

# Short Term Outcome of Children with Antenatally Diagnosed Heart Disease: A Retrospective Single Centre Study

DHEERAJ DEO BHATT<sup>1</sup>, DINESH KUMAR<sup>2</sup>

## ABSTRACT

**Introduction:** The aim of foetal echocardiography is to improve the outcome of fetuses with congenital heart diseases. Impact of foetal echocardiography on the fetuses with antenatally diagnosed heart disease is less studied in public sector hospitals in India.

**Aim:** To evaluate the short term outcome of infants born with antenatally diagnosed heart disease.

**Materials and Methods:** This was a retrospective observational study conducted from April 2016 to June 2019 in a tertiary care public hospital in Northern India. Data was tabulated as mean, frequency and percentages, analysis were done in Microsoft excel 2013. Study included total of 1013 patients who underwent foetal echocardiography during the study period.

**Results:** Heart disease was found in 59 patients after excluding five cases of ductal constriction. Referral for foetal

echocardiography was frequently late. Among the group with abnormal foetal echocardiography, the mean gestational age at the time of diagnosis was 28.4 weeks. Follow-up data was available for 45 patients. A 24.4% (11/45) of those diagnosed with heart disease did not survive till term. 50% (17/34) of those born died before three months of age. Only two neonates underwent surgery before three months of age. Overall, 62.2% did not survive beyond three months of age.

**Conclusion:** It was found that referrals for foetal echocardiography in setting were frequently late. Despite antenatal diagnosis the outcome for fetuses with heart disease was less than optimal. This reflects both the complexity of heart disease as well as lack of paediatric cardiac care to young infants in the setting. Access to high quality cardiac care for infants and neonates are essential for foetal echocardiography to have a meaningful impact on fetuses with heart disease.

**Keywords:** Echocardiography, Foetal, Neonates

## INTRODUCTION

Congenital heart disease is the most common malformation affecting human fetuses. The aim of foetal echocardiography is to identify structural heart disease or rhythm disorders in fetuses in order to improve their outcome. As a result of increasing awareness among physicians as well as patients, greater number of pregnant females are now-a-days undergoing foetal echocardiography. Though the impact of foetal echocardiography on the outcome of infants with congenital heart disease has been well studied in the west, there are only a handful of studies on this topic from India [1-5]. Most of these studies are from private institutions in Kerala, India. There is scarcity of data on this topic from other parts of India, especially from public sector hospitals. Survival of the fetuses with congenital heart disease depends on various factors like presence of extracardiac anomalies, severity of cardiac lesion, socio-economic status, religious/social influence and access to paediatric cardiac care [1-5]. All of these factors may vary in different healthcare settings even within a country. Therefore, there is a need to assess the effect of foetal echocardiography on the outcome of fetuses in other parts of the country.

This study was done to evaluate the outcome of fetuses who were antenatally detected to have heart disease in a public sector hospital in Northern India.

## MATERIALS AND METHODS

This was a retrospective observational study which was conducted in the Department of Paediatrics of a tertiary care public hospital in Northern India from April 2016 to June 2019. Ethical committee clearance and consent was not taken as this was a retrospective review of records of data. **Inclusion and exclusion criteria:** Patients who were referred for foetal echocardiography were included in the study. Patients who had repeat foetal echocardiography during the

period or those undergoing first trimester foetal echocardiography were excluded.

Foetal echocardiography was done on Philips XD 11 E machine with an S 2-5 curvilinear probe. Referred patients were divided into lower and higher risk groups. Lower risk pregnancies were defined as those pregnancies where the risk of the fetus having congenital heart disease was less than 1% as per the American Heart Association (AHA). Higher risk pregnancies were those which had more than 1% risk of having fetuses with heart disease [6]. After echocardiography, parents of fetuses with heart disease were explained about the nature of the cardiac lesion and the possible management options were discussed. They were then sent back to the referring Obstetricians. Children with complex and potentially serious heart disease were advised to conduct delivery of their child at a tertiary care cardiac centre. The actual delivery and postnatal management of these fetuses were done in different public sector hospitals, including our own hospital. All patients were advised postnatal echocardiography for confirmation of diagnosis. Data about the demography, indication, result of foetal echocardiography and outcome was retrieved from records.

## STATISTICAL ANALYSIS

Data was tabulated as mean (standard deviation), percentages and frequencies analysis was done in Microsoft Excel 2013.

## RESULTS

There were a total of 1013 patients who underwent foetal echocardiography from April 2016 to June 2019 in the hospital. The age of mother and gestational age at the time of foetal echocardiography is shown in [Table/Fig-1]. Sixty four fetuses had abnormal findings. After excluding five fetuses with ductal constriction, there were a total of fifty-nine fetuses with structurally abnormal hearts.

Variables	Value
Total number of patients (n)	1013
Average age (SD) (years)	27.3 (4.4)
Average Period of Gestation (SD) (weeks)	26.3 (4.4)
Average age, in those with heart disease (SD) (years)	26.0 (4.3)
Average period of gestation, in those with heart disease (SD) (weeks)	28.5 (5.2)

**[Table/Fig-1]:** Age and period of gestation of patients at the time of foetal echocardiography.

711/1013, (70.2%) of the patients who were referred for foetal echocardiography were at low risk pregnancies while 29.8% were at high risk. The indications for referral and the number of fetuses with structurally abnormal hearts are tabulated in [Table/Fig-2,3].

Referral indication	Number of patients (n)	Patients with heart disease in each group (n)
Maternal diabetes	118	2
Cardiac anomaly in ultrasound	67	51
Extra-cardiac anomaly in ultrasound	37	0
Previous child with heart disease	31	1
Twin pregnancy	29	0
Others	20	0
Total	302	54

**[Table/Fig-2]:** Referral indications and number of patients with heart disease with each indication in high risk patients.

Referral indication	Number of patients (n)	Patients with heart disease in each group (n)
No specific indication	522	5
Echogenic focus	98	2
Drugs during pregnancy	25	1
Bad obstetric history	24	2
IUGR	10	0
Others	32	0
Total	711	10

**[Table/Fig-3]:** Referral indications and number of patients with heart disease with each indication in low risk patients.

IUGR: Intrauterine growth retardation

The indication with the highest yield was abnormal heart seen in level two ultrasound, 76% of those who were referred for foetal echocardiography had structurally abnormal heart. Out of 51 such patients, 34 (66.7%) were referred because of an abnormality seen in the four chamber view and the remaining 17 were referred for an abnormal three vessel view.

Short term outcome data was available for 45 out of 59 patients. [Table/Fig-4] shows the variety of heart diseases diagnosed and their short term outcome till three months. Overall 28/45 (62.2%) of those who were antenatally diagnosed to have heart disease did not survive beyond the first three months.

## DISCUSSION

Ideally, all children with congenital heart diseases, especially the ones requiring intervention in the first few months of life should have an antenatal diagnosis by foetal echocardiography. This will help the parents in planning the pregnancy, place of delivery and arranging the logistics so that the outcome of the foetus is improved.

In this study, the outcome of fetuses who had an antenatal diagnosis of heart disease were studied. The majority of patients were from low socio-economic strata. Delivery and subsequent treatment of fetuses/neonates/infants was done in different public sector hospitals in Delhi.

The ideal timing of foetal echocardiography is 18-22 week as per the AHA guidelines [6]. In the present study, most referrals were

Diagnosis	Number of patients (n)	Died before birth (n)	Total death in three month (n)
VSD	15	0	2
Single ventricle	7	2	5
HLHS	5	2	5
PA IVS	3	0	3
AVSD	3	2	3
TOF	3	1	2
TGA	1	0	1
DORV/Coarctation	2	1	2
Coarctation	1	0	1
Ebstein	1	0	1
DCM	2	2	2
HCM	1	1	1
ccTGA	1	0	0
Total	45	11	28

**[Table/Fig-4]:** Abnormalities detected in foetal echocardiography and their short term outcome.

VSD: Ventricular septal defect; SV: Single ventricle; HLHS: Hypoplastic left heart syndrome; PA IVS: Pulmonary atresia with intact ventricular septum; AVSD: Atrioventricular septal defect; TOF: Tetralogy of Fallot; TGA: Transposition of great arteries; DORV: Double outlet right ventricle; DCM: Dilated cardiomyopathy; HCM: Hypertrophic cardiomyopathy; ccTGA: Congenitally corrected TGA

late. Among those detected to have structural heart disease, the mean gestational age at the time of foetal echocardiography was 28.4 weeks. Thus, most patients with structural heart disease had their antenatal diagnosis well beyond the legal time limit for medical termination of pregnancy. This pattern of late referral has been seen in previous studies from India [7-9].

Most referrals for foetal echocardiography (70.2%) in the present study had lower risk pregnancies. A 1.4% of the lower risk cases had heart disease compared to 16.2% of the higher risk cases. The AHA guideline states that foetal echocardiography is not indicated in those mothers who have lower risk pregnancies, which is defined as those pregnancies with less than 1% risk for heart disease in their foetus. However, in the present study, the majority of the subjects were from this lower risk group. This study reiterates the value of adhering to existing guidelines for referral as there was high yield of heart disease in the higher risk cases only.

Various studies from the west have documented the positive impact of prenatal diagnosis on specific types of heart diseases [10-12]. The heart diseases known to have been positively impacted due to prenatal diagnosis are hypoplastic left heart syndrome, coarctation of aorta, transposition of great arteries and pulmonary atresia. Though one may think that antenatal diagnosis would help the foetus and ensure its survival, it is not always true. In a study published in lancet in 1999, half of the fetuses with antenatally diagnosed heart disease ended in termination of pregnancy in UK [13].

There are a handful of studies from India which have described the postnatal outcome of fetuses with antenatally diagnosed heart disease [Table/Fig-5] [1-5]. Most of these studies are from private tertiary care medical centres from Kerala. There is only one small study on this subject from a public hospital in North India. The patients attending a public sector hospital are generally of low socio-economic status and it is difficult for them to access neonatal cardiac care.

These previous studies show that, there is high rate of foetal loss in pregnancies with antenatally detected heart disease. The percentage of fetuses not surviving till term in previous Indian studies range from 27.8-78.6 [1-5]. In the present study, out of the 45 patients whose follow-up was available 11/45 (24.4%) did not result in live birth. Foetal losses are due to spontaneous abortions,

Author and year of publication	Number of fetuses included	Setting	Percentage not surviving till term	Postnatal outcome (among those born alive)	Percentage undergoing procedures (among those born alive)
Vaidyanathan B et al., [2], 2013	68 (all conotruncal anomalies)	Private tertiary care cardiac centre in Kerala	54.4	17.8% died in neonatal period	17.8%
Changlani TD et al., [1], 2015	552 overall, 121 followed-up	Private tertiary care cardiac centre in Kerala	44.0	14% died in neonatal period.	27.2%
Sharma S et al., [3], 2017	18	Public medical college hospital in Punjab	27.8	15.3% of the 13 live born died in neonatal period	Not available
Devadasan S et al., [4], 2018	290 major congenital heart disease	Private tertiary care cardiac centre in Kerala	78.6	31% of the 62 live born cases died by one year	29% (exact timing not mentioned)
Vaidyanathan B et al., [5], 2020	504 (all univentricular heart)	Private tertiary care cardiac centre in Kerala	54.0	39.5% died at a median follow-up 10 months	16.2% underwent neonatal procedures
Bhatt DD and Kumar D, (Present study), 2021	59 Follow-up data available for 45	Public sector tertiary care centre in Delhi	18.6	50% of 34 live birth died before three months	5.9% underwent neonatal procedures

**[Table/Fig-5]:** Tabulation of data from previous studies from India which have described outcome of fetuses with antenatally detected heart disease.

intrauterine deaths and medical termination of pregnancies. Slightly lesser percentage of foetal loss in present study may be due to the fact that all diagnoses were made after the legal time limit of termination of pregnancy and hence medical termination did not contribute to the foetal losses.

In the present study, out of 34 live births, 17 (50.0%) died before three months of age with neonatal mortality of 41.1%. This was in contrast to previous studies where the mortality rate was lower than present study [1-5]. The percentage of death in the neonatal period in previous studies range from 14-17.8% [1-3]. One previous study has reported a mortality of 31% at one year whereas another has reported 39.5% mortality at a median follow-up of 10 months [4,5].

The poor postnatal outcome in present study reflects the complex nature of heart diseases as well as lack of access to timely cardiac interventional or surgical treatment to neonates and small infants with congenital heart disease. The outcome of neonate with heart disease depends upon a variety of factors including associated diseases, severity of heart disease, parental socio-economic status, access to care, and parental decision to continue cardiac care. In our study, all the parents of the affected newborns had the intention to continue cardiac care.

In the present study, out of the 17 newborn who died, eight were delivered in tertiary care paediatric centre, eight in a tertiary care cardiac centre and one was a home delivery. Out of these 17 infants, two infants with Ventricular Septal Defect (VSD) died of non-cardiac cause. One had birth asphyxia and another had undiagnosed trachea-oesophageal fistula, which was successfully operated. Subsequently, patient developed pneumonia and died due to pneumonia. None of the patients with a diagnosis of hypoplastic left heart syndrome, pulmonary atresia with intact septum, coarctation of aorta, Ebstein's anomaly or transposition of great arteries survived beyond the first month. Out of the 34 live birth with heart disease, 24 required surgical or catheter intervention but only two patients underwent any surgery or intervention in the first three months of life. Both of these were neonatal BT shunt and out of these one survived. This is again in contrast to previous studies from Southern India where higher percentage (16.8-17.2) of newborns with heart diseases underwent interventions [1,2,5].

In the present setting, despite prenatal diagnosis, the outcome of fetuses which require early intervention is suboptimal due to complexity of diseases and lack of access to timely intervention. Only one public sector hospital in Delhi is routinely doing cardiac surgical or interventional treatment in neonates and small infants, more such centres are needed. Many private institutions are providing neonatal cardiac care but access to such care for people from low socio-economic status needs to be improved. Kerala has successfully implemented a program called Hridayam

for children with heart disease. A web based registry was used to allocate children with heart disease to various public and private institutes for treatment according to the clinical priority [14]. Similar government program is needed in other parts of the country to improve the outcome of fetuses with antenatally detected heart disease.

### Limitation(s)

The limitation of this study was the small size, retrospective nature of the study and loss to follow-up of study subjects.

### CONCLUSION(S)

It is concluded from present study that, the referral for foetal echocardiography is frequently delayed and majority of referrals are of low risk cases. Earlier and more selective referral for foetal echocardiography is desirable. This will give the parents of fetuses with serious congenital heart disease adequate time to decide about continuing pregnancy versus opting for medical termination of pregnancy. In this study, the outcome of children with antenatally diagnosed heart disease was less than optimal. Infrastructure and manpower in public sector hospitals should be developed in order to cater to the children requiring intervention in neonatal and early infancy. Government health schemes should be designed such that timely intervention of neonates with heart disease is possible in both public and private sector hospitals.

### REFERENCES

- Changlani TD, Jose A, Sudhakar A, Rojal R, Kunjikutty R, Vaidyanathan B. Outcomes of infants with prenatally diagnosed congenital heart disease delivered in a tertiary-care paediatric cardiac facility. *Indian Paediatr.* 2015;52(10):852-56.
- Vaidyanathan B, Kumar S, Sudhakar A, Kumar RK. Conotruncal anomalies in the foetus: Referral patterns and pregnancy outcomes in a dedicated foetal cardiology unit in South India. *Annals of Paediatric Cardiology.* 2013;6(1):15-20.
- Sharma S, Kaur N, Kaur K, Naveen NC. Role of echocardiography in prenatal screening of congenital heart diseases and its correlation with postnatal outcome. *J Clin Diag Res.* 2017;11(4):12-14.
- Devadasan S, Balakrishnan B, Batra M, Sreeja P, Swapneel NP, Gopinathan K. Trends and outcomes after prenatal diagnosis of congenital cardiac defects: Experience of a dedicated fetal medicine centre from south India. *Journal of Fetal Medicine.* 2018;5:225-31.
- Vaidyanathan B, Vijayaraghavan A, Thomas S, Sudhakar A. Pregnancy and early post-natal outcomes of fetuses with functionally univentricular heart in a low-and-middle-income country. *Cardiol Young.* 2020;30(12):1844-50.
- Donofrio MT, Moon-Grady AJ, Hornberger LK, Copel JA, Sklansky MS, Abuhamad A, et al. Diagnosis and treatment of foetal cardiac disease: A scientific statement from the American Heart Association. American Heart Association Adults With Congenital Heart Disease Joint Committee of the Council on Cardiovascular Disease in the Young and Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and Council on Cardiovascular and Stroke Nursing. *Circulation.* 2014;129(21):2183-242.
- Chitra N, Vijayalakshmi IB. Foetal echocardiography for early detection of congenital heart diseases. *J Echocardiogr.* 2017;15(1):13-17.
- Nair A, Radhakrishnan S. Evaluation of referral pattern for fetal echocardiography at a tertiary care center in northern India and its implications. *J Obstet Gynaecol India.* 2016;66(Suppl 1):258-62.

- [9] Saxena A, Shrivastava S, Kothari SS. Value of antenatal echocardiography in high risk patients to diagnose congenital cardiac defects in foetus. Indian J Paediatr. 1995;62(5):575-82.
- [10] Tworetzky W, McElhinney DB, Reddy VM, Brook MM, Hanley FL, Silverman NH. Improved surgical outcome after fetal diagnosis of hypoplastic left heart syndrome. Circulation. 2001;103(9):1269-73.
- [11] Bonnet D, Coltri A, Butera G, Fermont L, Le Bidois J, Kachaner J, et al. Detection of transposition of the great arteries in fetuses reduces neonatal morbidity and mortality. Circulation. 1999;99(7):916-18.
- [12] Franklin O, Burch M, Manning N, Sleeman K, Gould S, Archer N. Prenatal diagnosis of coarctation of the aorta improves survival and reduces morbidity. Heart. 2002;87(1):67-69.
- [13] Bull C. Current and potential impact of foetal diagnosis on prevalence and spectrum of serious congenital heart disease at term in the UK. British Paediatric Cardiac Association. Lancet. 1999;354(9186):1242-47.
- [14] A based registry [Internet] [Last accessed on 2021 Jan 21]. Available from: <https://hridayam.in>.

**PARTICULARS OF CONTRIBUTORS:**

1. Associate Professor, Department of Paediatrics, ABVIMS and Dr RML Hospital, Delhi, India.
2. Professor, Department of Paediatrics, ABVIMS and Dr RML Hospital, Delhi, India.

**NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:**

Dr. Dheeraj Deo Bhatt,  
D6/99, Kaveri Apartment, Vasant Kunj, Delhi, India.  
E-mail: [dheeraj491@hotmail.com](mailto:dheeraj491@hotmail.com)

**PLAGIARISM CHECKING METHODS:** [\[Jain H et al.\]](#)

- Plagiarism X-checker: Nov 30, 2020
- Manual Googling: Jan 02, 2021
- iThenticate Software: Jan 06, 2021 (5%)

**ETYMOLOGY:** Author Origin**AUTHOR DECLARATION:**

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? No
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Nov 22, 2020**Date of Peer Review: **Dec 14, 2020**Date of Acceptance: **Jan 06, 2021**Date of Publishing: **Feb 01, 2021**