Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 12, 2023

ESTABLISHING THE CORRELATION OF ULTRASOUND TO CLINICAL DIAGNOSIS IN FETAL GROWTH RESTRICTION: A CLINICAL ASSESSMENT

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ABSTRACT

Background: Fetal growth restriction has varying etiology and is a leading cause of neonatal mortality and morbidity. Various long-term associated complications are subtle neurodevelopmental handicaps and growth retardation, and acute neonatal concerns being polycythemia, hypoglycemia, hypothermia, and perinatal asphyxia. Attentive surveillance of fetal growth is a vital factor.

Aim: The present study aimed to establish the correlation of ultrasound to clinical diagnosis in fetal growth restriction:

Methods: The present study assessed 144 subjects presenting with fetal growth restriction. The correlation between clinical findings and ultrasound diagnosis was made in all the subjects. The data gathered were analyzed statistically.

Results: The majority of the females presenting fetal growth restriction were residents of rural areas. The clinical diagnostic methods presented with a specificity and sensitivity of 74.4% and 70.9% respectively. On Doppler and ultrasonography, sensitivity was found to be 90.4% and 80.7%, whereas, specificity was 95.3% and 87.9% respectively. Among 63 cases of clinically suspected intrauterine growth restriction, 65% (n=41) of subjects were confirmed for intrauterine growth restriction.

Conclusions: The present study, considering its limitations, concludes that the best available modality for the diagnosis of fetal growth restriction is the Doppler study as it presents with high specificity. However, clinical diagnosis is an equally efficient modality to assess fetal growth restriction and is a cost-effective screening method.

Keywords: abdominal girth, doppler, fetal growth restriction, maternal weight gain, symphysio-fundal height, ultrasonography

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 12, 2023

INTRODUCTION

FGR or fetal growth restriction is a term that is clinically defined as the failure of the developing fetus to attain the genetically determined potential for the fetus that goes less than the 10th percentile or below the two standard deviations in gestationally matched weight measurements.[1] It is vital aspect to diagnose fetal growth restriction timely and at an early stage to achieve better perinatal management and outcomes as FGR or fetal growth restriction is correlated to adverse perinatal outcomes with existing literature data comprehensively depicting 4 times to 8 times increase in mortality and morbidity rates in neonates with fetal growth restriction.[2]

Existing literature data and previous studies have reported that fetal growth restriction can result in various neonatal morbidities including hypothermia, intraventricular hemorrhage, hypoglycemia, and/or polycythemia at the time of birth. Various long-term complications have also been associated with fetal growth restriction affecting the neurological system including metabolic syndrome, stroke, coronary artery disease, obesity, diabetes, adult life hypertension, behavioral dysfunction, developmental delay, and/or cerebral palsy.[3]

With the advancements in the various techniques and technologies of diagnostic imaging and improvement in the antenatal care modalities, the diagnosis of fetal growth restriction has largely increased. Various factors that can lead to fetal growth restriction include placental, fetal, and maternal factors. The perinatal outcomes can be improved when fetal growth restriction is diagnosed early and timely managed.[4] Hence, favorable outcomes in fetal growth restriction can be achieved if the cases are diagnosed early and managed promptly. This makes it a strong call for evidence-based and standard institution protocol for objective surveillance of fetal growth restriction in the intrauterine period.[5]

The incidence of fetal growth restriction is increasing globally including India. These developing nations have a scarcity of resources and have limited availability of healthcare facilities to all the population, especially those residing in rural areas. Hence, in these countries, ultrasound evaluation with the clinical examination is a regularly followed modality with needed documentation, and posing instructions to the affected subjects can be a helpful method.[6] The present study aimed to establish the correlation of ultrasound to clinical diagnosis in early diagnosis and management of fetal growth restriction.

MATERIALS AND METHODS

The present prospective clinical study aimed to establish the correlation of ultrasound to clinical diagnosis in early diagnosis and management of fetal growth restriction. The study was done at Department of Obstetrics and Gynecology, JNU Institute of Medical Science and Research Center, Jaipur, Rajasthan from June 2023 to December 2023 after the clearance was given by the concerned Institutional Ethical committee. The study population was the subjects of the Department of Obstetrics and Gynecology of the Institute. Verbal and written informed consent was taken from all the subjects before study participation.

The inclusion criteria for the study were females having a gestational age of 24 weeks or more, longitudinal lie, singleton pregnancy, and were willing to participate in the study. The exclusion criteria for the study were subjects that did not give consent for study participation, had fetal

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 12, 2023

congenital anomalies, doubtful gestational age owing to non-availability of scans and reports of the first trimester and non-confirmation of the last menstrual period date, transverse lie, polyhydramnios, and multiple pregnancies.

Initially, 144 females were screened for the study. These 144 females were selected from the group that was attending the antenatal care OPD of the institute. 21 females did not turn up for the follow-up and were hence, excluded from the study making the final sample size of 123 females. Before taking informed consent from study females, a detailed study design was explained to all the participants.

After the final inclusion of the study subjects, detailed history was recorded for all the subjects along with the clinical examination. Special consideration was kept in the history recording for family history, medical history, menstrual history, and obstetrics history. The gestational age was assessed from early ultrasound examination or the last menstrual period along with obstetrics and clinical examination.

At the first or initial visit, abdominal circumference, symphysio-fundal height, and maternal weight were assessed for all the participants. These parameters were further monitored at all the subsequent visits.

This was followed by color Doppler and obstetrics ultrasound in all the study participants. In females where fetal growth restriction was suspected from clinical assessment, follow-up was scheduled every fortnight, whereas, in females where fetal growth restriction was not clinically suspected, a monthly follow-up visit was scheduled. To confirm fetal growth restriction on ultrasonography, Hadlock's formula was used.

At birth, all the infants were examined and their weight was recorded in grams. The clinical findings seen on clinical examination were correlated with the findings on the ultrasound to establish the diagnosis of fetal growth restriction.

The data gathered were analyzed statistically using SPSS software version 21.0 (IBM Corp., Armonk, NY, USA). The data were expressed as frequency and percentage and mean and standard deviations. The positive predictive values, negative predictive values, specificity, and sensitivity were assessed and a comparison of the results was made. The significance level was kept at a p-value of <0.05.

RESULTS

The present prospective clinical study aimed to establish the correlation of ultrasound to clinical diagnosis in early diagnosis and management of fetal growth restriction. Initially, 144 females were screened for the study. These 144 females were selected from the group that was attending the antenatal care OPD of the institute. 21 females did not turn up for the follow-up and were hence, excluded from the study making the final sample size of 123 females. The majority of the study females were in the age range of 26-30 years with 60.97% (n=75) females followed by 37.39% (n=46) females in 20-25 years, 1.62% (n=2) subjects, and no subjects in >30 years at age as shown in Table 1.

The majority of the female participants of the study were from upper lower-class socioeconomic status with 67.47% (n=83) subjects followed by 20.32% (n=25) subjects from a lower middle class,

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 12, 2023

and 12.19% (n=15) subjects from lower-class socioeconomic status. No study subject was from upper or upper-middle-class socioeconomic status. Concerning the residential status, 88.61% (n=109) of subjects were from rural areas which was significantly higher compared to subjects residing in the urban areas with 11.38% (n=14) subjects and a p-value of <0.001 (Table 1).

On assessing the validity and reliability of FGR confirmed at birth and clinically suspected FGR in study subjects, it was seen that in 41 subjects where FGR was not confirmed at birth, FGR was not diagnosed by clinical assessment in 70.73% (n=29) subjects, whereas, FGR was diagnosed by clinical assessment (abdominal circumference, symphysio-fundal height) in 29.26% (n=12) study subjects. In 82 subjects where FGR was confirmed at birth, FGR was not diagnosed by clinical assessment in 25.60% (n=210 subjects, whereas, FGR was diagnosed by clinical assessment (abdominal circumference, symphysio-fundal height) in 74.39% (n=61) study subjects as depicted in Table 2.

The study results showed that for validity and reliability of ultrasonography findings suggesting FGR and FGR at birth, it was seen that in 41 subjects where FGR was not confirmed at birth, USG findings were non-suggestive of FGR in 80.48% (n=33) subjects and were suggestive of FGR in 19.51% (n=8) study subjects respectively. Among 82 subjects where FGR was confirmed at birth, USG findings were non-suggestive of FGR in 12.19% (n=10) subjects and USG findings were suggestive of FGR in 87.80% (n=72) subjects (Table 3).

It was also seen that concerning the validity and reliability of Doppler changes suggesting FGR and FGR confirmed at birth, in 41 subjects where FGR was not confirmed at birth, doppler changes were absent in 95.12% (n=39) subjects and were present in 4.87% (n=2) subjects respectively. In 82 subjects where FGR was confirmed at birth, doppler changes were present in 90.24% (n=74) subjects and were absent in 9.75% (n=8) study subjects respectively (Table 4). This suggests that color Doppler has a sensitivity of 90.24%, specificity of 95.12%, positive predictive value of 90.24%, and negative predictive value of 95.12%.

DISCUSSION

The present prospective clinical study assessed 123 pregnant females. The majority of the study females were in the age range of 26-3 years with 60.97% (n=75) females followed by 37.39% (n=46) females in 20-25 years, 1.62% (n=2) subjects, and no subjects in >30 years at age. These data correlated with the studies of Acharya D et al[7] in 2006 and Marhatta N et al[8] in 2017 where authors reported the majority of females presenting with FGR were in the age range of 26-30 years as in the present study.

It was seen that in majority of the female participants of the study were from upper lower class socioeconomic status with 67.47% (n=83) subjects followed by 20.32% (n=25) subjects from lower middle class, and12.19% (n=15) subjects from lower class socioeconomic status. No study subject was from upper or upper-middle-class socioeconomic status. Concerning the residential status, 88.61% (n=109) of subjects were from rural areas which was significantly higher compared to subjects residing in the urban areas with 11.38% (n=14) subjects and a p-value of <0.001. These results were similar to Sinha S et al[9] in 2018 and Kinare S et al[10] in 2010 where authors assessed subjects with similar demographics as seen in the present study.

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Concerning the validity and reliability of FGR confirmed at birth and clinically suspected FGR in study subjects, it was seen that in 41 subjects where FGR was not confirmed at birth, FGR was not diagnosed by clinical assessment in 70.73% (n=29) subjects, whereas, FGR was diagnosed by clinical assessment (abdominal circumference, symphysio-fundal height) in 29.26% (n=12) study subjects. In 82 subjects where FGR was confirmed at birth, FGR was not diagnosed by clinical assessment in 25.60% (n=210 subjects, whereas, FGR was diagnosed by clinical assessment (abdominal circumference, symphysio-fundal height) in 74.39% (n=61) study subjects. These results were consistent with the findings of Sharma DD et al[11] in 2016 and Straus RS et al[12] in 1999 where clinically suspected FGR and FGR at birth showed a similar correlation as in the present study suggested by authors.

For the validity and reliability of ultrasonography findings suggesting FGR and FGR at birth, it was seen that in 41 subjects where FGR was not confirmed at birth, USG findings were non-suggestive of FGR in 80.48% (n=33) subjects and were suggestive of FGR in 19.51% (n=8) study subjects respectively. Among 82 subjects where FGR was confirmed at birth, USG findings were non-suggestive of FGR in 9.75% (n=8) subjects and USG findings were suggestive of FGR in 90.24% (n=74) subjects. These findings were in agreement with the results of Hamudu NA et al[13] in 2004 and Jensen OH et al[14] in 1991 where the reliability and validity of ultrasonography findings suggesting FGR and FGR at birth seen in the present study were comparable to the results by the authors.

The study results showed that concerning the validity and reliability of Doppler changes suggesting FGR and FGR confirmed at birth, in 41 subjects where FGR was not confirmed at birth, doppler changes were absent in 95.12% (n=39) subjects and were present in 4.87% (n=2) subjects respectively. In 82 subjects where FGR was confirmed at birth, doppler changes were present in 90.24% (n=74) subjects and were absent in 9.75% (n=8) study subjects respectively (Table 4). This suggests that color Doppler has a sensitivity of 90.24%, specificity of 95.12%, positive predictive value of 90.24%, and negative predictive value of 95.12%.

This suggests that color Doppler has a sensitivity of 90.24%, specificity of 95.12%, positive predictive value of 90.24%, and negative predictive value of 95.12%. These results were in line with Mc Dermott JC et al[15] in 1986 and Pillay P et al[16] in 2012 where authors reported comparable validity and reliability of Doppler changes suggesting FGR and FGR confirmed at birth in their studies as seen in the present study.

CONCLUSIONS

Considering its limitations, the present study concludes that the best available modality for the diagnosis of fetal growth restriction is the Doppler study as it presents with high specificity. However, clinical diagnosis is an equally efficient modality to assess fetal growth restriction and is a cost-effective screening method.

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TABLES

Characteristics	Number (123)	Percentage (%)
Age range (years)		
<20	2	1.62
20-25	46	37.39
26-30	75	60.97
>30	0	-
Socioeconomic status		

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 12, 2023

Lower	15	12.19
Upper lower	83	67.47
Lower middle	25	20.32
Upper middle	0	-
Upper	0	-
Residential status		
Urban	14	11.38
Rural	109	88.61

Table 1: Demographic data of study participants

Parameters	FGR not confirmed at birth		FGR confirmed at birth	
	n=41	%	n=82	%
FGR not diagnosed by clinical assessment	29	70.73	21	25.60
FGR diagnosed by clinical assessment (abdominal circumference, symphysio-fundal height)	12	29.26	61	74.39

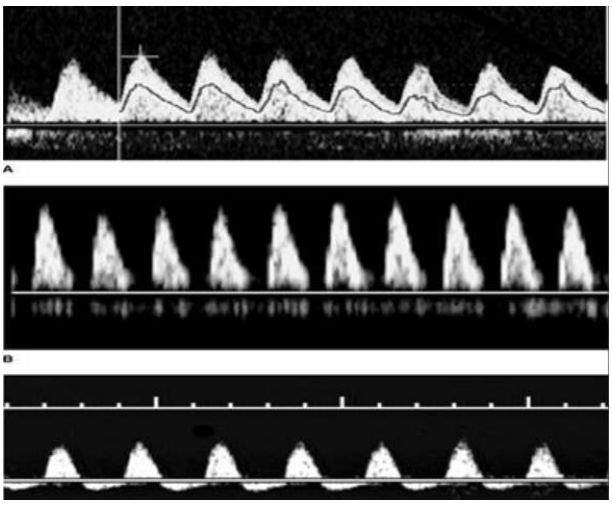
Table 2: Validity and reliability of FGR confirmed at birth and clinically suspected FGR in study subjects

Parameters	FGR not confirmed at birth		FGR confirmed at birth	
	n=41	%	n=82	%
USG non-suggestive of FGR	33	80.48	10	12.19
USG suggestive of FGR	8	19.51	72	87.80

Table 3: Validity and reliability of ultrasonography findings suggesting FGR and FGR at birth

Parameters	FGR confirmed at birth		FGR not confirmed at birth	
	n=82	%	n=41	%
Doppler changes absent	8	9.75	39	95.12
Doppler changes present	74	90.24	2	4.87

Table 4: Validity and reliability of Doppler changes suggesting FGR and FGR confirmed at birth



Umbilical arterial Doppler velocimetry studies, ranging from normal to markedly abnormal

A. Normal velocimetry pattern with an S/D ratio of <30

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 12, 2023

B. The diastolic velocity approaching zero reflects increased placental vascular resistance. **C.** During diastole, arterial flow is reversed (negative S/D ratio), which is an ominous sign that may precede fetal demise