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ORIGINAL ARTICLE

Arrhythmias in children with congenital heart defects.

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ABSTRACT… Objective: To find out the prevalence of different types of arrhythmias in children with congenital heart defects (CHDs) presenting at a tertiary care hospital. **Study Design:** Cross-sectional study. **Setting:** Department of Pediatrics, Rai Medical College Teaching Hospital, Sargodha Pakistan. **Period:** July 2021 to June 2022. **Material & Methods:** A total of 120 children of both genders aged 1 day to 16 years and presenting to study setting with confirmed CHDs were evaluated. At the time of enrollment, demographical information and disease history were noted. Necessary laboratory investigations like complete blood count and serum electrolytes were analyzed while standard electrocardiography (ECG) was performed. Prevalence of different types of arrhythmias was noted. **Results:** In a total of 120 children with CHDs, 64 (53.3%) were boys. Mean age was be 2.7±2.1. Most common electrolyte abnormalities were noted to be hyponatremia and hypermagnesemia found in 39 (32.5%) and 26 (21.7%) children respectively. There were 31 (25.8%) children who were diagnosed to have arrhythmias. Out of these 31 children, first degree A-V block was the most common types of arrhythmias observed in 24 (77.4%) cases while ectopic A-V rhythm were found in 3 (9.7%). **Conclusion:** The findings of this research revealed that arrhythmias are quite common among children having CHDs. There is a need to routine assessment for the possible presence of arrhythmias among children presenting with CHDs.

Key words: Arrhythmias, Congenital Heart Defect, Electrocardiography.

INTRODUCTION

The congenital heart defects (CHDs) are known to be the most frequent birth defects among newborns and its incidence is calculated to be around 9/1,000 live-births.[1] The incidence of arrhythmias usually rises with increase in the age of patients having CHDs.[2,3] Moreover, arrhythmias are considered to be the most common complaint requiring hospitalization among adult CHD cases.[4,5] The presence of arrhythmias might represent congenitally malformed or abnormal conduction system, displaced hemodynamics, hypoxic stress or residual of post-surgical sequelae.[6] The presence of arrhythmias among children with CHDs represents a unique and challenging scenario for pediatric cardiologists especially in the developing countries.[7]

As in a developing country like Pakistan, very few children get timely corrective surgeries so many of these children are thought to develop complications such as heart failure, severe cyanosis and arrhythmias. Range of arrhythmias subtypes may present among children with CHDs where several types might co-exist.[8] The literature shows that children with CHDs often represent with arrhythmias but local literature lacks evidence in this regards. A study from Uganda found prevalence of arrhythmias among children with CHDs to be 27.3%.[9] No major data exists regarding prevalence of different types of arrhythmias among children with CHDs in Pakistan so the present study was aimed at finding out the prevalence of different types of arrhythmias in children with CHDs presenting at a tertiary care hospital.

MATERIAL & METHODS

This cross-sectional study was performed at the Department of Pediatrics, Rai Medical College

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Teaching Hospital, Sargodha Pakistan from July 2021 to June 2022. Approval from "Institutional Ethical Committee" was obtained (certificate number: ERC/2021/173). Informed as well as written consents were obtained from parents/ caregivers or all study participants. A sample size of 120 cases was calculated considering prevalence of arrhythmias as 27.3% among children with CHDs with 95% confidence level and 8% margin of error. Inclusion criteria were children of both genders aged 1 day to 16 years and presenting to study setting with confirmed CHDs (as per medical history and record). Exclusion criteria were children having acquired heart disease or those whose parents/caregivers refused to be part of this research.

Children were enrolled form outpatient and emergency department as per inclusion/exclusion criteria. At the time of enrollment, demographical information and disease history were noted. Evaluation for features of heart failure was done and heart failure was graded as per severity according to "modified Ross Score". Children were categorized as no or mild heart failure with scores between 0-6 while children with scores above 6 were categorized as moderate to severe heart failure.[10,11] Necessary laboratory studies like complete blood count and serum electrolytes were analyzed using institutional laboratory while standard electrocardiography (ECG) was performed by a qualified electrocardiography technician while the children were in supine position. The ECG findings were interpreted by a cardiologist with post-graduate experience of 3 years or above. Hemoglobin below 10 g/dl were labeled as anemia while serum electrolyte parameters were labeled as per "Nelson Textbook of Pediatrics", 18th Edition.[12]

Data analysis was performed by "Statistical Package for Social Sciences (SPSS)" version 26.0. Quantitative variables were represented as mean and standard deviation (SD). Qualitative data were highlighted as frequency and percentages.

RESULTS

In a total of 120 children with CHDs, 64 (53.3%) were boys. The mean age was 2.7±2.1 years whereas 66 (55.0%) children were aged below 1 year. Area of residence was rural in 71 (59.2%) children. Most common electrolyte abnormalities were noted to be hyponatremia and hypermagnesemia found in 39 (32.5%) and 26 (21.7%) children respectively. Moderate/severe heart failure were noted in 34 (28.3%) children. Baseline characteristics of studied cases are shown in Table-I.

Characteristics		Number (%)
Gender	Boys	64 (53.3%)
	Girls	56 (46.7%)
Age (years)	<1	66 (55.0%)
	1-5	33 (27.5%)
	5-10	15 (12.5%)
	11-16	6 (5.0%)
Area of Residence	Rural	71 (59.2%)
	Urban	49 (40.8%)
Electrolyte Abnormalities	Hyperkalemia	15 (12.5%)
	Hypokalemia	4 (3.3%)
	Hypernatremia	18 (15.0%)
	Hyponatremia	39 (32.5%)
	Hypermagnesemia	26 (21.7%)
Heart Failure	No/Mild	86 (71.7%)
	Moderate/Severe	34 (28.3%)

Table-I. Characteristics of the children (n=120)

Distribution of types of CHDs revealed that ventricular septal defect (VSD), atrial septal defect (ASD), tetralogy of fallot (TOF) and patent ductus arteriosus (PDA) were the most frequent types seen in 36 (30.0%), 23 (19.2%), 19 (15.8%) and 13 (10.8%) children respectively as shown in Table-II.

Types of Congenital Heart Disease	Frequency (%)
Ventricular septal defect	36 (30.0%)
Atrial septal defect	23 (19.2%)
Tetralogy of Fallot	19 (15.8%)
Patent ductus arteriosus	13 (10.8%)
Transposition of the great arteries with Ventricular septal defect	5 (4.2%)
Complete artrio-ventricular defect	4 (3.3%)
Truncus arteriosus	4 (3.3%)
Tricuspid atresia	4 (3.3%)
Complex heart disease	3 (2.5%)
Others	9 (7.5%)

Table-II. Types of congenital heart defect (n=120)

There were 31 (25.8%) children who were diagnosed to have arrhythmias. Out of these 31 children, first degree A-V block was the most common types of arrhythmias observed in 24 (77.4%) cases while ectopic A-V rhythm were found in 3 (9.7%). Frequency of types of arrhythmias in children having CHDs is shown in Figure-1.

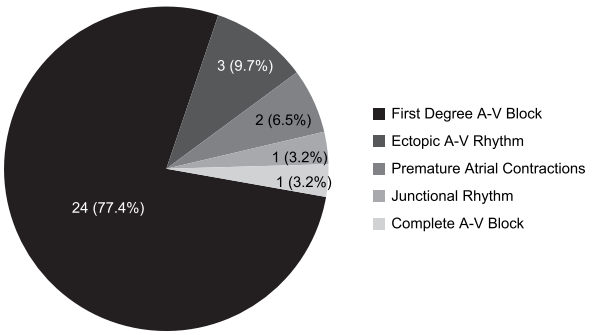

Figure-1. Frequency of types of arrhythmias in children having congenital heart defects n (n=31)

DISCUSSION

Pediatric age groups with CHDs are thought to develop arrhythmias frequently but not much work is seen in Pakistan in this specific research area so this study was conducted. If children are not diagnosed early and managed timely, the arrhythmias may go on to contribute to significant morbidity and mortality among children with CHDs. This research revealed the prevalence of arrhythmias as 25.8% presenting at a tertiary care hospital with CHDs which means that nearly 1/4th of all CHD children were having arrhythmias. These findings are somewhat similar to what was found by a study conducted in Uganda where the prevalence of arrhythmias among children with CHDs was 27.3%.[9] Studies in the past have noted much higher prevalence of arrhythmias among patients CHDs (41.2%) but difference is diagnostic modality like the utilization of holter ECGs could be reason why there is a difference between ours and others findings. As holter ECGs are not always available in a developing country like Pakistan, we had employed standard 12 lead ECGs for this research as is the case at most settings.

In this study, we found that first degree A-V block was the most commonest type of arrhythmias observed in 77.4% cases while ectopic A-V rhythm were found in 9.7%. A study done by Waldo and coworkers noted first degree A-V block to be the most frequent type of arrhythmias but only in 44.4% which is much lower than what we found.[15] A study done by Batte A et al found first degree A-V block as the commonest type of arrhythmias in 83.0% among children with CHDs.[9] Not much literature is available exploring types of arrhythmias among children with CHDs especially A-V block is not well described in the past by researchers so we have limitations comparing our findings with the contemporary data. In the past, first degree A-V block was perceived to be a benign abnormality but recently, researchers have described first degree A-V block to be linked with higher risk of atrial fibrillation, pace-maker implantations as well as all-cause mortality especially in higher age groups.[16] It has also been observed that cases accompanying borderline first degree A-V block during normal sinus rhythm might also have underlying dual A-V node physiology and might be at increased risk for clinical atrioventricular nodal re-entry tachycardia (AVNRT).[17] In our population, no national registry exists for enrollment and tracking of children with CHDs but it is estimated that many of the CHD cases grow into adults while not many are having corrective surgeries at the defined appropriate age, there is a need for all CHD cases to undergo ECG whenever they present to healthcare facilities for any reasons.

Being a single center study with a relatively small sample size, our findings should not be generalized. Prospective studies involving larger sets of data of different age groups will further help us in estimating the impact and outcomes related to arrhythmias among children with CHDs. There is also a need to conduct studies for the identification of possible factors contributing to different types of arrhythmias among children with CHDs.

CONCLUSION

The findings of this research revealed that arrhythmias are quite common among children having CHDs. There is a need to routine assessment for the possible presence of

arrhythmias among children presenting with CHDs.

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5	Veena Kumari	Literature review, References.	
6	Khurram Shahnawaz	Drafting, References.	
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