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Research Article

# Variable Prevalence of Congenital Heart Disease in Indian Scenario

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**2. Key words**

Cyanotic heart disease; Prevalence; India

## 1. Abstract

**1.1. Background:** Changing pattern and incidence of Congenital Heart Diseases (CHD) have been observed in various geographical locations.

**1.2. Aim:** To study the frequency, age-wise distribution, and spectrum of Congenital Heart Diseases (CHD) at a tertiary health care center in Ajmer, Rajasthan.

**1.3. Methods:** A retrospective analysis of case records of 8,641 patients in the age group of 0-18 years from January 2008 to July 2017 was done to ascertain the spectrum and distribution of CHDs. Clinical examination, electrocardiography, chest X ray and transthoracic echocardiography were used as diagnostic tools.

**1.4. Results:** Out of 8,641 patients, 2052 (23.75%) were found to have CHD. Male preponderance was observed (M/F ratio = 1.43). Study group comprised of 12.62% neonates, 39.38 % infants and 47.81% of more than 1-year age. 1742 (84.89%) were acyanotic, and 310 (15.11%) suffered from cyanotic heart disease. Among the a cyanotic heart diseases ventricular septal defect (VSD) was the most frequent lesion seen in 700 (40.18%), followed by atrial septal defect (ASD) in 370 (21.24%) children. Among the cyanotic heart diseases Tetralogy of Fallot (TOF) was the most frequent cyanotic heart disease seen in 196 (63.23%) patients.

**1.5. Conclusion:** The frequency of CHD at a tertiary care center in western India was 23.75 percent. VSD was the most common acyanotic while TOF was the commonest cyanotic CHD observed. TTE plays a major role in the diagnosis of CHD. When clinical evidences lead to suspicion of CHD, an echocardiography should be performed.

## 3. Introduction

Congenital heart disease, was defined by Mitchell et al as “a gross structural abnormality of the heart or intra thoracic great vessels that is actually or potentially of functional significance” [1]. It has been reported that CHD spectra differ according to geographical location [2]. According to a status report on CHD in India, 10% of the present infant mortality may be accounted for by CHD [3]. In community based studies from India the prevalence of CHD is not uniform across the country and ranges from 0.8 – 5.2/1000 patients [4,5]. Prevalence of CHDs in Chandigarh 5%, Punjab 3% and South India 2.5% are higher than other parts of the world [6-8]. Prevalence studies of congenital cardiac disease are necessary to establish baseline rates, and geographical trends that may help to raise the awareness of early medical and surgical intervention. It is critical in understanding the social and economic burdens placed on the patients and their families, demands placed on the health care system and health planning. Two-dimensional echocardiography with color Doppler has revolutionized the diagnosis and management of cardiac malformations. We conducted this study to assess the prevalence of CHD among patients attending a tertiary care center in western India.

## 4. Materials and Methods

A retrospective analysis of case records of 8,641 patients in the age group of 0-18 years from January 2008 to July 2017 was done to ascertain the spectrum and distribution of CHDs.

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### 4.1. Inclusion Criteria

Any patient having the signs and symptoms like shortness of breath, difficulty in feeding, excessive sweating, bluish discoloration of lips and tongue, failure to thrive, clubbing, palpitation, feeling of impending doom, fainting, light headedness, rapid breathing, discrepancy in pulse, cyanosis, heart murmur, abnormal chest X-ray, or strong family history, recurrent chest infections, high blood pressure, swelling of abdomen and feet, chest and abdomen pain, and arrhythmias and loss of consciousness, etc. were evaluated further and those suspected of cardiac disease were subjected for chest X-ray, electrocardiogram (ECG), followed by echocardiography.

### 4.2. Exclusion criteria

Neonates less than 2 weeks of age with diagnosis of PDA, known CHD patients presenting on follow up visits were excluded.

### 4.3. Methods

A thorough clinical history and examination was carried out. Those with history, symptoms or signs of heart disease were further evaluated with12 lead electrocardiography, chest X- ray and diagnosis was confirmed by Transthoracic 2D Echocardiography (TTE) (**Table 1**).

**Table 1:**Overall distribution of isolated congenital heart defects

| Congenital heart defects | Total number (%) |
|---|---|
| VSD (ventricular septal defect) | 700 (34.11) |
| ASD (Atrial septal defect) | 370 (18.03) |
| TOF (Tetralogy of fallot) | 196 (9.55) |
| PDA (Patent ductus arteriosus) | 163 (7.94) |
| PS (Pulmonary stenosis) | 134 (6.53) |
| PFO (Patent foramen ovale) | 120 (5.85) |
| MVP (Mitral valve prolapse) | 102 (4.97) |
| AS (Aortic stenosis) | 33 (1.61) |
| MALPOSITION | 32 (1.56) |
| TGA (Transposition of great arteries) | 32 (1.56) |
| BAV (Bicuspid aortic valve) | 28 (1.36) |
| AVSD (Atrioventricular septal defects) | 20 (0.97) |
| DORV (Double outlet right ventricle) | 18 (0.88) |
| TA (Tricuspid atresia) | 14 (0.68) |
| LVNC (Left ventricular non compaction) | 14 (0.68) |
| HCM (Hypertrophic cardiomyopathy) | 10 (0.49) |
| SV (Single ventricle) | 10 (0.49) |
| PA (Pulmonary atresia) | 8 (0.39) |
| SA (Single atrium) | 6 (0.29) |
| Ebstein's anomaly | 6 (0.29) |
| COA (Coarctation of aorta) | 6 (0.29) |
| RSOV (Rupture of sinus of valsalva) | 4 (0.19) |
| IAA (Interrupted aortic arch) | 2 (0.10) |
| COR T (Cor triatriatum) | 2 (0.10) |

Echocardiography was performed by senior cardiologists twice in a week, except in emergency situations. Echocardiography was done as per standards laid down by the American Society of Echocardiography [8], using the M-mode, two-dimensional and color Doppler, pulse and continuous wave echocardiogram. TTE was done in sub costal, Apical four chamber, Apical two chamber, Apical long axis, Parasternal long axis, Parasternal short axis (at various level of left ventricle like: basal, mid cavity or at level of papillary level and apical part), parasternal high short axis (at aortic valve, pulmonary valve level) and suprasternal view. The following age groups were considered: Newborns (1-30 days), infants (1-12 months), children and adolescents (>1-18years). Written consent was obtained from parents and/or attendants from all enrolled patients following all ethical commitments. The data was entered in to a Microsoft office excel spread sheet and analyzed.

## 5. Results

During the study period of 6.5 years, a total of 11,912 patients were screened and TTE was performed on 8,641 patients. 3942 patients were found to have CHD. 214 neonates with PDA aged less than 2weeks and were excluded. 1676 patients were excluded as they came on follow up visits after initial diagnosis of CHD. 2052 (23.75%) patients with CHD fulfilled the study criteria and were included in the study. Study group comprised of 12.62% neonates (n=259), 39.38 % infants (n=808) and 47.81% of more than 1-year age (n=985).CHD was more common in males in our study (male to female ratio = 1.43). PDA, MVP, bicuspid aortic valve and pulmonary atresia were more common in females. Rupture of sinus of Valsalva (RSOV), double outlet right ventricle (DORV) and tricuspid atresia had no gender preponderance. Rest of the CHDs were more common in males (**Table 3**).1742 (84.89%) patients were acyanotic while 310 (15.11%) patients suffered from cyanotic heart disease. Among the acyanotic heart diseases isolated ventricular septal defect (VSD) was the most frequent lesion seen in 700 (40.18%), followed by isolated atrial septal defect (ASD) in 370 (21.24%) children (**Table 2**). Among the cyanotic heart diseases tetralogy of Fallot (TOF) was the most frequent cyanotic heart disease seen in 196 (63.23%) patients followed by transposition of great arteries in 32 (10.32%) patients. Most common symptom was dyspnea (55.56%) followed by recurrent lower respiratory tract infections (42.54%) and failure to thrive (27.39%). 230 (11.21%) patients were asymptomatic and were evaluated on ground of cardiac murmurs (**Table-4**).

**Table 2:**Overall distribution of acyanotic congenital heart diseases

| Acyanotic CHD | Totalnumber (%) |
|---|---|
| VSD | 700 (40.18) |
| ASD | 370 (21.24) |
| PDA | 163 (9.36) |
| PS | 134 (7.69) |
| PFO | 120 (6.89) |
| MVP | 102 (5.86) |
| AS | 33 (1.89) |
| MALPOSITION | 32 (1.84) |
| BAV | 28 (1.61) |
| LVNC | 14 (0.80) |
| HCM | 10 (0.57) |
| COA | 6 (0.34) |
| RSOV | 4 (0.23) |
| IAA | 2 (0.11) |

**Table 3:** Overall distribution of congenital heart diseases including multiple congenital cardiac defects

| LESION | TOTAL | MALE | FEMALE | % |
|---|---|---|---|---|
| VSD | 1002 | 589 | 413 | 48.83% |
| ASD | 650 | 364 | 286 | 31.68 |
| PDA | 293 | 141 | 152 | 14.28 |
| PS | 274 | 178 | 96 | 13.35 |
| TOF | 202 | 122 | 80 | 9.84 |
| PFO | 174 | 109 | 65 | 8.48 |
| MVP | 106 | 42 | 64 | 5.17 |
| AS | 45 | 35 | 10 | 2.19 |
| MALPOSITION | 42 | 30 | 12 | 2.05 |
| TGA | 36 | 25 | 11 | 1.75 |
| BAV | 36 | 8 | 28 | 1.75 |
| LVNC | 20 | 14 | 6 | 0.97 |
| AVSD | 18 | 13 | 5 | 0.88 |
| DORV | 18 | 9 | 9 | 0.88 |
| TA | 16 | 8 | 8 | 0.78 |
| SV | 14 | 8 | 6 | 0.68 |
| PA | 12 | 3 | 9 | 0.58 |
| HCM | 10 | 10 | 0 | 0.49 |
| COA | 8 | 6 | 2 | 0.39 |
| EBSTEIN | 6 | 4 | 2 | 0.29 |
| SA | 6 | 2 | 4 | 0.29 |
| RSOV | 4 | 2 | 2 | 0.19 |
| IAA | 2 | 2 | 0 | 0.10 |
| COR T | 2 | 2 | 0 | 0.10 |

**Table 4:** Symptomatology of CHDs

| Symptoms | Number (%) |
|---|---|
| Dyspnea | 1140 (55.56) |
| LRTI | 873 (42.54) |
| FTT | 562 (27.39) |
| Cyanosis | 310 (15.11) |
| CCF | 256 (12.48) |
| Feeding difficulty | 232 (11.31) |
| Cyanotic spells | 123 (5.99) |
| Asymptomatic | 230 (11.21) |

**Figure 1:** Study flow chart.

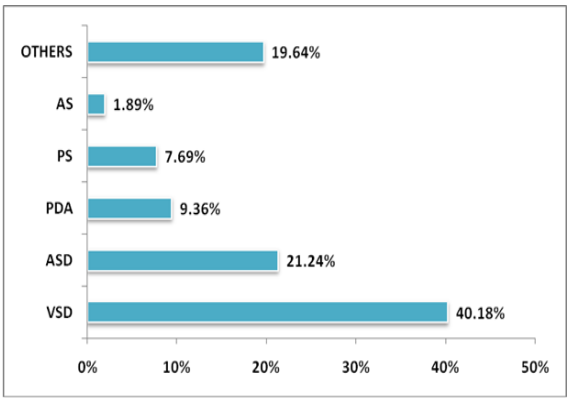



**Figure 2:** Histogram showing frequency distribution of acyanotic congenital heart defects.

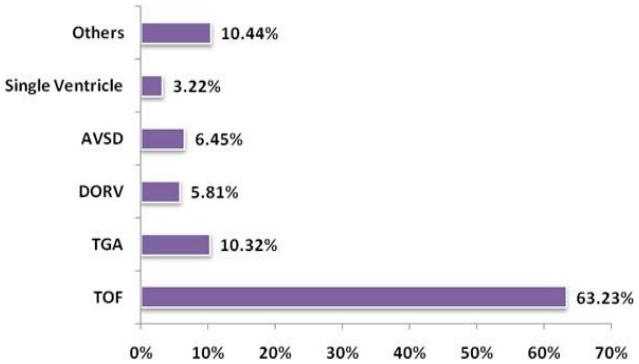
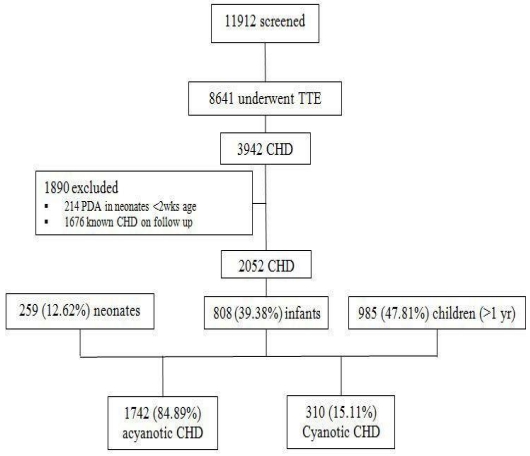



**Figure 3:** Histogram showing frequency distribution of cyanotic congenital heart defects.

## 6. Discussion

Congenital heart disease occurs in 8 per 1000 live births and comprises one of the major diseases in the pediatric age group [9]. CHD has become an important cause of morbidity and mortality in infancy and accounts for two-thirds of all major birth defects along with neural tube defects [10]. We carried out this study as there are very few Indian studies stating the epidemiology of CHD in our country. There is just one study available from India which gives the incidence of CHD per 1000 live births, by Khalil, et al [10]. They studied 10964 live births and observed the incidence



of 3.9/1000 live births. In this study, CHD was found in 23.75% cases. This is not a real picture of the prevalence rate of CHD in community as it is a hospital based study and included only those patients who were born in our hospital, referred from other hospitals, and those attended to our hospital for a variety of reasons.

Clinically dyspnea was the commonest presenting symptom followed by respiratory tract infections and failure to thrive. The same picture is reported in studies all over the world [10-12].

Our study showed a male preponderance, which is in accordance with studies *[13-15].*There are gender differences in the occurrence of specific heart lesions. TGA and left sided obstructive lesions are slightly more common in boys, whereas VSD, PDA, ASD and PS are more common in girls. However, in our study only PDA, pulmonary atresia, MVP and bicuspid aortic valve were more common in females. TGA, left sided obstructive lesions, TOF, ASD, VSD, PS were all common in males.

Acyanotic group formed the major bulk (84.89%) in our study which is in congruent with other Indian and western studies [3,16-18]. VSD was the commonest congenital heart defect similar to other studies [3, 19-21]. ASD was the second most common CHD in our study, correlating well with the frequency of 10-23% in various Indian studies, but it is higher than 6-8% reported from western countries. TOF was the most common cyanotic CHD correlating well with other studies.

Maximum number of cases of CHD was of the age group 0-1 year (52.0%) including neonates and infants which is in accordance with other studies from rest of India and rest of the world [3]. The frequency of the complex and rare types of CHDs was less when compared to the western data but similar to other Indian studies. This could be due to the severity of the defects which might have led to the death of the patients before accessing the medical facilities and racial and genetic factors between us and them. Various cases of CHD would have escaped diagnosis like neonates, especially born at home, who die without medical attention and those who are asymptomatic with mild to moderate degree of CHD, or those diagnosed at peripheral/private centers. This may increase our falsely low prevalence.

The magnitude of the CHD problem is considerable and is largely unrecognized, understated, and underestimated. However, encouraging results of treatment for most of the CHD from developed countries should prompt more clinicians to take up the challenge of managing these complex problems. Congenital malformations and in particular CHDs are likely to become important contributors to infant mortality in the near future. Hence, it is important to determine the exact prevalence and case burden of CHD so that appropriate changes in health policies can be recommended.

## 7. Conclusion

The frequency of CHD at a tertiary care center in western India was 23.75 percent. VSD and ASD were the most common acyanotic congenital heart defect while TOF was the commonest cyanotic congenital heart defect observed. TTE plays a major role in the diagnosis of CHD. Early diagnosis and treatment is the best approach to minimize the morbidity and mortality attributed to CHD. Hence, when clinical evidences lead to suspicion of congenital heart defect, an echocardiography should be performed.

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