

Prevalence of adult congenital cardiac disease: report from a tertiary care center

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Abstract:

Background: The term "congenital cardiac disease (CCD)" refers to birth defects of the heart that are typically identified within the first year of life. Most patients had their diagnoses delayed due to a lack of knowledge, the absence of, or the limited availability of cardiac care services. It is possible to lessen the impact of adult CCD with better diagnostics and earlier therapeutic interventions. **Objectives:** This study aimed to ascertain the prevalence and distribution of congenital heart disease among adult patients at a tertiary care institution in Uttarakhand state. **Materials and Methods:** Patients older than 18 who sought care at the cardiology clinic were screened for congenital heart disease with electrocardiograms (ECGs), echocardiograms, and chest X-rays. **Results:** The baseline characteristics of 315 research respondents by gender are shown in Table 1. Men averaged 25.62 years (± 6.51) and women 23.58 years (± 4.95), with no significant age difference ($p=0.068$). Male heart failure was 28% higher than female (9.28%, $p=0.047$). Females (45.71%) had more palpitations/rhythm disorders than males (17.71%, $p=0.069$). Asymptomatic/Murmur Evaluation and Cyanosis were similar. Men and women had similar hypertension rates ($p=0.085$). Basic characteristics and admission factors differed by gender. **Conclusion:** The data regarding the prevalence of adult congenital cardiac disease will be useful in formulating policy for early diagnosis and management of CCD. It will also help in assessing the risk factors for the treatment of complications of adult CCD.

Keywords: Adult Congenital Cardiac Disease, ASD, VSD, Palpitation.

Introduction:

"Congenital cardiac disease (CCD)" is a significant contributor to both morbidity and mortality in both pediatric and adult populations. The disease's prevalence has been documented as 3000 per million in adults [1] and 19 to 75 per 1000 live births in children worldwide [2,3]. The prevalence of the disease is significantly influenced by regional, socio-economic, and demographic disparities. The deleterious consequences of sickness on the adult population are profound, significantly

compromising their overall well-being and diminishing their quality of life.

The early detection of diseases is being facilitated by technological improvements, resulting in a notable improvement in survival rates in recent years [4]. However, regular health checkups are necessary to maintain adequate health status resulting increase in the economic burden upon them [5].

Congenital cardiac diseases can be categorized into cyanotic and acyanotic types, depending on the presence or absence of central cyanosis. Most cyanotic cardiac illnesses exhibit a modest clinical course; nevertheless, if left untreated, they have the potential to progress to Eisenmenger syndrome.

Moderate problems, including bicuspid aortic valve with stenosis, aortic regurgitation, "tetralogy of Fallot (TOF)", and atrioventricular canal anomalies, necessitate prompt intervention within the initial months of an individual's existence. Cyanotic cardiac disorders encompass conditions such as transposition of the major arteries and complete abnormal pulmonary connection, both of which necessitate prompt surgical intervention. Complex congenital heart illnesses encompass a range of conditions, such as single ventricle, pulmonary atresia, and transposition of great arteries with pulmonary stenosis [6]. These conditions necessitate the implementation of palliative surgical interventions. The available data on CCD in adults within our population is limited. Consequently, the objective of this study was to ascertain the prevalence of CCD to provide valuable information for the development of health policies.

Materials and Methods

The present study, characterized as a prospective, observational, cross-sectional investigation, was conducted by the cardiology department of a teaching hospital. This hospital is recognized as a tertiary care referral center. The study spanned from July 2016 to 2021. The study documentation underwent a thorough evaluation and received approval from the "Institutional Ethics Committee", which is duly registered with the Department of Health Research. After getting written informed consent, potential patients underwent a screening process. The objective of the research was to determine the prevalence of "chronic communicable diseases (CCDs)" among the adult population.

Patients older than 18 who sought care at cardiology clinics for a variety of heart issues were included. The "electrocardiogram (ECG)," echocardiography, and chest X-ray were used to screen patients suspected of having CCD. The produced questionnaire

included a comprehensive history, examination, and other factors.

The data was captured on Microsoft Excel 2015 and analyzed in SPSS 25. Descriptive statistics was used for analysis. Results were expressed as mean, standard deviation, and percentage; figures and tables were used to express the results.

Results

The cardiac department at our hospital saw 108,000 patients over five years, 315 (0.29%) had CCDs. There were 175 males (55.7%) and 140 females (44.4%). Population age distribution (mean SD) ... 24.68 ± 5.12 years (19 years to 61 years). The mean \pm SD age was 25.62 ± 6.51 years and 23.58 ± 4.95 years for males and females, respectively.

The most common cause for consultation was palpitation or rhythmic disorder (n=95, 30.16%) and evaluation of murmur (n=79, 25.08%) (Table 1). A significant prevalence of anxiety disorder was observed among individuals who were referred to evaluate cardiac disease. Tables 2 and 3 provide an overview of the age-related spectrum of congenital diseases.

A higher percentage (80%) of patients exhibited symptoms of cyanotic heart disease, while a smaller proportion (20%) presented with non-cyanotic heart illness. The prevailing "congenital cardiovascular disorders (CCDs)" seen in this study were "atrial septal defect (ASD)" accounting for 38.4% of cases, followed by "ventricular septal defect (VSD)" which constituted 25.07% of cases. The observation of "Tetralogy of Fallot (TOF)" was found in 50.7% of individuals diagnosed with cyanotic cardiac illness. "Autism spectrum disorder (ASD)" exhibited a higher prevalence among females, making it the most often occurring congenital condition (n=..., ...%). The age group most typically diagnosed with congenital heart disease beyond infancy is 18-25 years. Individuals within this age range commonly suffer symptoms such as palpitations, dyspnea, and anxiety. "Atrial Fibrillation (AF)" was determined to be the most commonly occurring arrhythmia among patients, with a prevalence rate of 10.15%. The variable in question demonstrates a positive

correlation with advancing age, being male, and the presence of heart failure, as indicated in Table 4.

Table 1 shows the baseline characteristics of 315 research subjects by gender. The average age of males was 25.62 years (± 6.51), while females averaged 23.58 years (± 4.95), with a non-significant age difference (p-value = 0.068). Female and male congenital heart disease patients had different admission causes. Males (28%) had higher heart failure than

females (9.28%), with a p-value of 0.047. Palpitation/Rhythm Disorder was more prevalent in women (45.71%) than men (17.71%), with a p-value of 0.069. Admission causes including Asymptomatic/Murmur Evaluation and Cyanosis showed differences without statistical significance. Statistically, both groups had equal hypertension rates (p=0.085). Congenital heart disease patients' baseline features and admission grounds differ by gender, as seen in this table.

Table 1: Baseline characteristics of the patients involved in this study.

Characteristic	Male (n = 175)	Female (n = 140)	p-value
Age	25.62 \pm 6.51	23.58 \pm 4.95	0.068
Current smokers	155 (%)	56 (%)	0.0365
NYHA Classification	2.5 \pm 0.5	2.0 \pm 0.5	0.069
Hospitalization factors for “congenital heart disease”			
Palpitation/Rhythm Disorder	31 (17.71%)	64(45.71%)	0.069
Heart Failure	49(28%)	13 (9.28%)	0.047
Asymptomatic/Evaluation of Murmur	48 (27.42%)	31 (22.14%)	0.058
Cyanosis	26 (14.85%)	38 (27.14%)	0.049
Hypertension	8 (4.57%)	7 (5%)	0.085

Table 2 shows the prevalence of cyanotic heart disease by age group and sex distribution. The incidence of ASD and VSD was about the same among males and girls between the ages of 18 and 25. Both ASD and VSD were marginally more common among women than men in the 25-to-40 age range. In patients between the ages of 40 and 60, ASD and AS were more

common in men, while VSD was more common in women. Very few people with ASD were found in the >60 age category, but the prevalence of the disorder was the same among males and females. There are significant age and gender-based differences in the prevalence of several cyanotic cardiac disorders, as shown in the table below.

Table 2: Age-wise spectrum of acyanotic disease

Acyanotic Heart Disease	18-25 Years (n=133)		25-40 Years (n=91)		40-60 Years (n=26)		>60 Years (n=2)	
	Male	Female	Male	Female	Male	Female	Male	Female
ASD	24 (18.04%)	32 (24.06%)	19 (20.87%)	26 (28.57%)	8 (30.76%)	10 (38.46%)	1 (50%)	1 (50%)
VSD	28 (21.05%)	16 (12.03%)	17 (18.68%)	12 (13.18%)	4 (15.38%)	2 (7.69%)	0	0

PDA	6 (4.5%)	2 (1.50%)	2 (2.19%)	2 (2.19%)	0	0	0	0
Coarctation	3 (2.25%)	0	1 (1.09%)	0	0	0	0	0
AS	8 (6.01%)	4 (3.00%)	6 (6.59%)	4 (4.39%)	2 (7.69%)	0	0	0
PS	8 (6.01%)	2 (1.50%)	2 (2.19%)	0	0	0	0	0
Total	77 (57.89%)	56 (42.10%)	47 (51.64%)	44 (48.35%)	14 (53.84%)	12 (46.15%)	1 (50%)	1 (50%)

Table 3 shows cyanotic heart disease prevalence by age and gender. Within the 18-25 age group, "Tetralogy of Fallot (TOF)" was the most common condition in both men and women. TOF was still common in 25-40-year-olds, but female TOF rates declined and Ebstein's oddity emerged. TOF remained the

most prevalent disorder in 40-60-year-old men, whereas Ebstein's abnormality increased in women. The >60-year-old group had no TOF or cyanotic cardiac disease. The table shows that TOF is the most frequent cyanotic heart condition across age groups, however, gender distributions vary.

Cyanotic Heart Disease	18-25 Years (n=44)		25-40 Years (n=15)		40-60 Years (n=4)		>60 Years (n=0)	
	Male	Female	Male	Female	Male	Female	Male	Female
TOF	18 (40.90 %)	14 (31.81%)	8 (53.33%)	4 (26.66%)	3 (75.00%)	1 (25.00%)	0	0
Ebstein	2 (4.54%)	4 (9.09%)	0	2 (13.33%)	0	0	0	0
Single ventricle	2 (4.54%)	0	0	0	0	0	0	0
Eisenmenger	3 (6.81%)	1 (2.27%)	1 (6.66%)	0	0	0	0	0
TGA	0 (0.00%)	0	0	0	0	0	0	0
TA	0 (0.00%)	0	0	0	0	0	0	0
Total	56.8125 (%)	19 (43.18)	9 (60.00%)	6 (40.00%)	3 (75.00%)	1 (25.00%)	0	0

Table 3: Cyanotic disease prevalence by age

Figure 1 shows heart illness patients' arrhythmia spectrum. The table shows five arrhythmias and their numbers and percentages. "Atrial Fibrillation (AF)", the most prevalent arrhythmia, affects 32 patients (10.15%). Ectopic Atrial Rhythm and PSVT each occur in

12 patients, 3.81% of the total. Eight individuals (2.54%) have "Ventricular Tachycardia (V-Tach)". "Complete Heart Block (CHB)" occurs in 6 people (1.90%). Each arrhythmia type and its prevalence in heart illness patients are shown in this table.

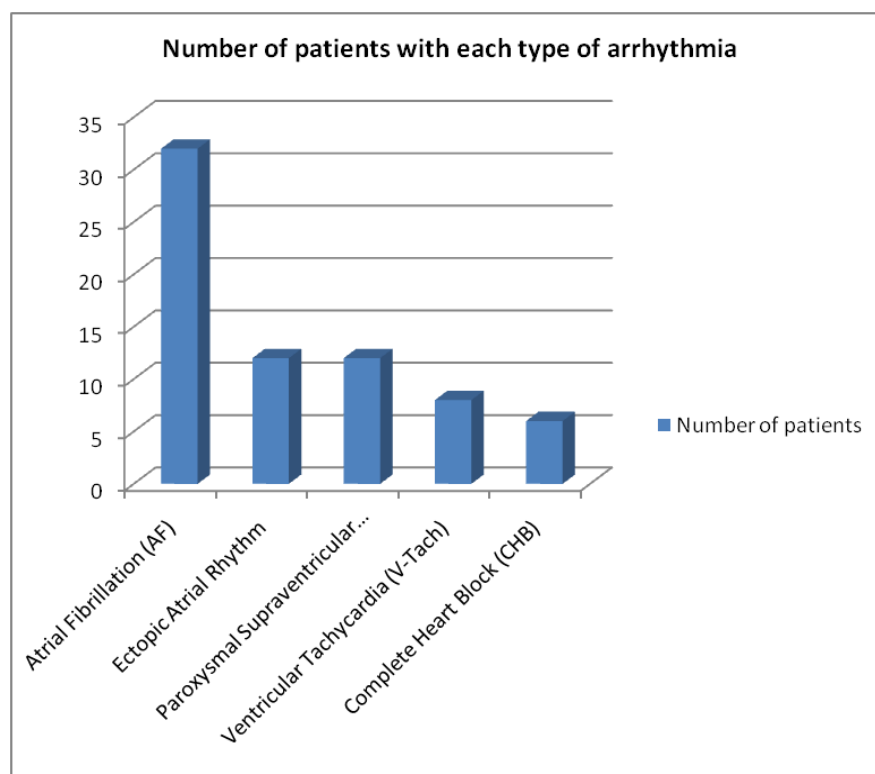


Figure 1: Spectrum of Arrhythmia amongst cardiac disease

Figure 2 outlines the New York Heart Association (NYHA) classification mean scores and standard deviations across different age groups. In the 18-25 years age range, the mean NYHA score is 1.2, indicating relatively low functional impairment with slight variability. For those aged 25-40 years, the mean score rises to 2.8, signifying greater functional limitations with a bit more variability. This age group has a significantly

higher NYHA classification. Individuals between 40-60 years have a mean score of 2.0, indicating moderate impairment with less variability. Those over 60 years exhibit a mean score of 1.5, suggesting a slightly lower level of functional impairment, but with more variability compared to the other groups. Overall, Figure 2 underscores an association between age and functional impairment due to heart disease.

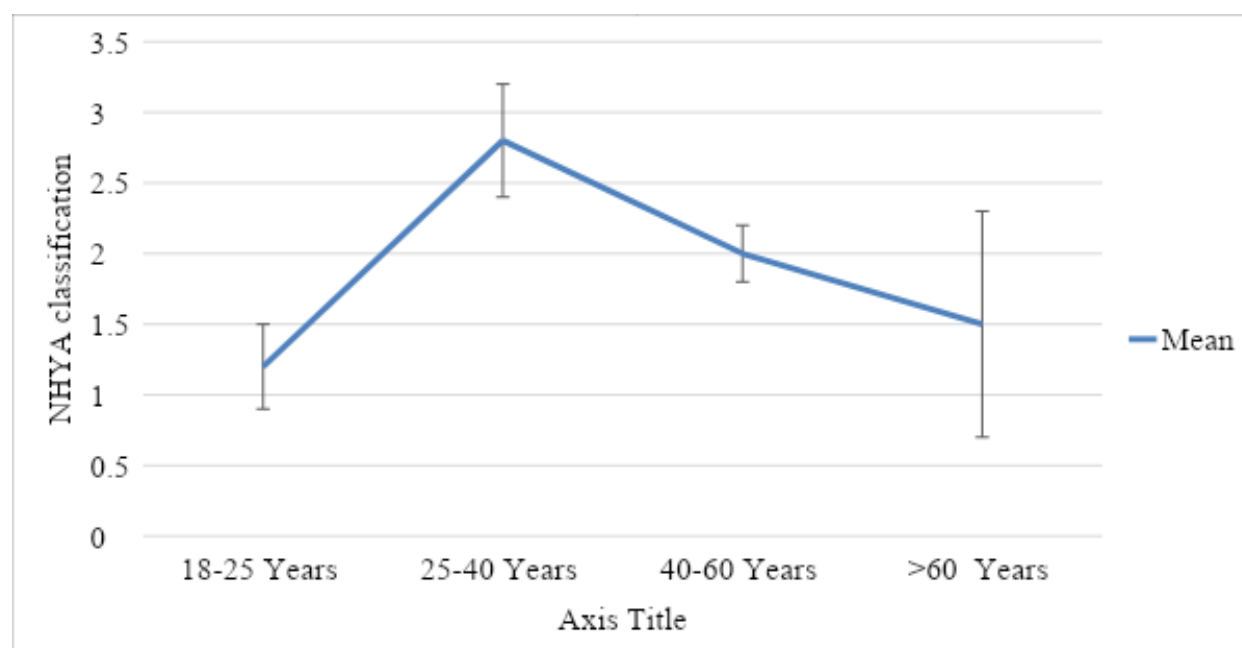


Figure 2: Average NYHA Classification concerning the age groups.

Table 4 shows the "findings of the follow-up study" among 315 patients with characteristics by gender. The below table presents different types of surgeries undergone by the patient. "Repair of Atrial Septal Defect (ASD)", "Repair of Ventricular Septal Defect (VSD)", "Patent Ductus Arteriosus (PDA)", "Arrhythmia Ablation" and more surgeries are performed among male and female patients. The prevalence of atrial septal defect (ASD) repair was found to be higher in females (47.85%) as compared to males (29.14%). On the other hand, the study has demonstrated that the complications of Arrhythmias are significant

differences between males (27.42%) and females (15.71%) and the significance is high in males rather than females and the significant p-value was < 0.05 . In this patient population, arrhythmias are the most prevalent consequence and ASD repair is the most common procedure, highlighting the significance of gender-specific cardiac care. Even the incidence of Pulmonary Hypertension Crisis was found to be higher in females (57.85%) in comparison to males (31.42%). The p-values provide evidence of statistical significance within certain categories.

Table 4: Findings of the follow-up study

	Characteristic	Male	Female	Overall	p-value
		n = 175	n = 140	n = 315	
Surgeries undergone by the patients	Repair of Atrial Septal Defect (ASD)	51 (29.14%)	67 (47.85%)	118 (37.46%)	0.063
	Repair of Ventricular Septal Defect (VSD)	45 (25.71)	25 (17.85%)	70 (22.22%)	0.053
	Patent Ductus Arteriosus (PDA) Closure	8 (4.57%)	4 (2.85%)	12 (3.80%)	0.047
	Coarctation of the Aorta Repair	2 (1.14%)	0	2 (0.63%)	0.055
	Tetralogy of Fallot Repair	26 (14.85%)	17 (12.14%)	43 (13.65%)	0.061
	Transposition of the Great Arteries (TGA) Repair	3 (1.71%)	0	3 (0.95%)	0.089
	Heart Transplant	1 (0.57%)	0	1 (0.31%)	0.082
	Pacemaker or Implantable Cardioverter Defibrillator (ICD) Implantation	21 (12.00%)	14 (%)	35 (11.11%)	0.064
	Arrhythmia Ablation	32 (18.28%)	24 (17.14%)	56 (17.77%)	0.065
Complicat	Arrhythmias	48 (27.42%)	22	70	0.041

ions			(15.71%)	(22.22%)	
	Valvular Dysfunction	12 (6.85%)	5 (3.57%)	17 (5.39%)	0.052
	Infective Endocarditis	14 (8.00%)	12 (8.57%)	26 (8.25%)	0.053
	Thromboembolic Events	4 (2.28%)	0	4 (1.26%)	0.056
	Aortic Aneurysm or Dissection	3 (1.71%)	0	3 (0.95%)	0.057
	Stroke	2 (1.14%)	1 (0.71%)	3 (0.95%)	0.059
	Pulmonary Embolism	3 (1.71%)	0	3 (0.95%)	0.078
	Exercise Intolerance	15 (8.57%)	18 (12.85%)	33 (10.47%)	0.085
	Arrhythmogenic Right Ventricular Dysplasia (ARVD)	1 (2.28%)	0	1 (0.31%)	0.089
	Sudden Cardiac Arrest	1 (0.57%)	0	1 (0.31%)	0.087
	No. of hospitalizations required during the study period	21.5 ± 5.21	26.35 ± 5.12	23.59 ± 4.5	0.085
Causes of hospitalization (excluding those who had surgeries)					
	Heart Failure Exacerbation	12 (6.85%)	4 (2.85%)	16 (5.07%)	0.089
	Arrhythmias	35 (20.00%)	25 (17.85%)	60 (19.04%)	0.091
	Infective Endocarditis	21 (12.00%)	15 (10.71%)	36 (11.42%)	0.096
	Pulmonary Hypertension Crisis	55 (31.42%)	81 (57.85%)	136 (43.17%)	0.089

Discussion

In this population-based analysis, this study examined the impact of congenital cardiac among adults. Through the observation, it

found a significant reduction in adult congenital cardiac disease mortality rate accompanied by a similar improvement in referral to adult congenital cardiac disease centers. This study

found that adult congenital cardiac disease is mostly available between a maximum age of 40 years. This study has also found that the age of patients was 29.92 years when most patients were below 45 years old. Therefore, this experiment found that the mean age of 31.7 years old patients accompanied with adult congenital cardiac disease. Even though there is no significant gender difference among the population; this is presented in our study. In addition, congenital heart disease has been identified as a significant contributor to both mortality and morbidity. The global incidence of adult congenital cardiac illness has been shown to range from 2000 to 4000 cases per million adults [5, 7, 8], but in India, the reported incidence is 2.4 cases per 1000 individuals [9].

Out of a total of 108,000 patients who saw a cardiologist at our hospital, 315 were diagnosed with congenital heart disease. The statistics, however, may not provide an accurate depiction as it only includes situations where individuals exhibited symptoms. The primary symptom mentioned by the patients was palpitation. The prevalence of cyanotic heart disease was shown to be higher compared to cyanotic heart disease, as documented in previous studies involving pediatric populations [10, 11, 12, 13]. "Autism Spectrum Disorder (ASD)" was identified as the most prevalent condition, exhibiting a higher incidence among females aged 18 to 60 years. This finding aligns with the results of the preceding investigation conducted by the authors [14]. A total of 22.22% of the cases examined in this study were determined to correlate with arrhythmia. "Atrial fibrillation (AF)" was determined to be the most prevalent arrhythmia, accounting for 10.15% of cases. The incidence of arrhythmia demonstrates an upward trend in correlation with advancing age, male gender, double outlet right ventricle, atrioventricular septal defect, and heart failure. The prevalence of complete heart block was observed to be 1.90% in the studied cases.

"Adult congenital cardiac" sickness is more common than complex cardiac disorders, according to the data. In our study, 43.3% of adult cardiac catheterization patients had ASD [15]. The prevalence of undiagnosed "Tetralogy of Fallot (TOF)" in adults varies globally. TOF was the second most common condition, accounting for 21% of instances, according to the investigation. Additionally, it

was the most common cyanotic congenital heart disease. Natural selection may have favored "Tetralogy of Fallot (TOF)" instances in our investigation. The most common congenital cardiac abnormality in children is VSD. Those with this syndrome usually have surgery or die before 18 [16].

Conclusions

The prevalence of adult congenital cardiac disease in the state of Uttarakhand is rather low; nonetheless, it is possible that the recorded cases may not accurately reflect the true extent of the condition. It is a significant contributor to both morbidity and death rates. The study also found that the arrhythmia is significantly more prevalent in males as compared to females and the age group of 25-40 years manifests significantly higher than other age groups. A significant proportion of these theses exhibit a high potential for complete remission, and subsequent surgical intervention can lead to a notable enhancement in the overall quality of life. The need to address the low socio-economic situations, comorbidities, lack of cardiac facilities, remote locations, and delayed diagnosis is evident. It is imperative to ensure accessibility of healthcare facilities in the state to distant highland areas, while concurrently fostering the dissemination of awareness.

Consent and Ethical Approval

This study received approval from the institutional ethical committee of HIMS. Data privacy and data management are adhered to by established protocols.

Competing Interests

The authors have stated that there are no conflicts of interest.

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