ISSN: 0975-1556

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2021; 13(4);473-479
Original Research Article

# A Cross-sectional Study to Determine the Echocardiographic and Radiological Profiles of Children with Clinically Confirmed Congenital Heart Disease

**Rizwan Haider[1], MD Rakif Raza[2], Subhrajyoti Tripathy[3]**

**[1]Associate Professor, Department of Pediatrics, Darbhanga medical college and Hospital, Laheriasarai, Darbhanga, Bihar, India**

**[2]PG Student, Department of Pediatrics, Darbhanga medical college and Hospital, Laheriasarai, Darbhanga, Bihar, India**

**[3]PG Student, Department of Pediatrics, Darbhanga medical college and Hospital, Laheriasarai, Darbhanga, Bihar, India**

**Received: 08-07-2021 / Revised: 20-07-2021 / Accepted: 25-08-2021**
**Corresponding author: Dr. Rizwan Haider**
**Conflict of interest: Nil**

**Abstract**

**Aim:** The aim of this study evaluates the echocardiographic and radiological profile of clinically diagnosed congenital heart disease in children

**Methods:** The Prospective, Observational study was conducted in the Department of Pediatrics, Darbhanga medical college and Hospital, Laheriasarai, Darbhanga, Bihar, India, for 15 months. 100 Children up to 12 years of age with clinically suspected cases of CHD were included in this study. All children up to 12years of age with complaints of recurrent chest infection, respiratory distress, cyanotic spells, squatting episodes, poor feeding, failure to thrive and other relevant history and examination findings suggestive of CHD were included in this study. Informed consent was taken from parents or caregivers.

**Results:** Out of 4700 patients (both IPD and OPD) 115 patients were found to have CHDs and the hospital incidence of CHD is 2.45%. Cough (81%) and breathlessness (66%) were major symptoms. Acyanotic CHD comprises 69% of total cases. Cardiomegaly 74%and hypertrophy 52% were major findings. Echo also suggested ACHD in 63% of cases.

**Conclusion:** The most common presenting symptoms in CHD were cough and breathlessness. Chest X-ray is important corroborative evidence in the diagnosis of CHD and was abnormal in 80% of cases with the presence of cardiomegaly in 74% of all cases.

**Keywords:** CHD, cardiomegaly, Echo



## Introduction

The term congenital is derived from the latin word ('con' means together and'genitus' meaning born) referring to 'present at birth'.[1]

Congenital heart disease (CHD) is defined as an abnormality in 'cardiocirculatory' structure or function that is present since birth, even though it may be discovered later. CHD remains the leading cause of death in children with malformation. Incidence being 8 CHD's per 1000 live births[2] and is the most common severe congenital abnormality. A given malformation may exist in relative harmony

with the fetal circulation, only to be modified considerably at least physiologically by the dramatic circulatory adjustments at birth. Further, weeks, months or years may elapse before the anomaly reveals itself as 'typical'. Thus, congenital heart defects are not only a fixed anatomic abnormality that appear at birth but instead are dynamic anomalies that originate in the early embryo, evolve during the course of extra uterine life.

Today we have come a long way and are very fortunate compared to our early twentieth century colleagues in that their statements of 'wisdom' then may seem tobe 'ridiculous' today. With the currently available treatment modalities over 75% of infants born with critical heart disease can survive beyond the first year of life and many can lead a near normal life thereafter. Never before has so much significance been attached to an early establishment of the disease than is now, because with newer treatment modalities becoming available, hence making it all the more important to establish an early diagnosis to significantly decrease the morbidity and mortality associated with CHD. A predisposing factor for recurrent respiratory tract infections is congenital heart disease which causes increased pulmonary blood flow. Ventricular Septal Defect (VSD), Atrial Septal Defect (ASD), Patent Ductus Arteriosus (PDA) are typical acyanotic congenital heart disease predisposed to recurrent respiratory tract infections in childhood. Shunting from left to right induces increased flow of pulmonary blood and pulmonary oedema. Pulmonary oedema progresses to congestive heart failure and becomes a nidus for lower respiratory tract infection. Pneumonia and congestive cardiac failure may be the early symptoms of congenital heart disease underlying it. The age at which symptoms begin in children with congenital heart disease depends on the severity of the defects. Large-scale ventricular septal defects and patent ductus arteriosus arise early and have more serious diseases resulting in CCF.3 It has been documented that the mortality rate caused by uncontrolled heart failure in children with CHD and pneumonia receiving conservative medical care is 11.9 % to 56 %. Controversial care for children with left to right shunt CHD concomitant with chronic pneumonia is still present. Increased pulmonary blood flow, pulmonary arterial pressure, right ventricle afterload, and cardiac dilatation increase the probability of pulmonary congestion, and with imperfect development of immune system function, the infants are more susceptible to pneumonia.[3]

These infants generally manifest with recurrent pneumonia, will be less responsive to medical therapy alone, and have recurrent pulmonary infections that will be difficult to eradicate. Pneumonia is difficult to treat, or may progress into serious pneumonia, and then heart and respiratory failure will occur. Assessment of cardiac function in children with CCF is based on electrocardiogram, ultrasonic cardiogram, and clinical data that is not precise. CCF's clinical characteristics include weight gain or oedema, dysphoria, cyanosis, poor reaction, light skin and milk intake reduction. All those features can be used to diagnose CCF early. These symptoms can also be seen in children with CHD, however. Thus, these clinical results were not unique to CCF and inadequate for correct diagnosis. Increased heart rate, pneumonia, or infection of the respiratory tract which often accompanies CHD can induce CCF. Although many studies have shown that there is increased risk of bronchopneumonia in children suffering from CHD, studies looking at the pattern of CHDs presenting as bronchopneumonia have not been completely available. Through this prospective cohort study, we would like to look into the pattern of CHDs presenting as bronchopneumonia. We will also get additional information about the subpopulation of CHDs landing in congestive cardiac failure or those

associated with high mortality or morbidity.[4,6]

## Material and methods

The Prospective, Observational study was conducted in the Department of Pediatrics, Darbhanga medical college and Hospital, Laheriasarai, Darbhanga, Bihar, India, for 15 months,

100 Children up to 12 years of age with clinically suspected cases of CHD were included in this study.

Patients with acquired heart disease and established cases of congenital heart disease were excluded front this study.

## Data Collection

All children up to 12 years of age with complaints of recurrent chest infection, respiratory distress, cyanotic spells, squatting episodes, poor feeding, failure to thrive and other relevant history and examination findings suggestive of CHD were included in this study.

Out of 4700 patients (both IPD and OPD) 115 patients were found to have CHDs. They underwent Chest X-ray and Electrocardiogram. The final diagnosis was confirmed by Echocardiography. Clinical diagnosis of the suspected CHD was then correlated with X-ray findings and Echocardiography.

## Statistical analysis

Data were entered into a Microsoft Excel datasheet and was analyzed using SPSS 25.0 version software. P-value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

## Results

**Table 1: Hospital incidence of CHD during the study period**

| | |
|---|---|
| Total admission during the study period | 4700 |
| Total CHDS during the study period | 115 |
| CHDs was taken into the study during the study period | 100 |
| Percentage of CHD in the study | 2.45 |

Table- 1 Shows that out of 4700 patients admitted 115 patients were found to have CHDs and the hospital incidence of CHD is 2.45%.

**Table 2: Distribution of CHD by mode of presentation clinically**

| Mode of presentation | No cases of CHD | Percentage |
|---|---|---|
| Breathlessness | 66 | 66 |
| Chest pain | 14 | 14 |
| Cough | 81 | 81 |
| Cyanosis | 29 | 29 |
| Fever | 43 | 43 |
| Chest pain | 38 | 38 |
| Feeding difficulties | 43 | 43 |
| FTT PEM Malnutrition | 55 | 55 |
| Palpitation | 10 | 10 |
| Fatigue | 8 | 8 |
| Suck rest suck cycle | 8 | 8 |
| Forehead sweating | 28 | 28 |

Table 2 depicts that cough (81%) and breathlessness (66%) were major symptoms.

**Table 3: Distribution of CHD cases by Clinical Diagnosis**

| Type Of CHD | No of cases | Percentage |
|---|---|---|
| CCHD | 31 | 31 |
| ACHD | 69 | 69 |
| Total | 100 | 100 |

Acyanotic CHD comprises 69% of total cases.

**Table 4: Distribution of CHD cases by Chest X-ray findings**

| Chest x-ray findings | No of cases | Percent |
|---|---|---|
| Cardiomegaly | 74 | 74 |
| Increased pulmonary vascular marking | 42 | 42 |
| Decreased pulmonary vascular markings | 34 | 34 |
| RVH/LVH | 52 | 52 |
| Pneumonia | 16 | 16 |

As per the table4. Cardiomegaly 74%and hypertrophy 52% were major findings.

**Table 5: Correlation of Clinical features with Chest X-ray**

| Correlation present or absent | No of CHD cases | Percentage |
|---|---|---|
| Correlating | 80 | 80 |
| Not Correlating | 20 | 20 |
| Total | 100 | 100 |

Echo also suggested ACHD in 63% of cases.

**Table 6: Correlation of Clinical diagnosis of total CHD with ECHO findings**

| Correlation with ECHO | No of CHD cases | Percentage |
|---|---|---|
| Not Correlating | 20 | 20 |
| Correlating | 80 | 80 |
| Total | 100 | 100 |

## Discussion

The term congenital is derived from the Latin word ('con' means together and'genitus' meaning born) referring to 'present at birth'. Congenital heart disease (CHD) is defined as an abnormality in 'cardiocirculatory' structure or function that is present since birth, even though it may be discovered later.[7] Thomas Bevill Peacock was a physician who practised in the 1800s at St Thomas' Hospital in London. He was the first to classify CHD into 4 categories: misplacements of the heart, pericardial abnormalities, cardiac malformations, and irregularities of the primary vessels. Peacock wrote about the causes of CHD, attributing most forms to abnormalities in embryonic development, particularly growth arrest[8]

The estimated birth prevalence of CHD is 8/1000 live births with a significant geographical difference. A recent systemic review reported the highest prevalence (9.3/1000 live births) in Asia due to the high birth rate and consanguineous marriages and the lowest prevalence in Africa (8.2/1000 live births). In India, over 180,000 children are born with CHD every year with state-wise variation and contribute to 10% of the present infant mortality. Nearly one- third of the CHD is critical, requiring intervention in the 1st year of life. Most of the CHD is thought to be multifactorial and result from a combination of genetic and environmental insult.[9] Fetal echocardiography can make a more accurate diagnosis of CHD even before birth With currently available

treatment modalities over 74% of infants born with critical heart disease can survive beyond the first year of life and many can lead a normal life thereafter.[10] Cardiogenesis begins on the 18th day of life with the formation of the carcinogenic crescent of the precardiac mesoderm and normally is completed by the 45th day of life with the formation of the membranous part of the ventricular septum. Cardiovascular maturation continues well after birth[11]

The main differences between the fetal and postnatal circulation are a) Presence of placental circulation, which provides a gas exchange for the fetus. The absence of gas exchange in the collapsed lungs results in very little flow of blood to the lungs and thus little pulmonary venous return to the left atrium

Presence of ductus venosus, joining the portal vein with the inferior vena cava, providing a low, resistance bypass for umbilical venous blood to reach the inferior vena Widely open foramen ovale to enable oxygenated blood (through umbilical veins) to reach the left atrium and ventricle for distribution to the coronaries and the brain; and lastly and Wide-open ductus arteriosus to allow right ventricular blood to reach the descending aorta, since lungs are non-functioning.[12]

The sudden expansion of lungs with the first few breaths causes a fall in pulmonary vascular resistance and an increased flow into the pulmonary trunk and arteries. The pulmonary artery pressure falls due to the lowering of pulmonary vascular resistance. The pressure relations between the aorta and pulmonary trunk are reversed so that the flow through the ductus is reversed. Instead of blood flowing from the pulmonary artery to the aorta, the direction of flow through the ductus, is from the aorta to the pulmonary trunk.[13]

The relative frequency of the most common lesions varies but nine common lesions form 81% of CHD. These are VSD (37%), ASD (6%), patent arterial duct (10%), atrioventricular septal defect (AVSD) (5%), pulmonary stenosis (PS) (10%), AS (6%), coarctation of aorta (6%), transposition of great arteries (5%), and TOF (5%). The other 20% of CHD consists of many rare or complex lesions.[14]

Breathlessness, chest retractions, FTT, feeding difficulty, cyanosis were the common clinical presentations in congenital heart disease. CHD should be suspected in all cases of recurrent chest infections and failure to thrive. A high index of suspicion, a detailed history, physical examination, chest x-ray, electrocardiogram along Echocardiography helps us to diagnose most of the congenital heart disease. With limited resources, clinical acumen forms the backbone for diagnosis for CHD. Early detection and intervention reduce the morbidity and mortality of CHD.[15] In our study out of 4700 patients (both OPD and IPD) 115 patients were found to have CHDs and the hospital incidence of CHD is 2.45%. This is comparable with other studies by Rakshit Reddy et al where incidence was found to be 1.85 %.[7] In a study done by Shymsundar incidence was 2.1 %[16] and 2.5 % in a study done by A. Saxena et al.[17]

In our study in clinical features, breathlessness was the commonest and it was in 66% followed by cough in 81% and fever in 43 % of cases whereas in a study done by Karthigaet al the incidence of breathlessness, cough and fever were present in 72%, 70% and 60% repectively.[18] and in a study done by Rakshith et al it was 68 %, 64 % and 58 % respectively.[7] In our study the distribution of CHD cases by clinical diagnosis was 69% for ACHD and 31 % for CCHD cases. In a study done by Chandra SekharKondapalli it was 85% for ACHD and 15 % for CCHD.[19]

In a study done by Rakshit Reddy et al it was 82 % for ACHD and 18 % for CCHD[7]In our study as per the chest x-ray findings following were there Cardiomegaly, Increased pulmonary

vascular markings (Pulmonary plethora), Decreased Pulmonary vascular markings (Pulmonary oligemia), RVH/LVH, Pneumonia in 74%, 42%, 34% 52% and 16% respectively. In a study done by Chandra SekharKondapalli incidence was 78%, 47%, 20% and 10 % respectively.[18] whereas in a study done by Laya B et al it was 65%, 25%, 10% and 30% respectively.[20] In our study the correlation of clinical profile with chest x-ray was 80%. In a study done by Chandra SekharKondapalli it was 80%[19] and in a study done by Akbar et al 3 it was 63%[21] and in a study done by Laya et al it was 71%.[20] In all these studies clinical diagnosis is strongly correlated and supported by chest x-ray findings. In our study the clinical diagnosis correlating with echo was 81%. In a study done by Mir D et al the incidence was found to be the same 69% fully correlating and 19% partially correlating and in a study done by Rakshith Reddy et al full correlation was seen in 73 % and partial correlation in 14 %.[7] In a study by Swenson et al and Klewer et al the clinic echo correlations were 82 % and 81 % respectively.[22,23]

## Conclusion

The most common presenting symptoms in CHD was cough and breathlessness. Chest X-ray is important corroborative evidence in the diagnosis of CHD and was abnormal in 80% of cases with the presence of Cardiomegaly in 74% of all cases. Properly carried out the clinical examination, Chest X-ray and ECHO evaluation are important tools in arriving at a near accurate diagnosis in CHD, however before undertaking surgical intervention echocardiographic confirmation of the diagnosis is required.

## Reference


1. Webb GD, Smallhorn JF, Therrein J. 'congenital heart disease' In: Zipes, Libby, Bonow, Braunwald, editors. Braunwalds Heart Disease, 7th Edition, Philadelphia: Saunders 2005: 1489-1547.
2. Bernstein D. Congenital heart disease. Behrman, Kleigman, Jenson, editors. Nelson Textbook of Pediatrics, 17th Ed, Philadelphia: Saunders, 2004: 1499-1502
3. Hoving PMF, Brand PLP. Causes of recurrent pneumonia in children in a general hospital. J Paediatr Child Health 2013;49(3):208-212.
4. Sadoh WE, Sadoh AE. Serum zinc values in children with congenital heart disease. Afr Health Sci 2013;13(3):601-606.
5. Saleh HK. Pattern of congenital heart disease in Southern Yemeni children referred for echocardiography. Saudi Med J 2009;30(6):824-828.
6. Sahan YO, Kilicoglu E, Tutar ZU. Evaluation of children with congenital heart disease hospitalized with the diagnosis of lower respiratory tract infection. The Journal of Pediatric Research 2018;5(1):32-36.
7. Reddy Rakshit, Amar Taksande. "Clinical Profile of Congenital Heart Disease in a Tertiary Care Hospital in Central India". Journal of Datta Meghe Institute of Medical Sciences University. 11;81-86.
8. Gelb BD. History of Our Understanding of the Causes of Congenital Heart Disease. Circ Cardiovasc Genet. 2015;8(3)529-36.
9. Meshram, Rajkumar Motiram, and Vishal Shankarrao Gajimwar. "Prevalence, profile, and pattern of congenital heart disease in Central India- A prospective, observational study". Nigerian Journal of Cardiology.2018;15(1):45.
10. Hag AI. Pattern of congenital heart disease in Sudanese children. East Afr Med J. 1994 ;71(9)580-6.
11. Schoenwolf G C, Bleyl S B, Brauer P R, Francis- West P H. Larsen's human embryology E-book. Elsevier. (2020).
12. Morton SU, Brodsky D. Fetal Physiology and the Transition to

Extrauterine Life. Clin Perinatol. 2016;43(3)395-407.
13. Kiserud T, Acharya G. The fetal circulation. Prenat Diagn. 2004 30;24(13)1049-59.
14. Karthiga S, Shweta Pathak, and Monica Lazarus. "Clinical and anthropometric profile of congenital heart disease in children admitted in pediatric ward". International Journal Of Scientific Study.2017;5(5):112-117.
15. S A. Study of Signs, Symptoms and Investigations of Congenital Heart Disease in A Teaching Hospital. Journal Of Medical Science and Clinical Research. 2017;05(05);21801-21805.
16. Shyamsunder D. Clinical Profile of Congenital Heart Disease in RIMS Hospital. Journal Of Medical Science and Clinical Research. 2018;6(12).
17. Karthiga S, Shweta Pathak, and Monica Lazarus. Clinical and anthropometric profile of congenital heart disease in children admitted in pediatric ward. International Journal of Scientific Study.2017;5(5):112-7.
18. Kondapalli C, Gondi K, Madana S. Evaluation of congenital heart disease clinically and by echocardiography in children of age group 0-12 years. International Journal Of Contemporary Pediatrics. 2019;6(2)507.
19. Saxena A. Congenital Heart Disease in India- A Status Report. Indian Pediatr. 2018 ;15;55(12)1075-1082.
20. Molaie A, Abdinia B, Zakeri R, Talei A. Diagnostic value of chest radiography in pediatric cardiovascular diseases- A retrospective study in Tabriz, Northwest of Iran. International Journal of Pediatrics.2015; 32(1):9-13
21. Laya BF, Goske MJ, Morrison S, Reid JR, Swischuck L, Ey EH, et al. The accuracy of chest radiographs in the detection of congenital heart disease and in the diagnosis of specific congenital cardiac lesions. Pediatr Radiol. 2006 ;36(7)677- 81.
22. Swenson, Jeanine M, et al. "Are chest radiographs and electrocardiograms still valuable in evaluating new pediatric patients with heart murmurs or chest pain?". Pediatrics.1997; 99;1:1-3;3.
23. Klewer SE, Samson RA, Donnerstein RL, Lax D, Zamora R, Goldberg SJ. Comparison of accuracy of diagnosis of congenital heart disease by history and physical examination versus echocardiography. Am J Cardiol. 2002 Jun 1;89(11)1329-31.