

Clinico-etiological profile of arrhythmia in children.

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Abstract

Background: Arrhythmias is a relatively unexplored arena of pediatric cardiology. The clinical presentation, types and management is highly variable. Recognition of pediatric arrhythmias is essential as prompt treatment can be lifesaving.

Objective: To study the clinical and etiological profile of arrhythmias in children in IPD patients in tertiary care center in Delhi.

Methods: The study consisted of 27 consecutive children, 1 month-12 years, presenting with cardiac arrhythmias or developing arrhythmias during hospital stay (IPD). Children with sinus arrhythmia, sinus tachycardia, sinus bradycardia and post-operative congenital heart disease patients were excluded from the study. The demography, clinical presentation, underlying heart diseases, electrolyte and blood gas disturbances, treatment modalities and outcome of various arrhythmias was studied. Data was compiled and analyzed using SPSS software.

Results: The most common age group was 3 months-2 years. The most common type of arrhythmia was tachyarrhythmia of which supraventricular tachyarrhythmia was the most common. PSVT was the most common supraventricular arrhythmia and the most common arrhythmia overall. Most common risk factor identified was underlying congenital heart disease. Treatment modalities varied depending upon the type and etiology of arrhythmia.

Conclusion: Cardiac arrhythmias have a wide variety of clinical manifestations and can present at any time from birth through adolescence. A high index of suspicion is needed as prompt recognition and treatment can be lifesaving.

Keywords: Electrocardiography, Heart disease, Arrhythmias, Etiology.

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Introduction

Arrhythmia is defined as an alteration of normal (sinus) cardiac rhythm. It is not as common in children as in adults but occurs with sufficient frequency to be a cause for concern. In pediatric patients, it can vary from the occasional extra beat to the occurrence of such rapid heart rates that heart failure supervenes. In children, most arrhythmias result from primary cardiac lesions or spontaneously or following intracardiac surgical procedures [1,2]. Other conditions like electrolyte abnormalities, drugs (digitalis, recreational drugs), and toxins, neurologic, immunologic or infectious diseases can also lead to arrhythmias. In developing countries like India, very few children with CHD get early corrective heart surgery especially in government set-up where waiting period is very long. Due to delayed surgery, these children develop many complications such as heart failure, severe cyanosis and other long-term sequelae which increase their risk of developing arrhythmias. In addition, children in low resource settings are at an increased risk of, infections electrolyte imbalances; factors which increase the risk of developing arrhythmias. The symptomatology of arrhythmias depends on the rate, rhythm and age of presentation. The different characteristics of arrhythmias and a more frequent presence of congenital heart disease make its management in this population different from that in adults.

Materials and Methods

This observational descriptive study was conducted at a tertiary care hospital in North India from January 2016 to December 2016. 27 consecutive children aged 1 month-12 years presenting with arrhythmias were enrolled after informed and written parental consent and assent. It was approved by the institutional review board. Children with sinus arrhythmia, sinus tachycardia, sinus bradycardia and post-operated congenital heart disease were excluded from the study. Detailed history and clinical examination was carried out. Chest X-Ray, 12 lead and long lead II Electrocardiography (ECG) was done. Blood investigations including serum sodium, potassium, calcium, arterial blood gas analysis and echocardiography was done. Other investigations relevant to the case were done. Treatment modalities of various arrhythmias was studied. Statistical analyses were performed using SPSS statistical software.

Results

Out of 27 patients, 11 (41%) were in the age group 3 months to 2 years. The least common age group was 10 years-12 years. Mean age at presentation was 49 months. There was a male preponderance with 17 (63%) males and 10 females (37%) (Table 1).

	1-3 months	3 months-2 years	2-10 years	10-12 years	P value
Male	3	8	6	0	0.53
Female	3	3	3	1	

Table 1. Age and sex distribution of cases.

The clinical symptoms were varied. Cough and fast breathing were the most common symptoms (Table 2).

≤ 24 months (n=15)	>24 months (n=12)
Cough 11/15	Palpitations 6/12
Fast breathing 6/15	Cough 4/12
Excessive crying 6/11	Chest pain 2/12

Table 2. Symptoms of children presenting with arrhythmias.

In our study, Heart disease was present in 16/27 (59%) of patients. 10 (37%) had congenital heart disease and 6 (22%) had acquired heart disease. The following table shows the types of arrhythmias found in various congenital heart diseases (Tables 3 and 4).

Heart disease	Arrhythmia	Number of patients
VSD	First degree A-V block, PAC	3,1
TOF	First degree A-V block, EAT	2,1
L-TGA	CHB	2
D-TGA	PSVT	1

Table 3. Types of arrhythmia in various Congenital heart diseases (n=10).

Heart Disease	Arrhythmia	Number of Patients
Viral myocarditis	VPC, VT	1,1
Diphtheric myocarditis	VT	1
DCM	VT, PJRT	1,1
RHD	AF	1

Table 4. Types of arrhythmia in various acquired heart diseases (n=6).

Most common type of arrhythmia was tachyarrhythmia seen in 20/27 (74%) patients, followed by bradyarrhythmia in 7/27 (26%) patients. Among the tachyarrhythmias, 16/20 (80%) cases were Supraventricular Tachyarrhythmias (SVT) and four (20%) were ventricular arrhythmia. Of the 16 cases of SVT, twelve patients had PSVT (75%). Other SVTs included Atrial Fibrillation (AF), Ectopic Atrial Tachycardia (EAT) and

Premature Atrial Complexes (PAC). Thus, PSVT was the most common tachyarrhythmia and the most common arrhythmia overall, constituting 44% of all arrhythmias. Among the ventricular tachyarrhythmias, there were 3 patients with Ventricular Tachycardia (VT) and 1 patient with Ventricular Premature Complexes (VPC) (Table 5).

Arrhythmia	Number of patients
PSVT	12
EAT	1
PAC	1
AF	1

PJRT	1
VT	3
VPC	1

Table 5. Types of tachyarrhythmia (n=20).

Among the 12 patients of SVT, underlying heart disease was present only one patient (D-TGA) while rest 11 patients had structurally normal heart. There were 7 cases of bradyarrhythmias which constituted 26% of all arrhythmias.

All cases had underlying congenital heart disease. Five patients had first degree AV-block which was the most common bradyarrhythmia while two patients presented with complete heart block, both of which had CC-TGA (Table 6).

Arrhythmia	Number of Patients
First degree heart block	5
Complete heart block	2

Table 6. Types of bradyarrhythmia (n=7).

Associated risk factor contributing to the development of arrhythmia was present in four cases. One case of myocarditis with acute-gastro-enteritis and hypokalemia developed VPC while 3 cases of VSD who had first degree AV block were all on digoxin.

contractions, junction rhythm, complete Atrioventricular (AV) dissociation or Premature Ventricular Contractions (PVCs) [8]. The apparent high incidence of heart disease in this study may be attributed to the large number of heart disease patients coming to this tertiary care centre.

Discussion

A total of 27 patients were recruited in the study. The mean age at presentation was 49 months. There were 17 (62%) patients in age group (birth 2 years), 9 (33%) between 2 years-10 years and only one patient (5%) in age group 10 years-12 years . This corroborates with the study by Sachetti and colleagues, which showed a bimodal distribution [3]. The steady increase in age group 2 years-10 years may be the result of development of re-entry pathways in existing aberrant conducting tissues [4]. In our study, there was male preponderance with 17/27 (63%) patients being males. 4/7 infants with SVT were males. This is similar to the study on SVT by Van der Merwe and colleagues, who found that there were 13 males and 11 female infants [5]. The male preponderance of SVT when the onset is in infancy has been verified in several reports.

Most common heart disease overall and most common acyanotic CHD found to be associated with arrhythmia was VSD. Most common cyanotic CHD found to be associated with arrhythmia was TOF. Most common arrhythmia found to associated with CHD overall was first degree AV-block. Of the children who had first degree AV block, none ever had corrective heart surgery. Among those with acquired heart disease majority had ventricular arrhythmia while one patient with rheumatic heart disease had atrial fibrillation and one patient with DCM developed PJRT. Most common type of arrhythmia was tachyarrhythmia seen in 20/27 (74%) patients, followed by bradyarrhythmia in 7/27 (26%) patients.

Sachetti and colleagues noted that clinical features of arrhythmias varied from asymptomatic to symptoms such as chest pain, syncope, respiratory distress and palpitations resulting in severe hemodynamic effects. Our study also had a similar finding with symptoms being highly variable depending upon the age of the child. In our study, Heart disease was present in 16/27 (59%) of patients. 10 (37%) had congenital heart disease and 6 (22%) had acquired heart disease. Studies by Van Der Merwe and colleagues found that and 15% with arrhythmias had associated congenital or acquired heart disease whereas study by Joshi and colleagues found that 21% of children with arrhythmias had associated congenital or acquired heart disease [6]. Clausen and colleagues found that 13% had associated congenital heart disease [7]. In study by batte and colleagues, arrhythmias were found in 27.3% of children; with 22.7% having first degree AV block while 4.6% had ectopic atrial rhythm, premature atrial

Among the tacharrhythmias, 16/20 (80%) cases were Supraventricular Tachyarrhythmias (SVT) and four (20%) were ventricular arrhythmia. Of the 16 cases of SVT, twelve patients had PSVT (75%). Other SVTs included Atrial Fibrillation (AF), Ectopic Atrial Tachycardia (EAT), Premature Atrial Complexes (PAC) and Permanent Junctional Reciprocating Tachycardia (PJRT). Thus, PSVT was the most common tachyarrhythmia and the most common arrhythmia overall, constituting 44% of all arrhythmias. Among the ventricular tachyarrhythmias, there were 3 patients with Ventricular Tachycardia (VT) and 1 patient with Ventricular Premature Complexes (VPC). Among the 12 patients of SVT, underlying heart disease was present only one patient (D-TGA) while rest 11 patients had structurally normal heart.

Other studies corroborate this finding. Sachetti and colleagues reported that the most common dysrhythmias are sinus tachycardia (50%) and supraventricular tachycardia (13%) [3]. In the study by Joshi and colleagues tachycardia was the commonest arrhythmia noted in 36 (40%) of children. 30 (83%) of the 36 children had SVT and 22 (73%) of these had PSVT [6]. Balaguer et al reported in their study on PSVT in

children that the most frequent diagnosis was SVT re-entrant (45%) [9]. Premkumar found that SVT was the most frequently sustained tachyarrhythmia in their study [10].

There were seven cases of bradyarrhythmias which constituted 26% of all arrhythmias. All cases had underlying congenital heart disease. Five patients had first degree AV-block which was the most common brady-arrhythmia while two patients presented with complete heart block, both of which had CC-TGA. Of the children who had first degree AV block, all had never had corrective heart surgery and none had any acid base or electrolyte disturbances. Three patients with VSD who had first degree AV-block were on digoxin at presentation. One of the possible explanations for the association between digoxin use and first degree AV block in could be that first degree AV block was a manifestation of digoxin toxicity in these children. However serum digoxin levels were not measured in children who had first degree AV block, which was a limitation. However, digoxin toxicity is known to cause first degree AV block [11].

There is generally paucity of data on the prevalence of first degree AV block among children with congenital heart diseases. This is because in the past, first degree AV block was considered a benign condition. However, recently first degree AV block has been reported to be associated with increased risk of atrial fibrillation, pacemaker implantation and all-cause mortality especially in adults [12]. Patients with a borderline first-degree AV block during normal sinus rhythm may also have dual AV node physiology and may be at higher risk for clinical Atrioventricular Nodal Re-entry Tachycardia (AVNRT) [13].

In the study by Joshi, 28.8% had conduction blocks, of which 69% were complete heart block (15 congenital heart block and 3 acquired heart block) [6]. One child of acute myocarditis of possible viral origin with acute-gastro-enteritis and hypokalemia developed VPC. In patients with underlying heart disease, even mild-to moderate hypokalemia increases their likelihood of cardiac arrhythmias, and this could have predisposed this child to development of VPC [14]. Arrhythmias associated with hypokalemia include a prolonged QT interval, ventricular extra systoles, and malignant ventricular arrhythmias such as ventricular tachycardia, torsades de pointes and ventricular fibrillation [15]. These results therefore provide an understanding of the type of arrhythmias among the children who are managed in the hospital. The study also shows some of the factors associated with these arrhythmias such as age of the child, clinical presentation, and digoxin use and electrolyte imbalances.

Limitation

The prevalence of cardiac arrhythmia could not be determined since no routine ECG was done for all children. The recurrence rate could not be commented upon as there was no long term follow up of the patients after discharge. This study was unable to assess other factors which could predispose these children to arrhythmias such as genetic factors, prematurity and congenital infections.

Conclusion

Arrhythmias in children have a wide range of presentations. PSVT was the most common arrhythmia overall in this study. Several most common etiological factors identified were underlying heart disease and other contributing being age of child, digoxin use and electrolyte imbalances. Treatment modalities depended upon the type of arrhythmias. Further large scale studies are needed for further elucidation on this topic.

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