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Original Research Article

Pattern of congenital heart diseases in Western Rajasthan: an echocardiographic study

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ABSTRACT

Background: Congenital heart disease (CHD) accounts for nearly one third of all major congenital anomalies. Globally the prevalence of CHD is 1.01 to 17.5 per 1000 live births. In India it is 1.3 to 26.4 per 1000 study population. CHD is an important cause of mortality and morbidity representing a global health burden. Early diagnosis and treatment may lead to improved prognosis in patients suffering from CHD. The aim of this study was to assess the pattern of CHD in Western Rajasthan, India by echocardiography.
Methods: This was a retrospective study carried out at Dr. S. N. Medical College and attached group of hospitals in Jodhpur, Rajasthan, India. The study period was from July 2014 to June 2017. Records of all patients undergoing transthoracic echocardiography from newborn to 25 years of age were analyzed for age, sex and CHD findings.
Results: In the study period, a total of 24,914 patients underwent echocardiography, of which 877 patients were identified as having CHD. Prevalence of CHD was 35.20 per 1000 study population. Amongst the total diagnosed CHD cases, 489 (55.76%) patients were male, with male to female ratio of 1.2:1. CHDs were diagnosed more commonly between 1 month and 1 year of age (41.28%). The commonest type of acyanotic CHD in the present study was ventricular septal defect (21.44%) and cyanotic CHD was tetralogy of Fallot (18.24%).
Conclusions: Prevalence of CHD in Western Rajasthan, India was 35.20 per 1000 study population. Profile of CHDs in the present study was similar to that in published literature.

Keywords: Congenital heart disease, Echocardiography, Prevalence, Western Rajasthan

INTRODUCTION

Congenital heart disease (CHD) is the most common congenital anomaly, representing a major global health problem. Twenty-eight percent of all major congenital anomalies consist of heart defects.[1]

Understanding the distribution of CHDs in the population is key to assess the burden of these anomalies, including the factors influencing local case mix and severity, in order to anticipate health needs and provide effective and appropriately targeted services for the prevention and management of these conditions.[2]

The most practical measurement of CHD occurrence is birth prevalence per 1,000 live births which is about 9 per 1000 live birth.[3,4] Worldwide prevalence of CHD ranges from 1.01 to 18.1 per 1000 study population.[5,6] The prevalence of CHD in India has been reported to be from 1.3 to 26.4 per 1000 study population.[7,8] Since CHDs are important cause of mortality and morbidity, early diagnosis and treatment may lead to improved prognosis.

METHODS

This was a retrospective study carried out in departments of cardiology and pediatrics of Dr. S. N. Medical College and attached group of hospitals, Jodhpur, India. The

study period was of 3 years duration, from July 2014 to June 2017. Dr. S. N. Medical College Jodhpur is a tertiary care and teaching institute in Western Rajasthan, India. Population drained by this institute is approximately 15 million. The institute caters to patients belonging to all strata of society from Western Rajasthan. The source of information was medical and echocardiographic records of all patients who visited the outdoor and indoor patient departments of pediatrics and cardiology. Clinical examination and 2-D and color Doppler echocardiography were considered as definitive tool for diagnosis of CHD. Records of all patients undergoing transthoracic echocardiography from newborn to 25 years of age were analyzed for age, sex and CHD findings. Congenital heart disease was defined as "a gross structural abnormality of heart or intrathoracic great vessels that is actually or potentially of functional significance excluding the systemic great arteries and veins" as defined by Mitchell et al.[9] Echocardiography was done as per standards laid down by the American Society of Echocardiography, using the M-mode, two-dimensional, color Doppler, pulse and continuous wave Doppler echocardiogram.[10]

Inclusion criteria

- Only first time visiting all comers diagnosed by clinical and transthoracic echocardiographic examination from newborn to 25 years of age were included in the study.

Exclusion criteria

- Previously enrolled patients presenting on follow up visits,

Acquired heart diseases (rheumatic fever, rheumatic heart disease, myocarditis, pericardial disease), mitral valve prolapse, cardiomyopathy (dilated, hypertrophic or restrictive), congenital arrhythmias (such as Long QT syndrome, Wolf-Parkinson- White syndrome).

Data analysis

As this was a descriptive study, data was entered into a Microsoft office excel spread sheet and analyzed. Ratios and percentages were used for evaluation.

RESULTS

A total of 24,914 patients were examined and underwent detailed transthoracic echocardiographic examination during the study period of 3 years. CHD was diagnosed in 877 patients during this period, thus giving a prevalence of 35.20 per 1000 study population. Amongst the total diagnosed CHD cases, 489 (55.76%) patients were males and 388 (44.24%) were females with male to female ratio of 1.2:1.

Table 1: Age wise distribution of 877 cases of CHDs.

Age of CHD	No. of cases	Percentage
Less than 1 month	176	20.06
1 month - 1 year	362	41.28
1 year - 5 year	161	18.36
5 year - 10 year	87	9.92
10 year - 15 year	54	6.16
15 year - 20 year	21	2.40
20 year - 25 year	16	1.82
Total	877	100

Table 2: Age wise and sex wise distribution of acyanotic CHDs.

CHD	<1 month	1 month-1 year	1 year-5 year	5 year-10 year	10 year-15 year	15 year-20 year	20 year-25 year	Total			Percentage of all CHD
								Male	Female	Total	
VSD	30	85	30	19	14	6	4	102	86	188	21.44
ASD	14	51	25	17	10	6	3	58	68	126	14.37
PDA	25	40	27	8	6	2	1	47	62	109	12.43
BAV	9	13	10	5	4	3	6	39	11	50	5.70
PS	7	16	9	7	3	1	0	24	19	43	4.90
PFO	7	16	3	1	1	1	0	14	15	29	3.31
AVCD	8	10	5	2	1	0	0	12	14	26	2.97
PAPVC	2	4	1	0	1	0	0	5	3	8	0.91
COA	0	2	2	0	0	0	0	3	1	4	0.46
Cor triatriatm	0	2	0	0	0	0	0	2	0	2	0.23
Congenital MS	0	0	1	0	0	0	0	1	0	1	0.11
Total	102	239	113	59	40	19	14	307	279	586	66.82

Abbreviations: ASD atrial septal defect; AVCD atrioventricular canal defect; BAV bicuspid aortic valve; CoA coarctation of aorta; MS mitral stenosis; PAPVC partial anomalous pulmonary venous connection; PDA patent ductus arteriosus; PFO patent foramen ovale; PS pulmonary stenosis; VSD ventricular septal defect

Age wise distribution of the 877 cases of CHDs is shown in table 1. Of the total patients diagnosed in the present study, 20.06% were below 1 month, 41.28% were between 1 month to 1 year and 28.28% were 1-10 years of age.

Table 2 presents distribution of acyanotic CHDs. Ventricular septal defect (VSD) (21.44%) was commonest type of acyanotic CHD in the study, followed by atrial septal defect (ASD), patent ductus arteriosus (PDA), bicuspid aortic valve (BAV) and pulmonary stenosis (PS). Acyanotic CHDs were most commonly diagnosed between 1 month to 1 year of age (27.25%).

Table 3 presents distribution of cyanotic CHDs. Tetralogy of Fallot (TOF) (18.24%) was the commonest type of cyanotic CHD in the present study, followed by D- transposition of great arteries (D-TGA), double outlet right ventricle (DORV), tricuspid atresia (TA) and single ventricle (SV). Cyanotic CHDs were most commonly diagnosed between 1 month to 1 year of age (14.02%).

Table 3: Age wise and sex wise distribution of cyanotic CHDs.

CHD	<1 month	1 month-1 year	1 year-5 year	5 year-10 year	10 year-15 year	15 year-20 year	20 year-25 year	Total			Percentage of all CHD
								Male	Female	Total	
TOF	21	73	34	19	10	2	1	95	65	160	18.24
D-TGA	17	12	3	3	0	0	0	28	7	35	3.99
DORV	12	13	6	3	1	0	0	22	13	35	3.99
Tricuspid atresia	11	11	1	1	0	0	0	13	11	24	2.74
Single ventricle	4	2	3	0	0	0	0	5	4	9	1.03
Truncus arteriosus	3	3	0	1	0	0	0	4	3	7	0.79
Ebstein anomaly	0	2	1	1	2	0	0	3	3	6	0.68
L-TGA	0	2	0	0	1	0	1	3	1	4	0.46
TAPVC	0	4	0	0	0	0	0	4	0	4	0.46
Pulmonary atresia	3	1	0	0	0	0	0	2	2	4	0.46
HRHS	2	0	0	0	0	0	0	2	0	2	0.23
HLHS	1	0	0	0	0	0	0	1	0	1	0.11
Total	74	123	48	28	14	2	2	182	109	291	33.18

Abbreviations: D-TGA D-transposition of great arteries; DORV double outlet right ventricle; HLHS hypoplastic left heart syndrome; HRHS hypoplastic right heart syndrome; L-TGA L-transposition of great arteries; TAPVC total anomalous pulmonary venous connection; TOF tetralogy of Fallot

Female preponderance in CHD was noted in ASD and PDA whereas male preponderance was noted in VSD, BAV, PS, TOF, D-TGA, DORV and total anomalous pulmonary venous connection (TAPVC).

DISCUSSION

Over time, the reported total CHD prevalence at birth has increased substantially, from 1 per 1,000 live births in 1930 to 9 per 1,000 live births in recent years. With a worldwide annual birth rate around 150 million births, this corresponds to 1.35 million live births with CHD every year, representing a major public health issue. The increase in reported total CHD birth prevalence over time might be caused by changes in diagnostic methods and screening modalities such as echocardiography which helped in diagnosing very small defects rather than representing a true increase. Amongst the continents, highest reported total CHD birth prevalence was found in Asia (9.3 per 1,000 live births) and the lowest in Africa (1.9 per 1,000 live births).[4,11] Table 4 presents prevalence of CHD in world in various studies. Globally high prevalence of CHD was found in hospital-based studies such as in Australia (17.5/1000) and Pakistan (10.0/1000).[12,13]

Majority of prevalence studies in India were either school based or hospital based as shown in table 5. Kapoor et al.[8] observed higher CHD prevalence of 26.4 per 1000 study population in India due to inclusion of mild, moderate and severe CHDs. Hospital based studies have higher CHD prevalence such as in Mysore (10.65/1000), Mumbai (13.28) and in Varanasi (19.14/1000).[18-20] Higher CHD prevalence of 35.20 per 1000 study population was observed in the present study compared to previously done studies in India and other countries of world. The reason for higher prevalence in the present study was that prevalence of CHD was assessed in

patients who had undergone echocardiography as compared to other studies in which prevalence was assessed among patients attending the hospital outpatient and inpatient department and also inclusion of all small or mild CHDs, and inclusion of cases up to 25 years of age.

Table 4: Prevalence of CHD in world studies.

Author, Ref no.	Country	Study population	Method	Number studied	Prevalence / 1000 study population
Fixer et al,[14]	USA	Community (4-17 year)	Clinical + Echo+ Cath + Surgery + Autopsy Prospective	379,561	6.6
Khalil et al,[15]	Sudan	School (5-15 years)	Clinical + Echo Prospective	13,322	2.0
Bassili et al,[5]	Egypt	School (5-15 years)	Clinical + Echo Prospective	869,434	1.01
Bolisetty et al,[12]	Australia	Hospital (0-1 or more years)	Clinical + Echo Restrospective	6156	17.5
Lindinger et al,[16]	Germany	Community (0-1 year)	Clinical + Echo+ Cath + Surgery + Autopsy Prospective	670,000	10.8
Masood et al,[13]	Pakistan	Hospital (0-13 year)	Clinical + Echo Descriptive	9614	10.0
Liu et al,[17]	China	Community (0-6 months)	Clinical + Echo Prospective	90,796	16.4
Ujuanbi et al,[6]	Nigeria	School (5-14 years)	Clinical + Echo	1712	18.1

Abbreviations: Cath catheterization; Echo echocardiography

Table 5: Prevalence of CHD in Indian studies.

Author, Ref No.	City	Study population	Method	Number studied	Prevalence / 1000 study population
Shrestha et al,[21]	Delhi	School (5-16 years)	Clinical + Echo + Cath + Surgery Collaborative	34,198	3.2
Vashishtha et al,[22]	Agra	School (5-15 years)	Clinical + Echo Prospective	8449	5.2
Thakur et al,[23]	Shimla	School (5-16 years)	Clinical + Echo Prospective	15,080	2.25
Chadha et al,[24]	Delhi	Community (0-15 years)	Clinical + Echo Prospective	11,883	4.2
Smitha et al,[18]	Mysore	Hospital (0 to 10 or more years)	Clinical + Echo Retrospective	74,589	10.65
Kapoor et al,[8]	Kanpur	Hospital (0-15 years)	Clinical + Echo Retrospectiv	10,641	26.4
Misra et al,[7]	Gorakhpur	School (4-18 years)	Clinical Prospective	118,212	1.3
Bhat et al,[25]	Dehradoon	Hospital (0-18 years)	Clinical + Echo Prospective	36,541	8.54
Sawant et al,[19]	Mumbai	Hospital (Live birth)	Clinical + Echo Prospective	2636	13.28
Bhardwaj et al,[20]	Varanasi	Hospital (0-68 years)	Clinical + Echo Prospective	34,517	19.14
Present study	Jodhpur	Hospital (0-25 years)	Clinical + Echo Retrospectiv	24,914	35.20

Abbreviations: Cath catheterization; Echo echocardiography

There was male preponderance with male to female ratio of 1.2:1 in the present study, as was also shown by Chadha et al, whereas female preponderance in CHDs was observed by Thakur et al.[23,24] The age at detection of CHD varies due to normal hemodynamic changes such as time lag in fall of pulmonary vascular resistance and closure of PDA occurring after birth. In the present study maximum number of cases (41.28%) were diagnosed between 1 month to 1 year of age and only 10.38% cases were diagnosed after 10 years of age. These findings were also consistent with study by Bhat et al.[25] in which 43% cases were detected by infancy and Smitha et al, in which maximum CHDs were detected in first year of life when compared to later years of life.[18]

Most common CHD observed in the present study was VSD accounting for 21.4% of cases. This was consistent with other studies done in India as shown in Table 6 except the study done by Thakur et al, in which ASD was the commonest CHD observed.[21] TOF was the most common

cyanotic CHD observed in 18.2% cases in the present study, correlating well with other Indian studies.[18-22]

Table 6: Profile of individual CHD in Indian studies.

Author, Ref no.	Profile of individual CHD (% of all CHD)												
	VSD	ASD	PDA	PS	AVCD	CoA	TOF	D-TGA	DORV	Ebstein Anomaly	TA	PA	TAPVC
Shrestha et al,[21]	30	23	11	10	-	-	4	-	-	-	-	-	-
Vashishtha et al,[22]	40.9	11.4	4.5	9.1	-	-	13.6	-	-	-	-	-	-
Thakur et al,[23]	32.2	38.2	-	-	-	-	-	-	-	-	-	-	-
Chadha et al,[24]	46	18	14	4	-	-	10	-	-	-	-	-	-
Smitha et al,[18]	40.5	19.1	9.5	-		-	13.4	-	-	-	-	-	-
Kapoor et al,[8]	21.3	18.9	14.6	3.2	10.3	-	4.6	1.1	0.4	1.1	-	-	0.4
Misra et al,[7]	40.8	18.3	2.1	8.5	-	-	-	-	0.7	1.4	-	-	-
Bhat et al,[25]	30.5	17.6	9.6	6.4	1.6	2.6	5.5	5.1	0.6	1.3	1.9	3.2	1.3
Sawant et al,[19]	42.9	25.7	5.7	2.9	-	2.9	8.6	-	-	-	2.9	-	-
Bhardwaj et al,[20]	33.3	19.1	4.1	1.5	2.4	0.6	16.8	2.9	1.5	0.6	0.8	-	0.9
Present study	21.4	14.4	12.4	4.9	2.97	0.5	18.2	3.99	3.99	0.68	2.7	0.5	0.46

Abbreviations: ASD atrial septal defect; AVCD atrioventricular canal defect; CoA coarctation of aorta; DORV double outlet right ventricle D-TGA D-transposition of great arteries; PA pulmonary atresia; PDA patent ductus arteriosus; PS pulmonary stenosis; TA tricuspid atresia; TAPVC total anomalous pulmonary venous connection; TOF tetralogy of Fallot; VSD ventricular septal defect

The present study was peculiar as the prevalence was highest as it was assessed in the patient population who underwent echocardiography as compared to other Indian studies in which prevalence was seen among patients attending inpatient and outpatient department. Authors have also studied patients up to 25 years of age which is higher as compared to most other Indian studies.

Limitation of the present study is that being a hospital-based study it does not reflect true community prevalence.

CONCLUSION

Prevalence of CHD in Western Rajasthan, India was 35.20 per 1000 study population. Profile of various CHDs in the present study was largely similar to the preexisting studies. In this era of most accurate diagnostic modalities, any clinical suspicion of CHD should be confirmed by echocardiography to hasten the diagnosis, timely management and prevention of complications.

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