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ORIGINAL ARTICLE

Frequencies of Different Congenital Heart Diseases in Children Coming for Echocardiography in a Tertiary Care Hospital

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ABSTRACT

Objective: To find out the frequencies of different congenital heart diseases (CHD) in children presenting for echocardiography.

Study Design: Descriptive, cross-sectional

Place and Duration of Study: March 2018-March 2020, Jinnah Hospital, Lahore

Material and Methods: 298 children presenting for echocardiography and diagnosed as CHD were included. Echocardiographic findings of all children were recorded and analyzed using SPSS-22.0.

Results: Of 298 patients, there were 153 (51.3%) male and 145 (48.7%) female patients respectively. Ventricular septal defects (VSD), atrial septal defects (ASD), tetralogy of Fallot (TOF) and patent ductus arteriosus (PDA) were the most frequent CHDs in decreasing order of frequency found in 82 (27.5%), 73 (24.5%), 39 (13.1%) and 23 (7.7%) patients respectively. The subjects having acyanotic and cyanotic heart diseases were 235 (78.9%) and 63 (21.1%) respectively. The most frequent acyanotic and cyanotic diseases in children were VSD (82, 27.5%) and TOF (39, 13.1%) respectively. Most frequent type of VSD was peri-membranous found in 72.0% (59) of VSD patients and most common ASD type was secundum seen in 72.6% (53) of ASDs. Severe pulmonary hypertension was seen in 13.4% of VSD and 16.4% of ASD patients.

Conclusion: In children, the most frequent congenital heart diseases were VSD, ASD, TOF and PDA in descending order of frequency. The most common acyanotic and cyanotic heart diseases were VSD and TOF respectively.

Key Words: Congenital heart diseases, Echocardiography, Ventricular septal defect

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INTRODUCTION

Congenital heart diseases (CHD) is a group of diseases in which the cardiocirculatory structure or function is abnormal at birth which is

sometimes discovered in adulthood.¹ Almost 0.8% of live births are complicated by cardiovascular abnormalities.¹ Congenital heart disease (CHD) is one of the commonest congenital anomalies leading to high morbidity and mortality and make

up one third of all congenital birth defects.² Nine out of every 1000 live births are suffering from any type of congenital heart diseases.^{3,4} The birth prevalence of this group of diseases have increased significantly (p value 0.03) during past 15 years reaching a highest level of 9.41 per 1000 births during 2010 to 2017.⁵ The prevalence of CHD is significantly higher ($p < 0.001$) in Asia than in any other part of the world. Also the rate of increase of the prevalence in the recent years (33% per 5 years) is also significantly higher ($p = 0.003$) in Asia than all other regions of the world.⁵ According to one Pakistani study, the congenital heart diseases occur in 82.9% of all heart patients having age less than 16 years presenting to a tertiary care hospital.⁶ According to this study, congenital heart disease was the most common spectrum of cardiac diseases in children. Another local study showed the congenital heart disease to be the second most common set of cardiac diseases (44.7%) after rheumatic heart disease (55.2%) among patients presenting for echocardiography.⁷ According to Rizvi et al, the prevalence of CHD in rural population of Pakistan was 3.4/1000.⁸

There is data available on the prevalence of CHD in children of Pakistan but there have been much less local data on the frequencies of different types of congenital heart diseases. So we conducted the present study to find out the frequency distribution of different types of CHD in the children presenting for echocardiography.

MATERIAL AND METHODS

It was a descriptive cross-sectional study conducted at Jinnah Hospital, Lahore from March 2018 to March 2020. The sampling was done by purposive non-probability technique. All children of less than 16 years of age who presented to echocardiography department of our cardiology unit and were diagnosed on echocardiography to have any type of congenital heart disease were included in the study. Exclusion criteria were the age > 16 yrs, presence of any acquired heart disease including rheumatic heart disease, acquired valvular diseases, cardiomyopathies and myocarditis. The sample size of 298 was calculated with 98% confidence interval and 5% margin of error with expected proportion of CHD to be 82.9% according to previous study by

Rashid et al.⁶ Echocardiographic findings of all patients regarding diagnosis, size of the lesion, type of the lesion (in case of ventricular or atrial septal defects), direction of the shunt, pulmonary hypertension and any associated lesion were saved on a proforma.

Data was analyzed using SPSS 22.0 software. The scale variables like age were presented by means and standard deviation. The categorical variables like gender, diagnosis, size of lesion, direction of the shunt, type of the lesion, pulmonary hypertension and any associated lesion were presented by frequency distributions and percentages.

RESULTS

Out of the total 298 study subjects, 153 (51.3%) were male while 145 (48.7%) were female. Mean age of the study subjects was 10.6 ± 4.3 years.

In the order of frequency, the largest number of children i.e. 82 (27.5%) had ventricular septal defects (VSD) followed by atrial septal defects (ASD), tetralogy of Fallot (TOF) and patent ductus arteriosus (PDA) which were present in 73 (24.5%), 39 (13.1%) and 23 (7.7%) children respectively.

Bicuspid aortic valve (AV), mitral valve prolapse (MVP), sub-aortic stenosis, pulmonary atresia, transposition of great arteries (dTGA) and pulmonary stenosis (PS) were present in 21 (7.0%), 15 (5.0%), 9 (3.0%), 9 (3.0%) and 7 (2.3%) patients respectively.

Least frequent congenital heart diseases in our study were partial anomalous pulmonary venous connections (PAPVCs), AV canal defect (AVSD), right ventricular outflow tract (RVOT) obstruction and coarctation of aorta. These diseases were found in 6 (2.0%), 4 (1.3%), 4 (1.3%) and 1 (0.3%) subjects respectively.

The study subjects having acyanotic and cyanotic heart diseases were 235 (78.9%) and 63 (21.1%) respectively. The most frequent acyanotic heart disease was VSD (82, 27.5%) and most common cyanotic heart disease was TOF (39, 13.1%).

Taking the biggest subgroup of our study i.e. VSD subjects, male and female patients were 58

(70.7%) and 24 (29.3%) respectively making a total of 82 children. The most frequent type of VSD was peri-membranous being present in 72.0% (59) of VSDs followed by muscular VSDs in 14.6% (12) and outlet VSDs in 13.4% (11) children. The shunt through VSD was left to right in most 65 (79.3%) patients followed by bidirectional and right to left shunt in 12 (14.6%) and 5 (6.1%) patients respectively. Severe pulmonary hypertension was found in only 11 (13.4%) children of VSDs. VSDs were small, moderate and large sized in 41 (50.0%), 17 (20.7%) and 24 (29.3%) subjects respectively. MVP, PDA, ASD and supramitral membrane were found as associated lesions along with VSD in 2 (2.4%), 2 (2.4%), 1 (1.2%) and 1 (1.2%) patients respectively (table 2).

TABLE 1: Frequencies of different congenital heart

diseases in study subjects

	Males n (%)	Females n (%)	Total n (%)
VSD	58 (19.5)	24 (8.1)	82 (27.5)
ASD	25 (8.4)	48 (16.1)	73 (24.5)
TOF	21 (7.0)	18 (6.0)	39 (13.1)
PDA	7 (2.3)	16 (5.4)	23 (7.7)
Bicuspid AV	11 (3.7)	10 (3.4)	21 (7.0)
MVP	7 (2.3)	8 (2.7)	15 (5.0)
Sub-aortic stenosis	5 (1.7)	4 (1.3)	9 (3.0)
Pulmonary atresia	3 (1.0)	6 (2.0)	9 (3.0)
dTGA	6 (2.0)	3 (1.0)	9 (3.0)
PS	5 (1.7)	2 (0.7)	7 (2.3)
PAPVCs	1 (0.3)	5 (1.7)	6 (2.0)
AVSD (AV canal defect)	2 (0.7)	2 (0.7)	4 (1.3)
RVOT obstruction	1 (0.3)	3 (1.0)	4 (1.3)
Coarctation of aorta	1 (0.3)	0 (0.0)	1 (0.3)
VSD+PS	1 (0.3)	0 (0.0)	1 (0.3)

TABLE 2: Characteristics of subgroup of patients having VSD

Gender	Male	58 (70.7%)	VSD Type	Peri-membranous	59 (72.0%)
	Female	24 (29.3%)		Outlet	11 (13.4%)
	Total	82 (100%)		Muscular	12 (14.6%)
Shunt Direction	Left to Right	65 (79.3%)	Size of VSD	Small	41 (50.0%)
	Bidirectional	12 (14.6%)		Moderate	17 (20.7%)
	Right to Left	5 (6.1%)		Large	24 (29.3%)
Pulmonary hypertension (PHT)	No PHT	31 (37.8%)	Associated Lesion	MVP	2 (2.4%)
	Mild	25 (30.5%)		PDA	2 (2.4%)
	Moderate	15 (18.3%)		ASD	1 (1.2%)
	Severe	11 (13.4%)		Supramitral Membrane	1 (1.2%)

Note: Nine patients of dTGA also had VSD but they were counted under dTGA and VSD was obligatory in them. Similarly 4 patients of AVSD were taken under AV canal defect, a separate entity.

Atrial septal defects (ASD) were present in 73 children out of which 25 (34.2%) were male and 48 (65.8%) were female. Primum, secundum and sinus-venosus ASDs were present in 7 (9.6%), 53 (72.6%) and 13 (17.8%) subjects respectively. Severe pulmonary hypertension was present in only 12 (16.4%) subjects with ASD. Considering the sizes of ASDs, small, moderate and large sized ASDs were present in 6 (8.2%), 27 (37.0%) and 40 (54.8%) respectively. Shunt through the ASDs was seen mostly in left to right direction (57, 78.1%) followed by bidirectional and right to left

shunts in 14 (19.2%) and 2 (2.7%) respectively. The lesions present along with ASDs were PAPVCs, MVP, cleft mitral valve (MV), PS and Lutembacher Syndrome in 5 (6.8%), 4 (5.5%), 2 (2.7%), 2 (2.7%) and 2 (2.7%) patients respectively (table 3).

Patent ductus arteriosus (PDA) was present in 23 (7.7%) children. All 23 patients of PDA had left to right shunt and most of them (60.9%, 14) had no associated pulmonary hypertension. Two patients of PDA (8.6%) had VSD and one patient (4.3%) had MVP as associated lesions (table 4).

TABLE 3: Characteristics of subgroup of patients having ASD

Gender	Male	25 (34.2)	ASD Type	Primum	7 (9.6)
	Female	48 (65.8)		Secundum	53 (72.6)
	Total	73 (100.0)		Sinus-venosus	13 (17.8)
Shunt Direction	Left to Right	57 (78.1)	Size of ASD	Small	6 (8.2)
	Bidirectional	14 (19.2)		Moderate	27 (37.0)
	Right to Left	2 (2.7)		Large	40 (54.8)
Pulmonary hypertension (PHT)	No PHT	3 (4.1)	Associated Lesion	PAPVCs	5 (6.8)
	Mild	22 (30.1)		MVP	4 (5.5)
	Moderate	36 (49.3)		Cleft MV	2 (2.7)
	Severe	12 (16.4)		PS	2 (2.7)
				Lutembacher Syndrome	2 (2.7)

Note: Four patients of AVSD were not counted under primum ASD and were taken as AV canal defect, a separate entity.

TABLE 4: Characteristics of subgroup of patients having PDA

Characteristics	Number (%)	
Sex	Male	7 (30.4)
	Female	16 (69.6)
	Total	23 (100.0)
Size of PDA	Small	5 (21.7)
	Moderate	9 (39.1)
	Large	9 (39.1)
Direction of Shunt	Left to Right	23 (100)
	Right to Left	0 (0.0)
Pulmonary Hypertension (PHT)	No PHT	14 (60.9)
	Mild	4 (17.4)
	Moderate	4 (17.4)
	Severe	0 (0.0)
Associated Lesions	VSD	2 (8.6)
	MVP	1 (4.3)

DISCUSSION

Out of all children of age less than 16 years presenting to tertiary care unit with cardiac diseases, 82.9% have congenital heart diseases.⁶ It is worth noting that 90% congenital heart diseases (CHD) are treatable and if early and timed diagnosis is done, they have good long term survival.² However, low socioeconomic countries like Pakistan lack the facilities of coping with these diseases as the birth prevalence of 9 per 1000 births⁵ pose a great burden on health system. Study by Rashid et al. found that the diagnosis of CHD is delayed in Pakistan in majority of children because of lack of trained health personnels and poor socioeconomic conditions.⁹

In the present study we measured the frequencies of different types of congenital heart diseases in children under 16 years of age presenting to echocardiography department of Jinnah Hospital,

Lahore. The most frequent CHD in children was ventricular septal defect (VSD) which was seen in 27.5% of the study subjects. This finding was in harmony with the previous studies by Rashid et al⁶, Sheikh et al⁷ and Ahmad et al¹⁰ who also found the VSD as the commonest congenital heart disease. Patel et al¹¹ however found VSD as the second most common CHD after Tetralogy of Fallot (TOF). Ahmad et al¹⁰ found the VSD to be most common CHD in the neonates even.

It was worth noting that our study showed the VSD, ASD, TOF and PDA in the decreasing order of frequency to be the first four most frequent congenital heart diseases (CHDs) being present in 27.5%, 24.5%, 13.1% and 7.7% study subjects respectively. The same diseases were seen to be the most frequent CHDs in the previous Pakistani studies by Rashid et al⁶ and Patel et al¹¹ as well as Indian study by Chatterjee et al¹². The same findings were also seen in neonates by Bibi et al¹³ as well as in grown-up patients (after the age of childhood) by Mughal et al¹⁴. In grown-up patients, however, the most frequent disease was ASD as compared to VSD. May the cause to this be that ASDs become symptomatic and are diagnosed at later ages in the life.

Like the previous studies by Rashid et al⁶, Sheikh et al⁷ and Patel et al¹¹, our study also showed that the most frequent acyanotic and cyanotic diseases in children were VSD and TOF respectively. In the grown-up patients, however, the most common acyanotic CHD was seen to be ASD although the most frequent cyanotic CHD was still TOF.¹⁴

We analyzed the biggest study subgroup i.e. VSD group and found that most common type of VSDs was peri-membranous type present in 72.0% of all VSD patients followed by muscular and then outlet (subarterial or doubly committed) VSDs in 14.6% and 13.4% of VSD patients respectively. The same pattern in the types of VSDs was seen by Hussain et al.¹⁵

In the present study, almost half of the patients of VSDs (50.0%, 41) were having small sized VSDs and majority (79.3%) of VSDs were having left to right shunt. Only 6.1% of the VSD patients had right to left shunt. Severe pulmonary hypertension was present in 13.4% of VSDs. Previous study by Hussain et al¹⁵ showed the severe pulmonary hypertension to be present in association with 22.17% of VSDs.

The most frequent type of ASDs seen in our study was secundum ASDs being present in 72.6% of all ASD patients. This finding was in agreement with the previously present data¹⁶. In majority of the ASD patients (57, 78.1%), the shunt was left to right. Also in 40 (54.8%) patients, the ASD was large sized and pulmonary hypertension was severe in 12 (16.4%) patients. Associated lesion seen with ASD were PAPVCs, MVP, Cleft MV, PS and mitral stenosis (Lutembacher Syndrome) in decreasing order of frequency.

CONCLUSION

The most frequent congenital heart diseases in children were VSD, ASD, TOF and PDA having frequencies of 27.5%, 24.5%, 13.1% and 7.7% respectively. Most common acyanotic and cyanotic heart diseases were VSD and TOF respectively. Most frequent type of VSD was perimembranous and most common ASD were of secundum type.

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