARI)

The proportion of CPI ≤ 1 indicative of brain sparing effect were significantly higher in the SGA foetus group. The proportion of CPI (MCA RI/UA RI) ≤ 1 indicative of brain sparing effect was significantly higher in the SGA foetus .Alaa et al(2005) considered MCA RI/UA RI < 1.0 abnormal. There was a strong correlation between the MCARI/UARI and neonatal outcome.

Comparison of Gestational outcome by Cerebro-umbilical index (CUI=MCA PI/UAPI)

- The proportion CU index ≤ 1.08 indicative of brain sparing effect were significantly higher in the SGA foetus group. Malhotra et al (2001) remarked that the PI ratio of MCA/ UA (CU index) is valuable for monitoring growth retarded and small for gestational age foetuses, particularly those, whose umbilical artery PI is high. In this study the proportion CU index (MCA PI/UA PI) ≤ 1.08 indicative of brain sparing effect was significantly higher in the SGA foetus group. Odibo AO et al (2005) reported that with a MCA PI/UA PI threshold of less than 1.08. Padmagirison and Rai (2006) noted that 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 14 of 70 (20%) SGA foetuses and 3 of 130 (2.3%) AGA foetuses had abnormal CUI index.

Comparison of Gestational outcome by foetal maturity

Out of 200 cases, 105 cases delivered vaginally. Caesarian sections were performed in 95 cases In case of SGA babies acute foetal distress (AFD) was the indication for CS in majority of cases.

Comparison of Gestational outcome by Mode of Delivery

Caesarean section rate noted in this study were significantly higher in SGA foetus group. In SGA group CS rate was 67.1% and in AGA group

34.6%. Peter Holmqvist et al (1986)⁸⁴ and Patrizial et al (2002)²⁹ also noted similar trend.

Comparison of Gestational outcome by Apgar score

- SGA babies were significantly more likely to have Apgar score <7 as compared to AGA babies. Low APGAR score of <7 and NICU admissions in this study were significantly more in SGA babies in comparison to AGA babies. 26 of 68 SGA foetuses (38.2%) and 12 of 132 AGA foetuses (9.09%) had low APGAR score of <7. Arora Devendra et al (2005)³⁴ and Francesc Figueras et al (2008)⁴³ also had similar findings.

Perinatal outcome in IUGR babies (N=68) with abnormal & Normal

- Doppler findings. In 2000, Ott WJ observed that Umbilical artery doppler blood flow studies were a better predictor of neonatal outcome than estimated foetal weight. SGA foetuses with normal doppler studies most likely represent constitutionally small, not pathologically growth restricted fetuses. In the SGA group 46 cases had abnormal doppler indices and 24 had normal doppler indices. In this study SGA foetuses with abnormal doppler study had a poor outcome in comparison to those with normal doppler study and the difference was statistically significant. SGA babies with abnormal doppler had lower fetal weight, poor Apgar score, higher CS rate. Seyam YS et al (2002), Arora Devendra et al (2005) and Francesc Figueras et al (2008) also found the same. In this study the number of NICU admissions among abnormal doppler group (22 of 46) and normal doppler group (6 of 24) was statistically not significant (p=0.064). SGA babies with abnormal Doppler had lower birth weight, poor Apgar score, Higher NICU admission and higher CS rate.

Table 2. Perinatal outcome in IUGR babies (N=68) with abnormal & Normal Doppler findings.

Events	Abnormal Doppler (46 cases)	Normal Doppler (22 cases)	P Value
NICU admission	22	6	0.064(NS)
Apgar Score <7	26	0	0.000(S)
Mean birth wt. (kg).	40	5	0.000(S)
No. of CS	39	9	0.000(S)

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