Section: Anaesthesiology

Original Research Article

CLINICOSONOGRAPHICAL EVALUATION OF INTRAUTERINE GROWTH RETARDATION

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Abstract

Background: IUGR has been a challenge to the obstetricians. Many new & modern methods have come out like Doppler velocimetry in adjunct to USG, has revolutionized the diagnosis of IUGR. However, evaluation of IUGR by simple clinical method like SFH measurement still holds high significance today. **Materials and Methods:** Data was collected from pregnant women attending the antenatal clinic & admitted to the indoor ward of Obstetric unit . Total 200 patients were studied. After clinical assessment, patients were subjected to ultrasonographic examination at 18- 22 weeks [to rule out congenital anomaly], at 30 weeks, 34 weeks & ≥37 weeks for detection of IUGR by fetal biometry and Doppler velocimetry. **Result:** The age group ranged between 19-40 years. Majority of patients in the study group were multigravida (60%) and belonged to lower socioeconomic status. We observed that 62% cases (n=62) in study group and 24% cases (n=24%) in control group were diagnosed with IUGR based on birth weight (≤ 2.5 kg). For abdominal girth, our study showed poor sensitivity of 35%, specificity of 59.7%, positive predictive value of 28.9% & negative predictive value of 66.6%. HC had higher sensitivity than BPD. The sensitivity of HC/AC ratio was found inferior than that of HC alone. FL/AC was found to have low sensitivity of (57.3%). On comparing the different Doppler velocimetry parameters, the highest sensitivity was of UA SDR (69.75%). Highest specificity & PPV was of CPR (98.5%) & (95.23%). The NPV was highest for both UA RI (75%) & UA SDR (75.47%) in present study. **Conclusion:** We concluded that SFH measurement is an inexpensive, simple & easily available method to study fetal growth. Therefore, it should be routinely used in all patients attending antenatal clinic. Ultrasound is a reliable method for diagnosing growth restriction & approximate baby weight thus forms a valuable aid for managing high risk cases. Fetal abdominal circumference is most predictive of IUGR followed by estimated birth weight. Fetal Doppler indices, in particular ratios obtained from cerebral circulation, helps in the prediction of neonatal morbidity.

INTRODUCTION

Abnormal fetal growth is relatively common clinical dilemma in Obstetrics. In recent years, the perinatal mortality & morbidity has drawn much attention towards this burning issue. Extensive studies have been carried out to evaluate the etiology of intrauterine growth retardation (IUGR). It is mainly due to a pathologic slow-down in the fetal growth pace, resulting in a fetus that is unable to reach its growth potential. Its incidence is between 3% and 7% of the total population with round figure of 5.13% with a progressively higher incidence during the last decade.[1] In India, the prevalence of LBW has been reported as 26% while the proportion of IUGR has been found to be 54%.[2]

Incidence of IUGR varies widely in literature with reports ranging from 1–12%,[3] the reason behind this may be different factors like social & economical status of the population studied, different criteria used for discrimination (10th percentile, 5th percentile etc.), different ways in which different curves are drawn, data obtained from different longitudinal & transverse studies. Low birth weight (LBW) is an important public health problem in developing countries like India and its prevention is an important priority as the

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condition is largely attributed to IUGR. It constitutes two third of low-birth-weight babies born in our country. Common predisposing factors include poor nutritional status of the mother and frequent pregnancies, in addition to obstetric and medical problems during pregnancy. Maternal weight of less than 40 kg and height of less than 145 cm leads to small for gestation age infants. Insufficient nutritional intake during pregnancy has adverse effect on fetal weight. Therefore, maternal health, education and empowerment bears a strong influence on perinatal outcomes.

All the countries of South Asia were signatories to the millennium development goal (MDG) targets of reducing maternal and infant mortality by 66-75% by the year 2015.[4] Given the recent progress, geopolitical inclinations and trends of investments in this area, it has been shown that these targets were difficult to meet due to the lack of intensive and holistic effort from major stake holders including both governmental and non-governmental bodies.[5] A reduction of at least one-third in the proportion of infants with LBW is one of the seven major goals for "A World Fit for Children" programme of the United Nations.[6] Concerted efforts should be made to gather indigenous data about the risk factors of IUGR. The present study was conducted to evaluate IUGR by various parameters using clinical, sonographical & by Doppler indices to enable early & accurate recognition, appropriate timed intervention & thus ensuring better outcome of pregnancy hence decreasing mortality & morbidity.

MATERIALS AND METHODS

Source of Data

The present study was carried out in the Department of Obstetrics & Gynecology, SSJGIMSR Almora , Uttarakhand during the period of September 2021 - September 2022.

Method of Collection Of data

Data was collected form pregnant women attending the antenatal clinic & admitted to the indoor ward of Obstetric unit beyond 28 weeks of gestation. After clinical assessment, patients were subjected to ultrasonographic examination at 18- 22 weeks to rule out congenital anomaly, at 30 weeks, 34 weeks & ≥37 weeks for detection of IUGR by fetal biometry and Doppler velocimetry.

Total 200 patients were studied. They were divided into control and study groups based on following criteria:

Control Group

- Date of last menstrual period was known for certain
- Close relation (±2 weeks) between gestational age & clinical evaluation
- No maternal complications known to affect the normal fetal growth e.g chronic hypertension, diabetes, heart disease.
- No patient with multiple gestation & family history of dwarfism.

Study Group

- Fundal height of uterus lagging behind at least 4 weeks of expected height according to gestational age.
- History of previous IUGR.
- Poor maternal weight gain.
- History of chronic hypertension, insulin dependent diabetes mellitus, severe anemia & maternal diseases known to affect fetal growth.

Method of Study

At booking, detailed history was taken and thorough general examination & obstetrical examination were done. Routine investigations were done. Following parameters were recorded:

1. SFH Measurement
2. Abdominal girth measurement
3. Ultrasound examination
   - Biparietal diameter (BPD)
   - Head circumference (HC)
   - Abdominal circumference (AC)
   - Femur length (FL)
   - Ratio between HC & AC
   - Ratio between FL & AC
   - Amniotic fluid index (AFI)
   - Estimated Fetal Weight (EFW)
4. Doppler Study
   - Umbilical artery indices (SDR, RI, PI)
   - Middle cerebral artery indices (SDR, RI, PI)
   - Cerebroplacental ratio (CPR)

After delivery, baby was considered small for gestational age if birth weight was below 10th percentile for gestational age. For each parameter, true positive, false positive, positive predictive value & negative predictive value was calculated.

RESULTS

Following observations were made in 100 clinically diagnosed IUGR cases (STUDY GROUP) and 100 clinically normal cases (CONTROL GROUP) based on SFH, abdominal girth, liquor status, maturity of head and fetal biometry, fetal Doppler velocimetry of Middle Cerebral Artery (MCA) & Umbilical Artery (UA). Efficacy of clinical, ultrasonographic parameters & Doppler were observed.

Table 1: Age distribution in IUGR & normal cases.

Age	Study group (N= 100)	Percentage %	Control group (N= 100)	Percentage %
≤ 19	5	5	3	3
20 - 24	45	45	35	35
25 - 29	30	30	50	50

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30 - 34	10	10	9	9
≥35	10	10	3	3

Table 2: Maternal & fetal demographic profile

Parameter (mean ±SD)	Study group (N= 100)	Control group (N= 100)
Maternal age	25 ± 2.82	26 ± 3.326
Primigravida	40	55
Multigravida	60	45
Live born	94	100
Still born	6	0
Birth weight (kg)	2 ± 0.258	2.8 ± 0.266
IUGR Babies	62	24

Table 3: Prediction of IUGR by symphysiofundal height measurement & its correlation with birth weight

Clinical prediction	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No.	%
Study group	100				
IUGR	62	62	62	38	38
Normal	24	24	24	76	76
Control group	100				
IUGR	12	10	10	90	90
Normal	88	90	90	10	10

Table 4: Prediction of IUGR by abdominal girth & its correlation with birth weight

Prediction by Abdominal girth measurement	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No	%
Study group	100	31	31	67	67
IUGR	38	11	11	27	27
Normal	62	20	20	40	40
Control group	100	19	19	81	81
IUGR	24	9	9	15	15
Normal	76	10	10	66	66

Table 5: Prediction of IUGR by bpd & its correlation with birth weight

Prediction by BPD measurement	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No	%
Study group	100	66	66	34	34
IUGR	48	38	38	10	10
Normal	52	28	28	24	24
Control group	100	16	16	84	84
IUGR	14	9	9	5	5
Normal	86	7	7	79	79

Table 6: Prediction of IUGR by HC measurement & its correlation with birth weight

Prediction by HC measurement	Total number of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No.	%
Study group	100	67	67	33	33
IUGR	63	46	46	17	17
Normal	37	21	21	16	16
Control group	100	16	16	84	84
IUGR	17	11	11	6	6
Normal	83	5	5	78	78

Table 7: Prediction of IUGR by AC & its correlation with birth weight

Prediction by AC measurement	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No.	%
Study group	100	66	66	34	34
IUGR	70	63	63	7	7
Normal	30	3	3	27	27
Control group	100	16	16	84	84
IUGR	15	14	14	1	1
Normal	85	2	2	83	83

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Table 8: prediction of IUGR by HC/AC measurement & its correlation with birth weight

Prediction by HC/AC measurement	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No.	%
Study group	100	65	65	35	35
IUGR	58	45	45	13	13
Normal	42	20	20	22	22
Control group	100	16	16	84	84
IUGR	11	10	10	1	1
Normal	89	6	6	83	83

Table 9: prediction of IUGR by FL & its correlation with birth weight

Prediction by BPD measurement	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No	%
Study group	100	66	66	34	34
IUGR	49	37	37	12	12
Normal	51	28	28	23	23
Control group	100	16	16	84	84
IUGR	14	9	9	5	5
Normal	86	8	8	78	78

Table 10: prediction of IUGR by FL/AC measurement & its correlation with birth weight

Prediction by FL/AC measurement	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No.	%
Study group	100	68	68	32	32
IUGR	52	39	39	13	13
Normal	48	29	29	19	19
Control group	100	16	16	84	84
IUGR	16	10	10	6	6
Normal	84	6	6	78	78

Table 11: prediction of IUGR by AFI & its correlation with birth weight

Prediction by AFI measurement	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No.	%
Study group	100	66	66	34	84
IUGR	27	23	23	4	4
Normal	73	43	43	30	30
Control group	100	16	16	84	84
IUGR	24	10	10	14	14
Normal	76	6	6	70	70

Table 12: Prediction of IUGR by estimated fetal weight & its correlation with birth weight

Prediction by Estimated fetal weight	Total no. of cases	Prediction by birth weight			
		IUGR		Normal	
		No.	%	No.	%
Study group	100	66	66	34	34
IUGR	78	59	59	19	19
Normal	22	7	7	15	15
Control group	100	16	16	84	84
IUGR	13	12	12	1	1
Normal	87	4	4	83	83

Table 13: distribution according to umbilical artery (UA) s/d ratio

UA S/D Ratio	Cases (N = 100)		Control (N= 100)	
	No.	%	No.	%
SGA & AGA	38	38 %	68	68 %
IUGR	62	62 %	32	32 %

Table 14: distribution according to UA resistance index (RI)

UA RI	Cases (N = 100)		Control (N = 100)	
	No.	%	No.	%
SGA & AGA	42	42 %	86	86 %
IUGR	58	58 %	14	14 %

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Table 15: distribution according to middle cerebral artery (MCA) s/d ratio

UA S/D Ratio	Cases (N = 100)		Control (N = 100)	
	No.	%	No.	%
SGA & AGA	52	52 %	83	83 %
IUGR	48	48 %	17	17 %

Table 16: distribution according to middle cerebral artery (MCA) RI

MCA RI	Cases (N = 100)		Control (N = 100)	
	No.	%	No.	%
SGA & AGA	60	60%	84	84%
IUGR	40	40 %	16	16 %

Table 17: distribution according to cerebro - placental ratio (CPR)

Parameter	Cases (N = 100)		Control (N = 100)	
	No.	%	No.	%
CPR >1	68	68%	90	90%
CPR < 1	32	32 %	10	10 %

Table 18: Comparision of efficacy of all parameters in clinically diagnosed IUGR cases

Parameter	SFH (%)	Abd. Girth (%)	BPD (%)	HC (%)	AC (%)	HC/AC (%)	FL/AC (%)	AFI (%)	EFW (%)
Sensitivity	72	35	57.5	68.6	95.4	69.2	57.3	34.84	89.3
Specificity	66	59.7	70.5	48.4	79.4	62.8	59.3	88.23	44.1
PPV	62	28.9	79.1	73	90	77.5	75	85.18	75.6
NPV	76	66.6	46.1	43.2	90	52.3	39.5	41.09	68.1

Table 19: Comparision between efficacies of different doppler parameters in predicting IUGR

Parameter	UA SDR	UA RI	MCA SDR	MCA RI	$CPR\left(\frac{MCA\ PI}{UA\ PI}\right)$
Sensitivity	69.76	62.79	47.67	41.86	46.5
Specificity	70.17	84.21	78.9	82.45	98.2
PPV	63.82	75	63	64.28	95.23
NPV	75.47	75	66.66	65.27	70.8

DISCUSSION

Despite dramatic improvement in many areas of clinical obstetrics, the ability to detect SGA or IUGR in fetuses, has remained disappointing. Accurate diagnosis assures that affected fetuses can be delivered under optimal circumstances to diminish intrapartum morbidity. Many investigators had attempted to diagnose IUGR by different methods. As technology improved and became readily available to the clinicians, studies shifted from diagnosis by simple clinical parameters to measurement of multiple non-linear fetal parameters. Among them simple clinical method of measuring the SFH, abdominal girth & determination of different fetal parameters by sonography have stood the best.

A total of 200 cases were studied. The age group ranged between 19-40 years. 83 cases in the study group & 85 cases in control group belong to 20-29 years of age. Only 2% cases in study group & 3% in control group were above 35 years. 5% cases in study group & 3% cases in control group are ≤19 years. Majority of patients in study group were multigravida (60%). Most cases (75%) belong to lower socioeconomic status. We observed that 62% cases (n=62) in study group and 24% cases (n=24%) in control group were diagnosed with IUGR based on birth weight (≤ 2.5 kg). For abdominal girth, our study showed poor sensitivity of 35%, specificity of 59.7%, positive predictive value of 28.9% & negative predictive value of 66.6%. The outcome of abdominal girth varies in prediction of IUGR because of the abdominal fat content & hence it is doubtful to consider it as a reliable parameter for prediction of IUGR.

On USG examination, we recorded parameters like biparietal diameter, head circumference, abdominal circumference, femur length and amniotic fluid index. Based on these parameters, ratio between HC & AC, and FL & AC were calculated. For biparietal diameter, we observed sensitivity of 57.5%, specificity of 70.5%, PPV of 79.6% and NPV of 46.1%. For head circumference, our study showed a sensitivity of 68.6%, specificity of 48.4%, PPV of 73% and NPV of 43.2%. For abdominal circumference, we observed sensitivity of 95.4%, specificity of 79.4%, PPV of 90% and NPV of 90%. Abdominal circumference is affected first in IUGR due to depletion of glycogen stores in liver & subcutaneous fat.[7] Warsof et al in 1986 showed AC measurement is more predictive of IUGR than either HC or BPD or combination of these two parameters together.[8]

Another useful method in evaluation of small babies is HC/AC ratio which compares the most preserved organ in malnourished fetus the brain with the most compromised organ the liver. We found that HC/AC showed a sensitivity of 69.2%, specificity of 62.8%, PPV of 77.5% and NPV of 52.3%. On the other

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hand, FL/AC showed a sensitivity of 57.3%, specificity of 59.3%, PPV of 75% and NPV of 39.5%. Relation of ultrasound estimation of effective birth weight & its correlation with presence of IUGR after delivery is observed in our study. Employing Hadlock's formula, positive predictive value of estimated fetal weight (EBW) was 86.7% in present study sensitivity of EBW 89.3%. Specificity, positive predictive value, negative predictive value 44.1%, 75.6%, 68.1% respectively, which in close conjunction with Hadlock.[9] HC had higher sensitivity than BPD. The sensitivity of HC/AC ratio was found inferior than that of HC alone. FL/AC was found to have low sensitivity of (57.3%).

Oligohydramnios has long recognized as a sequela of IUGR. Polyhydramnios, normal AFI or oligohydramnios may occur with IUGR but oligohydramnios is common. In our study 27 cases had oligohydramnios out of 100 cases those diagnosed clinically as IUGR. From these 27 cases, 23 were actually IUGR by birth weight. Sensitivity was 34.84% which was low. Sensitivity has wide variation according to Dizon et al.[10] So, this can't be used to screen IUGR fetuses. But it has good specificity (88.23%). So, if liquor volume is normal in suspected IUGR cases, fetal jeopardy is less likely.

The Doppler signals were recorded in 3.5 Hz frequency with a curvilinear probe. We observed indices like S/D ratio, resistance Index (RI) and pulsatility index (PI). The umbilical artery has been the first & the most studied artery since the introduction of Doppler in obstetrics. In present study, abnormal UA SDR was seen in 69.76% of IUGR & normal UA SDR in 70.17% of cases with SGA & AGA. 62.79% of women with IUGR had abnormal UA RI while 84.2% of women with SGA & AGA had normal UA RI. Abnormal MCA RI was found in 40% of cases & 16% in control. 41.86% of women with IUGR had abnormal MCA RI while 82.45 % with SGA & AGA had normal MCA RI. In present study abnormal CPR was taken as CPR ≤ 1. The percentage of abnormal CPR was 32% in cases & 10% in control. Efficacy of different parameters in the study were compared & the result shows AC measurement has highest sensitivity (91.3%) & accurate in predicting IUGR.

On comparing the different Doppler velocimetry parameters in present study, the highest sensitivity was of UA SDR (69.75%). Highest specificity & PPV was of CPR (98.5%) & (95.23%). The NPV was highest for both UA RI (75%) & UA SDR (75.47%) in present study & is similar with that of BN Lakhhar.[11] Thus, CPR is the most specific marker for prediction of IUGR with highest positive predictability among all Doppler parameters. As ultrasound facilities are not available at all places in our country, small for gestational age babies can be screened by simple measurement of SFH alone. Ultrasound examination can be done in those cases who show low SFH results. If ultrasound facilities permit, both tests should be done.

CONCLUSION

We concluded that SFH measurement is an inexpensive, simple & easily available method to study fetal growth. Therefore, it should be routinely used in all patients attending antenatal clinic. Ultrasound is a reliable method for diagnosing growth restriction & approximate baby weight thus forms a valuable aid for managing high risk cases. Fetal abdominal circumference is most predictive of IUGR followed by estimated birth weight. Fetal Doppler indices, in particular ratios obtained from cerebral circulation, helps in the prediction of neonatal morbidity.

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