

# Spectrum of congenital heart diseases at tertiary-care hospital in north western Rajasthan in India

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## Abstract

**Background:** Heart diseases constitute an important group of pediatric illness and major cause of childhood mortality and morbidity. According to a status report on congenital heart disease (CHD) in India, 10% of the present infant mortality may be accounted for by CHD.

**Objective:** (i) To study the spectrum of CHD in children under 5 years of age and (ii) to study the correlates of different CHDs through demographic and socioeconomic variables.

**Materials and Methods:** This study was conducted on 390 patients under 5 years of age in the Department of Pediatrics, SP Medical College attached to PBM Associated Group of Hospitals, Bikaner, Rajasthan, India, from September 2014 to August 2015. The criteria to suspect heart disease was followed as formulated by Alexander Nadas as NADA'S criteria. The diagnosis was confirmed by echocardiography.

**Result:** Pattern of CHD in this study was 88.9% cases of acyanotic CHD and 11.1% cases of cyanotic CHD. Ventricular septal defect (VSD) was the most common CHD present in 38.5%, followed by atrial septal defect (ASD) in 12.8%, patent ductus arteriosus (PDA) in 8.5%, ASD + VSD in 7.4%, tetralogy of fallot (TOF) in 5.1% of total cases. A total of 131 (33.6%) patients had <3 SD weight for length/height Z-score. Pulse oximetry examination shows 54 cases (13.8%) with SpO<sub>2</sub> ≤ 85%, while 281 (72.1%) cases with SpO<sub>2</sub> > 85%–95%, and 55 cases (14.1%) with SpO<sub>2</sub> > 95%.

**Conclusion:** Acyanotic CHD was the most common. VSD was the most common CHD. TOF was the most common cyanotic CHD. According to the WHO Z-score, 52.6% patients showed moderate to severe malnutrition. About 72.1% of cases showed SpO<sub>2</sub> between 85% and 95%, which shows that a pulse oximetry SpO<sub>2</sub> <95% considered a positive test, should be repeated in an hour, if positive again repeated in another hour, and if remained positive, echocardiography is indicated for evaluation of CHD.

**KEY WORDS:** Pattern, congenital heart diseases, pulse oximetry

## Introduction

Heart diseases constitute an important group of pediatric illness and major cause of childhood mortality and morbidity.

Congenital heart diseases (CHDs) are relatively common with a prevalence ranging from 3.7 to 17.5 per 1,000 live

births<sup>[1,2]</sup> As stated by a status report on CHD in India, 10% of the present infant death may be accounted for by CHD.<sup>[3]</sup> As per a large hospital-based study from India, the occurrence of CHD is 3.9/1,000 live births.<sup>[4]</sup> In community-based studies from India,<sup>[5,6]</sup> the prevalence of CHD varies from 0.8–5.2/1,000 patients. Thus, the prevalence of CHD is not uniform across the country.

The term congenital is derived from the Latin word (“con” means together and “genitus” means born) referring to “present at birth.” CHD is known as a defect in “cardiocirculatory” structure or function that is existent from birth, although it may be discovered later.<sup>[7]</sup>

CHD remains the leading cause of death in children with malformation,<sup>[8]</sup> incidence being 8 CHD's per 1,000 live births and is the most common severe congenital abnormality.<sup>[9]</sup> In

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our country, majority of the childbirths still take place at home, and routine neonatal screening is not common, so it is very difficult to calculate the prevalence of CHD.<sup>[10]</sup>

There are no studies regarding CHD in northwest part of Rajasthan. This article aimed to study more about CHD in northwestern part of Rajasthan.

## Materials and Methods

This study was conducted in the Department of Pediatrics, SP Medical College attached to PBM Associated Group of Hospitals, Bikaner, Rajasthan, from September 2014 to August 2015. The hospital is a major referral center (Tertiary Teaching Hospital) in the region. Patients under 5 years of age groups were studied during the study period. All suspected patients underwent a thorough clinical examination after a detailed history and were followed by investigations such as SpO<sub>2</sub>, chest X-ray, ECG, echocardiography, and color doppler. The criteria to suspect heart disease was followed as formulated by Alexander Nadas named as NADA'S criteria.

### NADA'S Criteria

#### Major

- (i) Systolic murmur grade 3 or more
- (ii) Diastolic murmur
- (iii) Cyanosis
- (iv) CCF
- (v) Abnormal BP

#### Minor

- (i) Systolic murmur grade < grade 3, especially with thrill
- (ii) Abnormal S<sub>2</sub>
- (iii) Abnormal X-ray

One major or two minor criteria are essential for diagnosis of heart disease.

Diagnosis of all suspected cases was confirmed by echocardiography, which was done by Cardiologist.

## Result

In this study, majority of patients (68.9%) belonged to ≤ 1 year of age. Male: female ratio was 1.4:1. Most common mode of presentation was respiratory complaints (cough, fast

breathing, breathlessness), followed by not gaining weight. Hindu: Muslim community represented 87.2%, 12.8%, respectively. Rural: urban represented 67.9%, 32.1%, respectively. About 56.2% of patients showed history of recurrent respiratory tract infection.

Pattern of CHD was 88.9% cases of acyanotic CHD and 11.1% cases of cyanotic CHD. Ventricular septal defect (VSD) was the most common CHD (38.5%), followed by atrial septal defect (ASD) in 12.8% cases, patent ductus arteriosus (PDA) in 8.5% case, ASD + VSD was in 7.4% cases, tetralogy of fallot (TOF) in 5.1% of cases, while other echocardiography findings were present in 24.6% of cases.

Of the total 390 patients, 77 (19.7%) patients showed normal weight for age, 100 (25.6%) patients showed <1–2 SD weight for age, 102 (26.2%) patients showed <2–3 SD weight for age, while 111 (28.5%) patients showed <3 SD weight for age.

This study shows 99 (25.4%) patients had normal height for age, 85 (21.8%) patients showed <1–2 SD height for age, 97 (24.9%) patients showed <2–3 SD height for age, while 109 (27.9%) patients showed <3 SD height for age.

A total of 126 (32.3%) patients showed normal weight for length/height Z-score, 59 (15.1%) patients showed <1–2 SD weight for length/height Z-score, 74 (19%) patients showed <2–3 SD weight for length/height Z-score, while 131 (33.6%) patients showed <3 SD weight for length/height Z-score.

According to the WHO Z-score 185 (47.4%) patients showed normal or borderline malnutrition, while 205 (52.6%) patients showed moderate to severe malnutrition.

Of the total 390 cases, 281 (72.1%) patients showed their SpO<sub>2</sub> between >85 and 95, while 54 (13.8%) and 55 (14.1%) cases showed their SpO<sub>2</sub> ≤ 85 and >95, respectively. On applying  $\chi^2$ -test, the difference was found statistically highly significant ( $p < 0.001$ ).

## Discussion

In this study, pattern of CHD was 88.9% cases of acyanotic CHD and 11.1% case of cyanotic CHD. VSD (38.5%) was the most common CHD, followed by ASD in 12.8% cases, PDA in 8.5% case, ASD + VSD in 7.4% cases, TOF in 5.1% of cases, while other echocardiography findings were present in 24.6% of cases. VSD was the most common acyanotic CHD, and TOF was the most common cyanotic CHD. Of 390 cases,

**Table 1:** Distribution of cases according to weight for length/height (Z-score)

Weight for length/height (Z-Score)	Age group (years)						Total	
	≤1		>1–3		>3–5		No.	%
	No.	%	No.	%	No.	%		
Normal	91	33.8	13	21.0	22	37.3	126	32.3
<1SD	33	12.3	16	25.8	10	16.9	59	15.1
<2SD	46	17.1	15	24.2	13	22.0	74	19.0
<3SD	99	36.8	18	29.0	14	23.7	131	33.6
Total	269	100	62	100	59	100	390	100

**Table 2:** Distribution of cases according to echocardiography

Echocardiography	Age group							
	<= 1		>1-3		>3-5		Total	
	No.	%	No.	%	No.	%	No.	%
VSD	102	37.9	28	45.2	20	33.9	150	38.5
ASD	36	13.4	7	11.3	7	11.9	50	12.8
PDA	27	10.0	4	6.5	2	3.4	33	8.5
ASD + VSD	25	9.3	0	–	4	6.8	29	7.4
TOF	10	3.7	4	6.5	6	10.2	20	5.1
VSD + PDA	8	3.0	4	6.5	0	–	12	3.1
ASD + PDA	7	2.6	0	–	0	–	7	1.8
PS	4	1.5	2	3.2	0	–	6	1.5
ASD + TR	4	1.5	0	–	0	–	4	1.0
DORV	4	1.5	0	–	0	–	4	1.0
Dextrocardia + VSD	2	0.7	0	–	2	3.4	4	1.0
Hypertrophic cardiomyopathy	4	1.5	0	–	0	–	4	1.0
PDA + MR	0	–	0	–	4	6.8	4	1.0
TAPVC + VSD	4	1.4	0	–	0	–	4	1.0
VSD + MR	0	–	2	3.2	2	3.4	4	1.0
VSD + PS + PDA	1	0.4	2	3.2	0	–	3	0.8
ASD + VSD + TA	2	0.7	0	–	0	–	2	0.5
AS	0	–	0	–	2	3.4	2	0.5
ASD + MS	2	0.7	0	–	0	–	2	0.5
ASD + PS	0	–	2	3.2	0	–	2	0.5
ASD + PS + PDA	2	0.7	0	–	0	–	2	0.5
ASD + PS + TA	2	0.7	0	–	0	–	2	0.5
Dextrocardia + TOF	0	–	0	–	2	3.4	2	0.5
Dextrocardia + VSD + PA	2	0.7	0	–	0	–	2	0.5
Dextrocardia + VSD + PDA	2	0.7	0	–	0	–	2	0.5
Dilated cardiomyopathy	2	0.7	0	–	0	–	2	0.5
Mild TR + MR	0	–	2	3.2	0	–	2	0.5
MR + TR + Dilated cardiomyopathy	2	0.7	0	–	0	–	2	0.5
Severe MR	0	–	0	–	2	3.4	2	0.5
Truncus arteriosus	2	0.7	0	–	0	–	2	0.5
VSD with PS	2	0.7	0	–	0	–	2	0.5
VSD + AR	2	0.7	0	–	0	–	2	0.5
VSD + mild MR + ALCAPA	0	–	2	3.2	0	–	2	0.5
VSD + mild TR	2	0.7	0	–	0	–	2	0.5
VSD + PA + PDA	0	–	0	–	2	3.4	2	0.5
VSD + PDA + MR	0	–	0	–	2	3.4	2	0.5
VSD + PS	0	–	2	3.2	0	–	2	0.5
VSD + severe PS	2	0.7	0	–	0	–	2	0.5
VSD, severe MS, MR	1	0.4	0	–	1	1.7	2	0.5
Coarctation of aorta	0	–	0	–	1	1.7	1	0.3
Dextrocardia + VSD + PS	1	0.4	0	–	0	–	1	0.3
MR + PS	0	–	1	1.6	0	–	1	0.3
Pulmonary atresia	1	0.4	0	–	0	–	1	0.3
TGA	1	0.4	0	–	0	–	1	0.3
VSD + PS + TA	1	0.4	0	–	0	–	1	0.3
Total	269	100	62	100	59	100	390	100

**Table 3:** Distribution of cases according to cyanotic and acyanotic CHD

	N	%
Type of CHD		
Acyanotic CHD	347	88.9
Cyanotic CHD	43	11.1
Total	390	100
Distribution of cases according to acyanotic CHD		
Simple acyanotic CHD		
AS	2	0.6
ASD	50	14.4
VSD	150	43.2
PDA	33	9.5
PS	6	1.7
Coarctation of aorta	1	0.3
MR	2	0.6
Hypertrophic cardiomyopathy	4	1.2
Dilated cardiomyopathy	2	0.6
Total	250	72.1
Complex acyanotic CHD		
ASD + VSD	29	8.4
ASD + PDA	7	2.1
ASD + PDA + PS	2	0.6
ASD + PS	2	0.6
ASD + MS	2	0.6
ASD + TR	4	1.2
VSD + PS	2	0.6
VSD + MS + MR	2	0.6
VSD + AR	2	0.6
VSD + MR	6	1.7
VSD + TR	2	0.6
VSD + PDA	12	3.4
VSD + PDA + MR	2	0.6
VSD + PS	4	1.2
VSD + PS + PDA	3	0.9
MR + TR	4	1.2
MR + PS	1	0.3
PDA + MR	4	1.2
Dextrocardia + VSD + PDA	2	0.6
Dextrocardia + VSD	4	1.2
Dextrocardia + VSD + PS	1	0.3
Total	97	27.9
Distribution of cases according to cyanotic CHD		
Simple cyanotic CHD		
TOF	20	46.5
TGA	1	2.3
Truncus arteriosus	2	4.6
DORV	4	9.2
Pulmonary atresia	1	2.3
Total	28	65.1
Complex cyanotic CHD		
Dextrocardia + TOF	2	4.6
ASD + PS + TA	2	4.6
ASD + VSD + TA	2	4.6
Dextrocardia + VSD + PA	2	4.6
TAPVC + VSD	4	9.2
VSD + PA + PDA	2	4.6
VSD + PS + TA	1	2.3
Total	15	34.9

213 (54.7%) cases showed weight  $\leq 2$  SD. Of 213 cases, 111 cases showed weight  $<3$  SD and severe malnutrition. A total of 177 (45.3%) cases were normal or borderline. In this study, 109 (27.9%) cases showed  $<3$  SD height for age, while 97 (24.9%) cases showed  $<2-3$  SD height for age, while 184 (57.2%) cases showed normal for height for age. Of 390 cases, 205 (52.6%) cases showed  $<2$  SD weight for length/height Z-score; they showed moderate to severe malnutrition, while 185 (47.4%) cases show normal or borderline weight for length/height Z-score. Of the total 390 cases, 54 cases (13.8%) showed  $\text{SpO}_2 \leq 85\%$ , while 281 cases (72.1%) cases showed  $\text{SpO}_2 >85\%-95\%$ , and 55 cases (14.1%) showed  $\text{SpO}_2 > 95\%$ . A pulse oximetry  $\text{SpO}_2 < 95\%$  of either location or a saturation difference  $>3\%$  between the right hand and either foot considered a positive test should be repeated in an hour; if positive again, repeated in another hour, and, if remained positive, echocardiography is indicated. Mean age of presentation of CHD was  $15.77 \pm 18.22$  months.

Before drawing conclusion on mean age in CHD, it must be noted that mean age of symptoms, mean age of diagnosis, and mean age of presentation are three different variables; in a particular patient, all three may differ. It may be noted for purpose of this study, age of presentation to the hospital (at the time of inclusion) was the only criterion considered, hence the results need to be interpreted carefully and accordingly.

Our results are in line with the study done by Bhat et al.,<sup>[11]</sup> who found that VSD was the commonest in 30.4% patients, followed by ASD in 17.63% and PDA in 9.62%. Our results are in line with the study done by Vaidyanathan et al.,<sup>[12]</sup> who show in 59% cases, weight was  $\leq 2$  SD. Our results differ from the study done by Vaidyanathan et al.,<sup>[12]</sup> which shows that height  $\leq 2$  SD in 26.3%. Our results are in line with observation by Vaidyanathan et al.,<sup>[12]</sup> which shows that weight for length/height Z-score  $\leq 2$  SD were present in 55.9% of cases. Our results are in line with observation by American Academy of Pediatrics, which shows that a pulse oximetry saturation  $\text{SpO}_2 < 90\%$  require urgent echocardiography evaluation. Our results differ from the study done by Baspinar et al.,<sup>[13]</sup> which shows mean age of CHD diagnosis was  $2.2 \pm 3.64$  years.

The delay in age of diagnosis of CHD is mainly owing to decreased awareness of people in rural areas toward health-related problems. So, our government has to make effective policies to health educate the people in rural areas.

## Conclusion

In this study, pattern of CHD was 88.9% cases of acyanotic CHD and 11.1% cases of cyanotic CHD. VSD (38.5%) was the most common CHD, followed by ASD in 12.8% cases, PDA in 8.5% case, ASD + VSD was in 7.4% cases, and TOF in 5.1% of cases. TOF was the most common cyanotic CHD. Major presenting complaint was respiratory complaints, followed by not gaining weight, and 56.2% cases showed recurrent respiratory tract infections.

This study shows that 52.6% cases revealed moderate to severe malnutrition. Malnutrition is common in children with

CHD; early corrective intervention will result in significant improvement in nutritional status.

According to pulse oximetry saturation, 72.1% of cases showed  $\text{SpO}_2$  between 85% and 95%, which shows that a pulse oximetry  $\text{SpO}_2 < 95\%$  considered a positive test for early detection for CHD, should be repeated in an hour, if positive again repeated in another hour, and if remained positive, echocardiography is indicated for evaluation of CHD.

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