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Original Research Paper

Radio-Diagnosis

FETAL ECHOCARDIOGRAPHY AS A ROUTINE ANTENATAL SCREENING TOOL FOR DETECTION OF FETAL CONGENITAL CARDIAC STRUCTURAL ANOMALIES.

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ABSTRACT **Background:** Fetal echocardiography plays a pivotal role in detecting congenital cardiac structural anomalies. Though foetal echocardiography is mostly reserved for high risk pregnant women, its role as a routine prenatal screening tool needs to be defined. **Objectives:** To evaluate the role of fetal echocardiography as a routine antenatal screening tool for detection of congenital cardiac structural anomalies.To compare the prevalence of congenital cardiac structural anomalies by fetal echocardiography in antenatal women with low risk and high risk factors for cardiac structural anomalies. **Materials and methods:** The study was carried out in the department of radiodiagnosis, SNMC, Agra. 500 fetal hearts between 18-26 weeks gestation were evaluated through fetal echocardiography.They were categorised into two groups -low risk (Group I) and high risk (Group II) and scanned through four chamber , LVOT , RVOT and three vessel view. **Result:** The prevalence of fetal congenital cardiac structural anomalies in this study is 14/1000.Fetal echocardiography had a sensitivity of 85% & specificity of 99%. PPV is 85% and NPV is 99%. The incidence of congenital cardiac structural anomalies in high risk and low risk group was 12 % & 14.8 % per 1,000 respectively. **Conclusion:** based on these findings it is highly suggestive that every pregnant woman should be subjected to a detailed fetal echocardiography. Fetal echocardiography should be included as a part of routine antenatal screening irrespective of risk factors for congenital cardiac structural anomalies.

KEYWORDS : Fetal echocardiography, low risk and high risk, screening tool, sensitivity.

1. INTRODUCTION

Structural heart anomalies are congenital abnormalities of cardiovascular system, characterized by various anatomical departures of heart and great vessels from normal conditions[1]. In the developed world, cardiac structural anomaly is considered to be the most major congenital anomaly and a leading cause of mortality in the first year of life[2,3].Fetal congenital cardiac structural anomaly is one of the most frequently diagnosed congenital disorders afflicting approximately 0.8% to 1.2% of live births worldwide[4].Its burden in India is enormous, because of a very high birth rate. It has been estimated that over 1,80,000 children in India are born with cardiac structural anomaly every year[5]. As only a very small proportion get required intervention, the number of young adults with congenital structural anomaly is steadily increasing. This heavy burden emphasizes its importance in India. It has been seen that routine clinical examination of newborns has a poor sensitivity for detection of congenital structural anomaly [6,7]. Echocardiography with Doppler is the gold standard for the diagnosis of congenital structural anomalies in newborns which has a very high sensitivity and specificity[8]. Fetal echocardiography can help to identify heart defects before birth so that a quicker diagnostic or surgical operation is possible after a baby has been born.

2. MATERIALS AND METHODS

This prospective observational study was carried out in the Department of Radiodiagnosis in Sarojini Naidu Medical College , Agra. Our aim was to evaluate the utility of fetal echocardiography as a routine antenatal screening tool for detection of fetal congenital cardiac structural anomalies.It included 500 antenatal women during gestational age of 18-26 weeks who visited Department of Radiodiagnosis and were referred from Antenatal OPD of Obstetrics and Gynaecology in S.N.Medical College , Agra.The study was conducted in 2 years i.e. from October 2020 to September 2022. All the subjects were categorised according to risk factors into two groups – Group I (low risk) and Group II (high risk) groups. Group I included antenatal women having any known risk factors for congenital heart defects which are indications laid down by Pediatric Council of the American Society of Echocardiography9. Group II included antenatal women with no risk factors for congenital heart defects.

Inclusion Criteria -

- Antenatal women who visited Department of Radiodiagnosis and were referred from Antenatal OPD of Obstetrics and Gynaecology of S.N.Medical College, Agra between 18-26 weeks of gestation irrespective of the risk factors.

Exclusion Criteria-

- Refusal to consent.
- Antenatal women with less than < 18 weeks and > 26 weeks of gestational age.

The technique for fetal echocardiography was according to the International society of USG in Obstetrics and Gynecology guidelines for fetal echocardiography[10]. The fetal heart was examined in all the cases.

3. RESULTS

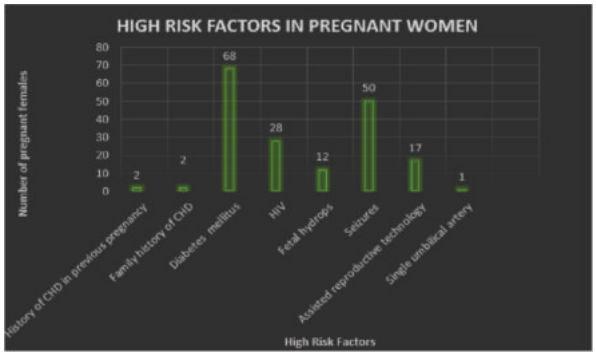
Before conducting the study , the consent of antenatal women and institutional ethical committee were taken. Mean maternal age of Group I was 27.90 yrs while the mean maternal age of Group II was 28.17 yrs. In Group I , majority of the study population constituted 24w-24w+6d who contributed ~20.7 % and in Group II , majority of the study population constituted 23w-23w+6d who contributed ~20.6 %.

Table 1 : Distribution of cases in high risk and low risk groups

	N	%	CSAs	%
HIGH RISK GROUP	180	36	2	28.57
LOW RISK GROUP	320	64	5	71.43
Total	500	100	7	100

Out of 500 cases , 180 cases were under high risk group and 320 cases were under low risk group.Two of the fetal congenital cardiac structural anomalies were detected in high risk group. While five cases of fetal congenital cardiac structural anomalies were detected in low risk group.

Table 2 : Distribution of cases according to high risk factors in pregnant women.



Total 180 pregnant women were under high risk groups out of which maximum number of pregnant women i.e. 68 were diagnosed with diabetes, 50 of pregnant women had seizures, 28 of them had HIV while there was one of single umbilical artery, 2 of them had family history of congenital heart defects and history of congenital heart defects in previous pregnancy.

Table 3 : No. of cases of fetal congenital cardiac structural anomalies diagnosed by fetal echocardiography.

Fetal congenital cardiac structural anomalies Diagnosed	No. of Cases Detected
Ventricular Septal Defect	3
Transposition of great arteries	1
Echogenic cardiac focus	1
Hypoplastic left heart syndrome	1
Left persistent SVC	1
Total	7

Total 7 cases of fetal congenital cardiac structural anomalies were detected. Out of which maximum (3) number of cases detected were of Ventricular septal defects, one each of Transposition of great arteries, echogenic cardiac focus, Hypoplastic left heart syndrome and left persistent SVC were detected through fetal echocardiography.

Table 4 : Distribution of cases of fetal congenital cardiac structural anomalies in high risk and low risk groups

Fetal Congenital Cardiac structural anomalies	HIGH RISK GROUP	LOW RISK GROUP
Ventricular Septal Defect	1	2
Transposition of great arteries	-	1
Echogenic cardiac focus	1	-
Hypoplastic left heart syndrome	-	1
Left persistent SVC	-	1
Total	2	5

One case of Ventricular septal defect was noted in a patient with previous history of congenital heart defects and another of Echogenic cardiac focus was noted in pregestational diabetes. Five of the fetal congenital cardiac structural anomalies cases were of low risk group.

In our study , Disease prevalence was 1.4 % , Sensitivity of fetal echocardiography was ~85.71 % , Specificity was ~ 99.80 % , Accuracy was 99.60 % , Positive predictive value was ~ 85.71 % , Negative predictive value was ~ 99.80 % stating that Fetal Echocardiography is a highly sensitive , specific and accurate screening tool for detection of fetal congenital cardiac structural anomaly.

Fetal congenital cardiac structural anomalies detected in our study-

Figure 1: A 31 yrs old, primigravida presented with gestational diabetes at 24 weeks of gestation , an *echogenic cardiac focus* was present in the left ventricle of the fetal heart.

Figure 2: A 28 yrs old , multigravida presented with weight > 70 kgs at 25 weeks of gestation in which the three vessel view showed *fourth vessel to the left and anterior of pulmonary artery, which was the persistent left SVC. Both Left SVC and Right SVC were present.*

A 27 yrs old , primigravida presented at 24 weeks of gestation with *Hypoplastic left heart syndrome* in the fetal heart. **Figure 3** : shows a small left ventricle with comparatively enlarged right ventricle. **Figure 4:** In a four chamber view, comparatively enlarged atria and right ventricle can be seen.

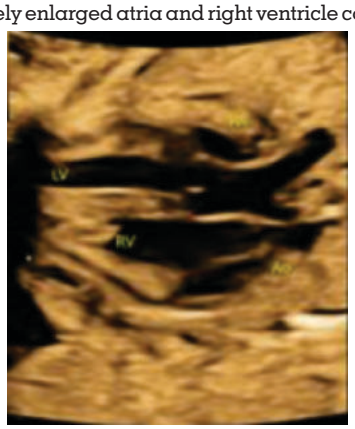


Figure 5: A 28 yrs old, multigravida presented at 24 weeks of gestation with *Transposition of great arteries* in the fetal heart. This figure shows *complete transposition of great arteries,*

with Aorta arising from Right ventricle(RV) and Pulmonary Artery(PA) arising from left ventricle (LV). Pulmonary artery bifurcation was also noted.

Figure 6 : A 31 yrs old , multigravida presented at 25 weeks of gestation. A membranous type *Ventricular septal defect* was noted.

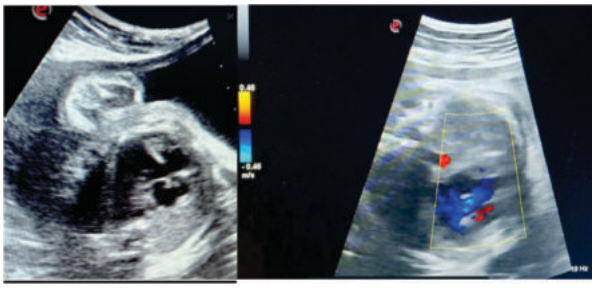


Figure 7 : A 28 yrs old, primigravida with a previous history of fetal congenital cardiac structural anomaly (VSD) presented at 23 weeks of gestation. This figure shows a large sized *membranous type ventricular septal defect*. **Figure 8** shows colour flow through the defect.

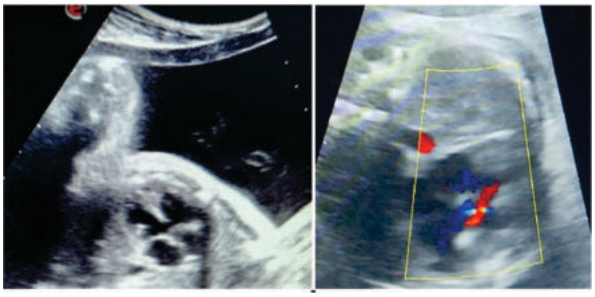


Figure 9: A 27 yrs old , multigravida presented at 26 weeks of gestation.A membranous type *Ventricular septal defect* was noted. **Figure 10** shows colour flow through the defect.

4. CONCLUSION

Fetal echocardiography has opened a new horizon and is considered a highly sensitive and specific tool with strong predictive values for prenatal detection of fetal congenital cardiac structural anomaly. The difference in the incidence of fetal congenital cardiac structural anomalies between the two groups was not significant statistically. As in our study , more cases of fetal congenital cardiac structural anomaly are diagnosed in low risk groups as compared to high risk groups. Based on these findings it is highly suggestive that every pregnant woman should be subjected to atleast one detailed foetal echocardiography as a part of routine antenatal screening irrespective of the risk factors to improve overall survival and longevity of the neonate.

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