



IMPORTANCE OF USG EXAMINATION IN FETAL SURVEILLANCE & DIAGNOSIS OF LATE ONSET FGR : A CROSS - SECTIONAL STUDY

Radio-Diagnosis

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ABSTRACT

Introduction : Fetal surveillance of pregnancies that are complicated by IUGR is essential to improve fetal outcome. **Aim and objectives:** To identify the fetal growth restriction in small babies, differentiate healthy & pathologically small ones & provide this information to the clinicians for pregnancy management. **Material & Methods :** This cross-sectional observational study was conducted on patients after clearance from Board of Studies and Ethical committee in the Department of Radiodiagnosis at Rajshree Medical Research Institute, Bareilly Uttar Pradesh during 2020-2022. **Results:** The mean Fetal Heart Rate was significantly more among IUGR group compared to Normal group. Discrepancy in gestation age was significantly more among IUGR group. Abnormal Uterine Notch, Abnormal PI Umbilical Artery, Abnormal PI Middle cerebral artery, Abnormal Cerebroplacental ratio and Abnormal Average PI of uterine arteries was significantly more among IUGR group. **Conclusion:** It was discovered that the diagnostic acuity of Umbilical artery RI and UA PI in predicting a poor neonatal outcome was high. The cerebroplacental index has a high specificity and positive predictive value. Reduced perinatal morbidity & mortality in IUGR fetuses will result from an early Doppler pregnancy investigation for these indices.

KEYWORDS

IUGR, Uterine Notch, Umbilical Artery .

INTRODUCTION

Fetal growth restriction (FGR) detected beyond 32 weeks of pregnancy is typically referred to as late FGR.^[1] When FGR first develops, the usual pattern of deterioration evolves from rising Doppler parameter abnormalities to aberrant biophysical parameter abnormalities.^[2] Conventionally, the terms "fetal growth restriction" and "small for gestational age" (SGA) have been used to describe the two clinical manifestations, respectively.^[3]

FGR complicates around one-third of late preterm deliveries that are medically needed. Neonatal acidosis, cesarean birth for fetal distress, and hospitalization to the neonatal ICU are all related to late FGR.^[4] Low-risk SGA refers to small fetuses with moderate growth restriction (>3rd centile) and normal placental function on both the fetal (normal CPR) and maternal (normal uterine Doppler) sides, while high-risk FGR refers to small fetuses with severe smallness or Doppler evidence of placental dysfunction.^[5]

Other Doppler measurements, such as MCA, have been investigated to indicate the fetal response to placental insufficiency as UA velocimetry is not a sensitive metric to detect late stages of FGR. The use of MCA Doppler revealed that 15-20% of term SGA fetuses with normal UA Doppler had lower impedance in MCA blood flow.

Furthermore, the CPR (Cerebro-placental ratio), which combines the pulsatility index of the MCA and UA, has been demonstrated to be more sensitive to hypoxia (defined as a reduced partial pressure of oxygen [pO₂] in the arterial system) than its individual components and it correlates better with adverse outcome.

METHODOLOGY

This cross-sectional observational study was conducted on patients in the Department of Radiodiagnosis at Rajshree Medical Research Institute, Bareilly Uttar Pradesh during the period 2020-2022.

Study Population

The study subjects included Singleton pregnancy with Gestational age from >32 weeks to term. Known date of last menstrual period (LMP)/ or pregnancy dated in first trimester by ultrasound where known LMP is not available.

The patients were examined by trans-abdominal ultrasound followed by color Doppler studies. The fetal biometry, assessment of biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femoral length (FL), fetal heart rate, placental maturity and amount of liquor was noted.

The USG computer program identified the individual cardiac cycles & computed the 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. PI of umbilical artery, MCA, CP ratio (PI of MCA/UA), Average PI of Uterine arteries and Ductus venosus normal / abnormal waveform noted for fetal wellbeing evaluation.

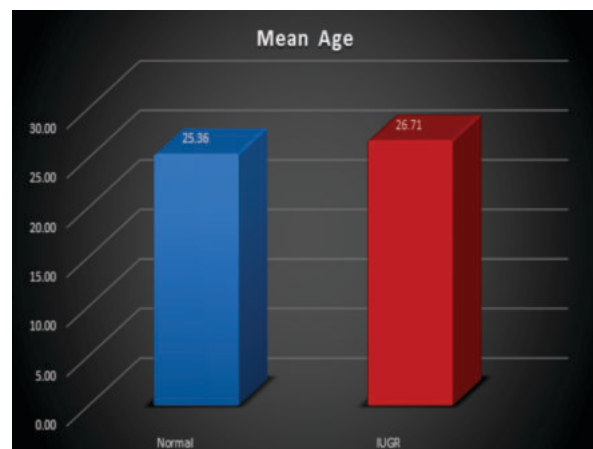
Statistical Analysis

The data was entered into the Microsoft excel and the statistical analysis was performed by statistical software SPSS version 21.0. The student t-test was used for comparing the mean values between the 2 groups whereas chi-square test was applied for comparing the frequency. The p-value was considered to be significant when less than 0.05.

RESULTS

Table 1: Distribution of study population according to Age

		Normal	IUGR		p-value
Age		25.36±3.67	26.71±3.74		0.137
Gravida	1	22	14	36	
		52.4%	50.0%	51.4%	
	2	18	14	32	
		42.9%	50.0%	45.7%	
	3	2	0	2	
		4.8%	0.0%	2.9%	

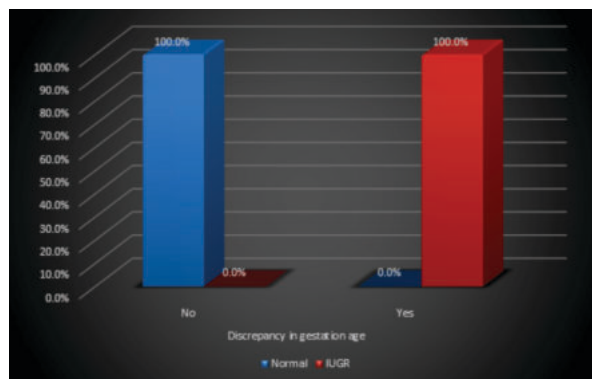


The mean age of Normal group was 25.36±3.67 yrs ranging 19-34 yrs, IUGR group : 26.71±3.74 yrs & over-all study population : 25.90±3.70 yrs ranging 19-35 yrs. Primigravida was found among 51.4% and multigravida among 48.6% women.

Table 2: Comparison of Discrepancy in gestation age between Normal and IUGR groups

Discrepancy in gestation age	Impression		Total
	Normal	IUGR	
No	42	0	42
	100.0%	0.0%	60.0%
Yes	0	28	28
	0.0%	100.0%	40.0%

□2 value = 70.001*, p-value < 0.001*



Discrepancy in Gestational age was significantly more among IUGR group.

Table 3: Distribution of study population according to BPD , AC , FL & Fetal Weight

	Impression	Mean	Std. Deviation	t-test value	p-value
Biparietal diameter (BPD)	Normal	8.45	0.33	4.408	0.001*
	IUGR	8.16	0.12		
Abdominal circumference (AC)	Normal	29.50	1.76	2.715	0.008*
	IUGR	28.54	0.81		
Femur length (FL)	Normal	6.51	0.38	2.118	0.038*
	IUGR	6.35	0.17		
Fetal weight	Normal	2307.86	323.09	4.083	0.001*
	IUGR	2052.54	83.27		

The mean BPD, AC, FL and Fetal weight was significantly more among Normal group compared to IUGR group.

Table 4: Distribution of study population according to PI Umbilical Artery between Normal and IUGR groups

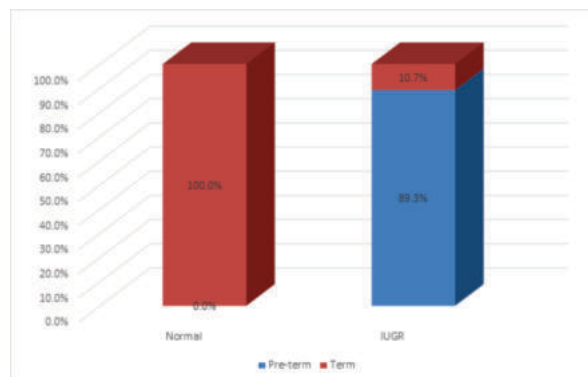
	Impression		Total	p-value
	Normal	IUGR		
Abnormal PI Umbilical Artery	0	7	(7)	< 0.001*
	0.0%	25.0%	11.4%	
Abnormal Average PI of uterine arteries	0	4	4	0.012*
	0.0%	14.3%	5.7%	
Abnormal PI Middle cerebral artery	0	21	21	< 0.001*
	0.0%	75.0%	30.0%	
Abnormal Cerebro placental ratio	0	22	22	< 0.001*
	0.0%	78.6%	31.4%	
Ductus Venosus Wave Form	0	0	0	1.000
	0.0%	0.0%	0.0%	

Abnormal PI UA, Average PI of uterine arteries was significantly more among IUGR group. Abnormal PI MCA was significantly more among IUGR group. Abnormal Cerebro placental ratio was significantly more among IUGR group. There was no significant difference in Ductus Venosus Wave Form between IUGR and Normal groups.

Table 5: Distribution of study population according to Timing of pregnancy

	Impression		p-value
	Normal	IUGR	
Pre-term	0	25	< 0.001*
	0.0%	89.3%	
Pre-Eclampsia/ Eclampsia	0	6	0.007*
	0.0%	21.4%	
SGA	0	28	< 0.001*
	0.0%	100.0%	
Low Baby Weight	0	28	< 0.001*

	0.0%	100.0%	
Neonatal Admission required	1	24	< 0.001*
	2.4%	85.7%	
Steroid required	1	24	< 0.001*
	2.4%	85.7%	



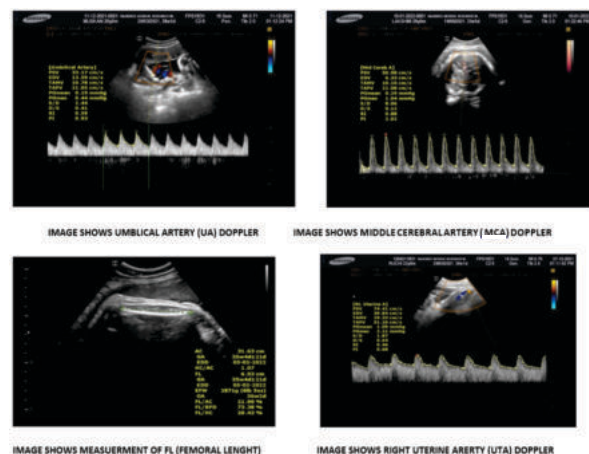
Pre-term pregnancy was significantly more among IUGR group. Pre-Eclampsia/ Eclampsia was significantly more among IUGR group. SGA and Low baby weight was significantly more among IUGR group. Neonatal Admission required was significantly more among IUGR group. Steroid required was significantly more among IUGR group.

Table 6: Distribution of study population according to sensitivity , specificity, PPV, NPV & accuracy of Usg & Doppler parameters

	PI Umbilical Artery	PI Middle cerebral artery	Cerebro-placental ratio	Average PI of uterine arteries	Ductus Venosus Wave Form	Over-all Doppler
Sensitivity	71.43%	75.00%	78.57%	85.71%	92.86%	92.86%
Specificity	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Positive Predictive Value	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Negative Predictive Value	84.00%	85.71%	87.50%	91.30%	95.45%	95.45%
Accuracy	88.57%	90.00%	91.43%	94.29%	97.14%	97.14%

The sensitivity of PI UA, PI MCA, CPR, Average PI of uterine arteries and Ductus Venosus Wave Form was 71.43%, 75.00%, 78.57%, 85.71% and 92.86% respectively. The accuracy of PI UA, PI MCA, Cerebro-placental ratio, Average PI of uterine arteries and Ductus Venosus Wave Form was 88.57%, 90.00%, 91.43%, 94.29% and 97.14% respectively. The sensitivity of Doppler was 92.86%, Specificity was 100.00%, Positive Predictive Value was 100.00%, Negative Predictive Value was 95.45% and Accuracy was 97.14%.

IMAGES



DISCUSSION

Umbilical artery Doppler testing need to be done on all intrauterine growth-restricted fetuses with weight or abdominal circumference

below the gestational age 10th percentile.^[5] PI is frequently utilized in conjunction with Doppler parameters to address intrauterine growth limitation. In fetuses with intrauterine growth restriction, there is a substantial risk of perinatal morbidity and death.^[6]

Prevalence of IUGR

The prevalence of IUGR in clinically suspect cases of fetal growth restriction was 40% in the present study, whereas Khanduri et al.^[7] observed a prevalence of 62.9%. The greater frequency of IUGR in the current study may be explained by the fact that the pregnancies included in the study were previously identified as having clinically suspicious IUGR.

Age

In our study, the mean age among Normal group was 25.36±3.67 years with range from 19-34 years and IUGR group was 26.71±3.74 years with a range from 19-35 years and over-all study population was 25.90±3.70 years with a range from 19-35 years. Khanduri et al.^[7] found that the mean age of the women was 26.13±4.21 years with a range from 18-37 years. Malik and Saxena.^[8] observed that most cases were between 21 and 25 years of age comprising 47% cases with age range of 18-40 years.

Fetal parameters

In current study, the mean BPD, AC, Fetal Length, and Fetal weight was significantly more among Normal group compared to IUGR group. Fetal malnutrition (FM) has a negative impact on body composition, including decreased protein and muscle content, organ structure, bone, chemical makeup, and enzyme functioning.

We found no significant difference in the distribution of Gravida between Normal and IUGR groups. Primigravida was found among 51.4% and multigravida among 48.6% women though there were more Primigravida among normal group (52.4%) with 47.6% multipara compared to IUGR group with equal proportion (50.0%) of Primigravida and multipara.

In line with our study, Shivaprasad et al.^[9] observed that number of primigravida mother who delivered IUGR infants were 43.3% in control group compared to 46.7% in case group. Malik and Saxena.^[8] observed that Primipara were 49% cases that were most significantly associated with IUGR. This was followed closely by mothers who were para I constituting 38% of total cases.

In current study, low birth weight was significantly more among IUGR group (100.0%) compared to normal group (0.0%) which was similar to the findings by Malik and Saxena.^[8] 90 newborns have been found to have birth weight of less than 2.5 kg, whereas 10 newborns were found to have birth weight of 2.5 kg or more.

The mean duration of NICU was significantly more among IUGR group (2.36±1.45 days) compared to Normal group (0.19±1.23 days). Shivaprasad B et al.^[9] reported that Compared to IUGR infants with normal prenatal Doppler scans, infants with abnormal antenatal Doppler scans spend more time in the NICU.

Doppler Findings

In our study, Abnormal PI Umbilical Artery, PI Middle cerebral artery, Cerebro placental ratio and Average PI of uterine arteries was significantly more (28.6%, 75.0%, 78.6% and 14.3% respectively) among IUGR group. Similar to our study, Malik and Saxena.^[8] found that abnormal uterine artery indices were present in 37 cases, with nine of those cases showing uterine artery diastolic notching with elevated Doppler indices and the remaining 28 cases showing only abnormal uterine artery PI without diastolic notching.

The lack of diastolic flow is frequently linked to pregnancy complications, such as IUGR and fetal hypoxia. Fetal hypoxia and acidosis are strongly correlated with findings of ARFV (missing or reversed diastolic blood flow velocity) (Tannindron et al.).^[10]

In current study, the sensitivity of Doppler was 92.86%, Specificity was 100.00%, Positive Predictive Value was 100.00%, Negative Predictive Value was 95.45% and Accuracy was 97.14%. The sensitivity of PI Umbilical Artery, PI Middle cerebral artery, Cerebro-placental ratio, Average PI of uterine arteries and Ductus Venosus Wave Form was 71.43%, 75.00%, 78.57%, 85.71% and 92.86% respectively. The accuracy of PI Umbilical Artery, PI Middle cerebral

artery, Cerebro-placental ratio, Average PI of uterine arteries and Ductus Venosus Wave Form was 88.57%, 90.00%, 91.43%, 94.29% and 97.14% respectively.

The pulsatility index is at its height by the third visit (late third trimester), at which point the criteria are more sensitive since it has been shown in the literature that it initially falls and then increases. Diastolic flow reduces in situations of placental insufficiency, increasing the PI value.^[10]

The single-center design and limited sample size of this study are its limitations. However, it offers the benefit of employing the same few researchers and a single machine to assess a homogenous low-risk group.

CONCLUSION

The purpose of the current study was to highlight the importance of Doppler ultrasonography examinations in IUGR patients for identifying damaged babies in utero and prompting necessary intervention. In the current investigation, it was discovered that the diagnostic acuity of umbilical artery RI and UA PI in predicting a poor neonatal outcome was high. In predicting a poor prenatal outcome, the cerebroplacental index has a high specificity and positive predictive value. Reduced perinatal morbidity & mortality in IUGR fetuses will result from an early Doppler pregnancy investigation for these indices.

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