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ORIGINAL ARTICLE

Frequency and Clinical Profile of Cardiac Arrhythmias and its Immediate Outcome in Children at Tertiary Care Hospital

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ABSTRACT

Objective: To determine the frequency and clinical profile of arrhythmia and its immediate outcome in children presenting to a tertiary care center.

Study Design: A cross-sectional study.

Duration and place of study: July 2021 to June 2022, the National Institute of Cardiovascular Diseases, Karachi.

Methodology: A total of 100 children of both gender , ranging in age from 1 day to 18 years, who presented with the symptoms of syncope, decreased or increased heart rate, chest discomfort, breathlessness were included in this study. Children who presented with cardiac arrhythmias had varying proportions of several criteria of relevance, such as clinical characteristics, age and gender distribution. In patients with unexplained arrhythmias or syncope, a thorough history, general physical exam, and cardiac examinations—including 12-lead electrocardiograms, 2-D echocardiograms, and Holter studies—were conducted.

Results: A total of 100 children were included in this study among them 70 children presented with tachyarrhythmia and 30 children presented with bradycardia. The average age was 8.13± 4.45 years. Among the tachyarrythmias group the most frequent initial symptoms recorded in 45 (64.28%) and 15 (21.42%) youngsters, respectively, were palpitation and chest pain. A total of 19 (27.14%) children were discovered to have acyanotic CHDs. SVT was found to be the most common type of arrhythmia in 25 (30.1%) children, followed by ventricular tachycardia and atrial fibrillation in 15 (21.42%) and 10 (14.28%) of the same age groups. A total of 3 (4.28%) of the hospitalized children died. Among the bradycardia group 80% of children were found with complete heart block, 53.3% syncope, 26.7% were asymptomatic, and 20% were with multiple findings of irritability, poor feeding, breathlessness, and syncope. 20% of them developed LV dysfunction.

Conclusion: The most frequent presenting symptoms were palpitations and chest discomfort. The other most common types of arrhythmia were supraventricular tachycardia, atrial fibrillation, ventricular tachycardia and bradycardia. Children's hospital stays were generally short and the therapy for arrhythmias had favorable overall results, however, 4.28% of children in the tachyarrhythmia's group died of heart failure, while there was no expiry in the bradycardia group.

Keywords: Arrhythmias, palpitations, supraventricular and ventricular tachycardia, bradycardia and heart Block

INTRODUCTION

Tachycardias and bradycardias are examples of unusually fast or slow heart rates, respectively, that are indicative of cardiac dysrhythmias. Since arrhythmia is extremely uncommon in infants and children, the frequency and clinical importance of arrhythmia are different in kids compared to adults.. Depending on the child's age, different paediatric arrhythmia symptoms will present. It's interesting to note that a physical examination of a young children with serious arrhythmias may reveal nothing abnormal. Patients with heart rhythm problems may complain of a variety of conditions, but they frequently seek medical attention because of symptoms including palpitations, syncope, presyncope, or dyspnea.[1, 2].

The most frequent tachyarrhythmia in children is SVT (Supraventricular Tachycardia). According to reports, 25% of children who present with SVT show WPW syndrome (Wolf Parkinson White Syndrome) on their ECG. [3, 4] Ventricular arrhythmias are rare in childhood and may be benign or malignant. Clinically presentation is variable, symptoms may range from palpitations , chest pain, shortness of breath ,light headedness, syncope, and hemodynamic compromise to death.[5]

Atrial Fibrillation (AF) in children is very uncommon. Patients are usually symptomatic at presentation and in the setting of rapid ventricular rates, hypotension and syncope may ensue. As in adults, the possibility of atrial thrombus with the risk of embolic stroke is of great concern. Children and adolescents present with complaints of palpitations. Weakness and signs of congestive heart failure may be seen.[6]

The most typical signs of paediatric bradycardia are sinus bradycardia, junctional bradycardia, or atrioventricular block. It may occur structurally normal in context of concomitant congenital cardiac disease due to a variety of distinct etiologies.[7] Bradyarrhythmias include AV conduction irregularities and problems with sinus node function. In children, sinus node dysfunction (SND) is not very prevalent. Clinical Presentation of Bradyarrhythmias are relatively uncommon, most children with SND don't exhibit any symptoms. Between 1/15,000 and 1/25,000 live children are commonly reported to have congenital complete AV block.[8] Late post-operative dysrhythmias are the commonest medical problem encountered after repair of congenital heart defects.[9]

Few children with CHD have early corrective heart surgery in developing nations, particularly in government settings where the waiting period is very long. These children experience numerous difficulties as a result of the delayed operation, including cardiac failure, severe cyanosis, and various long-term after effects that raise their chance of developing arrhythmias. Children in low-resource environments are also more likely to experience infections, electrolyte imbalances, and other conditions that raise the risk of arrhythmia development. [10,] A greater percentage of newborns and children are being diagnosed with cardiac rhythm disorders as a result of enhanced vigilance and recent technological advancements.

Determining the frequency of various forms of abnormal cardiac rhythm and its immediate outcome in children was the aim of this study.

METHODOLOGY

From July 2021 to June 2022, this cross-sectional study was carried out at the National Institute of Cardiovascular Diseases (NICVD), Karachi. Parents'/guardians' informed and written consents were obtained. The sample size was calculated using WHO sample size calculator considering the 34.5% frequency of arrhythmia , [11] 95% confidence level at a 10% margin of error the minimum sample size was 100 patients. The approach of non-probability sequential sampling was used.

Children experiencing chest discomfort, decreased or increased heart rate, or syncope were included in the study. They

ranged in age from one day to 18 years and were of both gender. Children with sinus arrhythmias, those who had previously had a permanent pacemaker implanted, and children whose parents/guardians expressed a preference against their participation in the trial were excluded from the study.

A thorough medical history as well as data on demographic and clinical factors were gathered. Holter studies for patients with unexplained arrhythmias and syncope as well as comprehensive general and cardiac evaluations were done. The confirmed cases of a certain type of arrhythmia were managed, and treatment was administered while recording the treatment's immediate response.

The length of the patient's hospital stay was measured from the time of admission to the time of discharge. If the patient during or just after the procedure in the hospital, it was referred to as in-hospital mortality. Arrhythmias that respond to treatment within 72 hours of administration are referred to as having an immediate response.

Amiodarone, adenosine, DC shock, propranolol, pacemaker, DC shock, and observation therapy responses were noted. Effect modifiers such age, gender, heart rate, SBP, DBP, birth weight, BMI, symptoms, and duration of stay were addressed through stratification. A significant result was determined by the post-stratification chi-square test, with a p-value of 0.05.

Data were stored and analyzed using SPSS version 23.0; median with Interquartile range were given on age, weight and HR, Counts with percentages were reported on gender, clinical features, ECG findings, ECHO, and other studied parameters of cardiac disease children

RESULTS

A total of 100 children were included in this study among them 70 children presented with tachyarrhythmia and 30 children presented with bradycardia. The average age was 8.13± 4.45 years. Among the tachyarrhythmia group the most frequent initial symptoms recorded in 45 (64.28%) and 15 (21.42%) youngsters, respectively, were palpitation and chest pain. A total of 19 (27.14%) children were discovered to have acyanotic CHDs. In 16 (22.85%) youngsters, associated acquired cardiac disorders were found. Among the bradycardia group 80% of children were found with complete heart block, 33.3% syncope, 26.7% were asymptomatic, and 40.2% were with multiple findings of irritability, poor feeding, breathlessness, and syncope. The demographic and clinical features of the children with tachyarrhythmias evaluated at baseline are shown in Table 1. SVT was found to be the most common type of arrhythmia in 25 (30.1%) children, followed by ventricular tachycardia and atrial fibrillation in 15 (21.42%) and 10 (14.28%) of the same age groups. According to the distribution of gender and age in relation to the different forms of tachyarrhythmia, statistically significant variations were found, as mentioned in Table 2.

Table 3 displays the precise distribution of treatment modalities and outcomes in relation to various types of tachyarrhythmias. A total of 3 (4.28%) children died, of whom 2 had atrial fibrillation and the remaining 1 had atrial tachycardia. Heart failure was the primary factor in the deaths of all 3 youngsters.

Table-4 reports the baseline characteristics of studied who presented with bradycardia, in the present study there were thirty children, the median age was 4 years (IQR= 1.5 – 8) years, 66.7% were male gender, the median weight was 12 kg (IQR= 10 – 18) kg, median HR was 45 per minute (IQR = 40 -50) per minute, clinically 80% children presented with syncope, 26.7% were asymptomatic, and 20% were with multiple findings of irritability, poor feeding, breathlessness, and syncope.

Amongst all, 80% of pateints were found with complete heart block, 6.7% with high-grade AV block, and 13.3% with SN dysfunction. There was no underlying cardiac conditions found in 50%, however 16.7% were post-operative TOF, 13.3% were post-operative VSD, 13.3% patients were found to have large PDA , 3.3% with repaired sinus venosus ASD, 3.3% with levo transposition of great artries (L-TGA) respectively. 86.7% of patients required TPM immediately followed by PPM. 24 Holter was done in 40%. Two neonates presented with complete heart block amongst them one had positive maternal SLE. Majority of pateints improved, 20% of them developed LV dysfunction. In outcome, 86.7% were improved and 13.3% were kept on follow-up.

Table-1: Children's Characteristics who presented with tachyarrythmias (n=70)

Features		Number (%)
Sex	Male	40 (57.1%)
	Female	30 (42.85%)
Age in years	<1	2 (2.85%)
	1-5	20 (28.57%)
	6-10	22 (31.42%)
	11-18	26 (37.14%)
Age (years)		8.13±4.45
Heart Rate		210.76±34.97
SBP		101.87±11.81
DBP		66.0±9.80
Symptoms	Palpitation	45 (64.28%)
	Chest discomfort	15 (21.42%)
	Syncope	10 (14.28%)
CHD	Acyanotic CHD	19 (27.14%)
	Cyanotic CHD	9 (12.85%)
	No any	26 (37.14%)
Acquired cardiac Diseases		16 (22.85%)

Table-2: Age and Gender Distribution in Relation to Types of tachyarrhythmias (N=70)

Types of arrhythmias	Gender			Age				
	Male (n=40)	Female (n=30)	P-value	<1 (n=2)	1-5 (n=20)	6-10 (n=22)	11-18 (n=26)	P-Values
Atrial fibrillation	4 (10.00%)	06 (20%)	0.011	-	-	4 (18.18%)	6 (23.07%)	0.001
Atrial flutter	3 (7.5%)	-		-	2 (10%)	-	1 (3.84%)	
Atrial Tachycardia	7 (17.5%)	1 (3.33%)			2 (10%)	3 (13.63%)	-	
AVRT	2 (5%)	1 (3.33%)		-	-	2 (9.09%)	1 (3.84%)	
Flutter	1 (2.5%)	1 (3.33%)		-	1(5%)	-	1 (3.84%)	
Multifocal atrial tachycardia	-	2 (6.66%)		-	-	1 (4.54%)	-	
SVT	13 (32.5%)	12 (40%)		2 (100%)	14 (70.00%)	07 (31.81%)	10 (38.46%)	
Ventricular fibrillation	-	2 (6.66%)		-	-	-	1 (3.84%)	
Ventricular tachycardia	10 (25.00%)	05 (16.66%)		-	1 (5%)	05 (22.72%)	6 (23.07%)	

Table-3: Relationship between Types of Treatment and tachyarrhythmias (N=70)

Types of arrhythmias	Adenosine (07)	Amiodarone (26)	DC Shock (6)	Observation (3)	Propranolol (28)
Atrial fibrillation	-	5 (19.23%)	-	-	10 (35.71%)
Atrial flutter	-	1 (3.84%)	-	-	3 (10.71%)
Atrial Tachycardia	-	1 (3.84%)	-	-	5 (17.85%)
AVRT	1 (14.28%)	-	-	-	1 (3.57%)
Flutter	-	-	1 (16.66%)	-	-
Multifocal atrial tachycardia	-	1 (3.84%)	-	-	-
SVT	06 (85.71%)	11 (42.30%)	-	3 (100%)	7 (25.00%)
Ventricular fibrillation	-	-	1 (16.66%)	-	-
Ventricular tachycardia	-	7 (26.92%)	4 (66.66%)	-	2 (7.14%)
	On Follow-up		2		13.3

Table 4: Baseline Characteristics of Studied Children who presented with bradycardia (n=30)

Variable		n	%
Gender	Male	20	66.7
	Female	10	33.3
Age (years)	Median (IQR)	4	1.5 – 8
Weight (kg)	Median (IQR)	12	10 – 18
HR	Median (IQR)	45	40 - 50
	Syncope	16	53.3
	Asymptomatic	8	26.7
	Irritability/ poor feeding/ breathlessness	6	20

Table 5: Clinical profile of cardiac arrhythmias in children who presented with bradycardia at Tertiary Care hospital (n=30)

Parameters		n	%
Bradyarrythmia	Complete heart block	24	80
	High-grade AV block	2	6.7
	SN dysfunction	4	13.3
ECHO	Large PDA	4	13.3
	Postoperative TOF	4	13.3
	Repaired VSD	4	13.3
	Repaired sinus venosus ASD	2	6.6
	L-TGA	1	3.3
	No disease	15	50
PPM	Yes	26	86.6
	No	4	13.3
Holter	Yes	12	40
Mother SLE	Yes	1	3.3
Complication	LV Dysfunction	3	10
Outcome	Improved	26	86.6
	On Follow-up	4	13.3

DISCUSSION

In this study, we discovered that 64.28% and 21.42% of children reported having palpitations and chest discomfort respectively, as their most frequent presenting symptoms. Respiratory distress was the primary symptom in 55% of children with abnormal heart rhythm, while palpitations and chest discomfort were each noticed in 27.7% of cases, according to research by Premkumar S et al. from India [12].

Supraventricular tachycardia (SVT) was found to be the most common kind of arrhythmia in children, accounting for 35.71% of all cases. Atrial fibrillation and ventricular tachycardia made up the other 14.28% and 21.42% of all cases. SVT and heart block were discovered to be the most prevalent cardiac abnormalities seen in 2.0 and 1.4% of children in a Cairo research assessing high-risk children for cardiac disease [13].

In this study, 40% of the children had CHDs, and the results are consistent with regional statistics showing that 60.9% of children with arrhythmias have some form of CHD [13]. We found that administering IV amiodarone for the treatment of SVT was successful in 42.30% of patients, while adenosine was effective in 85.71 % of SVT instances. After the initial resuscitation, adenosine was described by Robert TG et al as a useful choice in SVT situations [1]. The use of adenosine for the treatment of SVT, which develops following a successful first resuscitation from ventricular fibrillation, was also described in the study by Robert T. Gerhardt et al [14].

The most prevalent age range in a study by Samir Bhatia et al. was 3 months to 2 years. Tachyarrhythmia, namely supraventricular tachyarrhythmia, was the most prevalent kind of arrhythmia. The most prevalent arrhythmia overall and among supraventricular arrhythmias was PSVT. Congenital cardiac disease was the most common risk factor found [15].

According to Sachetti and colleagues, the clinical characteristics of arrhythmias ranged from asymptomatic to symptoms like palpitations, syncope, chest discomfort, and respiratory distress that had serious hemodynamic repercussions [16].

Atrial fibrillation was identified in 47% of patients as the most prevalent mechanism of SVT, according to research by Rinee Harris et al. Following in number were AVNRT (22%) and AVRT (18%). In addition, 4% of the patients had atrial flutter, and 9% of the patients had atrial tachycardia [17].

In our study among the bradyarrythmia group 80% of children were found with complete heart block, 6.7% with high-grade AV block, and 13.3% with SN dysfunction. In study done by Beshoy Tamer Atta et al, A total of 70.5% of patients had sinus bradycardia, 13% had complete heart block (CHB), 10% had long QTc syndrome with sinus bradycardia, and 3.3% had first- and second-degree heart blocks, [18]. In our series 4 patients (13.3%) had large PDA while only 1(3.3%) presented with L-TGA with complete heat block. The study by Lev M et al. predicted that structural cardiac disease will be present in 25–33% of instances of congenital CHB. By far, L-TGA with ventricular inversion has been the most frequently related lesion [19, 20].

The current study had limited prolong follow up data. As a single-centre study with a modest sample size, our findings need to be confirmed in further research. As we only saw immediate results in this trial, more research using longer follow-up methods is needed.

CONCLUSION

The most frequent presenting symptoms were palpitations and chest discomfort. The other most common types of arrhythmia were supraventricular tachycardia, atrial fibrillation ventricular tachycardia and bradycardia. Children's hospital stays were generally short and the therapy for arrhythmias had favourable overall results, however 4.28% of children in the tachyarrythmias group died, while there was no expiry in the bradycardia group.

REFERENCES

1. Muhsen AA, Lazim HJ, Alqaisy OZ. Childhood Dysrhythmias: Clinical Pattern, Management and Immediate Outcome. Int J Adv Res Biol Sci. 2019;6(11):85-95.
2. John M. Miller, Douglas P. Zipes. Braunwald's Heart Disease. A textbook of Cardiovascular Medicine. 10th ed. Philadelphia: 2015. Diagnosis of Cardiac Arrhythmias. In: Mann, Zipes, Libby, Bonow editors; p. 662.
3. Marchlinski F. Harrison's principles of internal medicine. 17th ed. NewYork: McGraw-Hill Co; 2008. The tachyarrhythmias. In: Fauci AS, Brauwald E, Kasper DL, Hauser SL, Longo D, Jameson JL, Loscalzo J, editors; pp. 1425–43.
4. Rekawek J et al. Riskfactors for cardiac arrhythmias in children with congenital heart disease after surgicalintervention in the early postoperative period. J Thorac Cardiovasc Surg. 2007; 133:900-4.
5. Silka, M. J. and A. Garson, Jr. (1999). Ventricular Arrhythmias. Clinical Pediatric Arrhythmias. P. C. Gillette and A. Garson, Jr. Philadelphia, W.B. Saunders Company: 121-145
6. Emergency diagnosis and management of pediatric arrhythmias https://www.ncbi.nlm.nih.gov/pmc/articles/PMC29 38490.
7. VanHare GF. Clinical paediatric arrhythmias. 2nd ed. Philadelphia: WB Saunders company; 1999. Supraventricular Tachycardia In: Gillette PC, Garson A, editors; pp. 97–118.
8. Michealsson M, Engle MA. Congenital Complete heart block: an international study of thenatural history. Cardiovasc Clin.1972; 4:85-101.
9. Baruteau A, Perry J, Sanatani S et al. (2016): Evaluation and management of bradycardia in neonates and children Eur J Pediatr., 175(2): 151-61.
10. Perry JC. The diagnosis and emergency management of pediatric tachyarrhythmias. Pediatr Emerg Med Rep 1996; 1: 65-73.
11. Bukata IT, Tegene E, Gobena T, Woldesenbet YM. Prevalence and determinants of cardiac arrhythmias and conduction anomalies in adults aged ≥ 40 years in Jimma Town, Southwest of Ethiopia: a cross-sectional study. Afr Health Sci. 2022 Mar;22(1):210-219. doi: 10.4314/ahs.v22i1.27. PMID: 36032455; PMCID: PMC9382499
12. Premkumar S, Sundararajan P, Sangaralingam T. Clinical Profile of Cardiac Arrhythmias in Children Attending the Out Patient Department of a Tertiary Paediatric Care Centre in Chennai. J Clin Diagn Res. 2016; 10(12):SC06-SC08. doi: 10.7860/JCDR/2016/21751.8992
13. Dorostkar PC, Dick M. Current management of supraventricular tachycardia in children. Heart Dis Stroke 1994; 3: 394-400.

14. Hegazy RA, Lotfy WN. The value of Holter monitoring in the assessment of Pediatric patients. Indian Pacing Electrophysiol J. 2007; 7(4):204-214.
15. Gerhardt RT, Furlong R, Schrank K, Ress BD. Adenosine conversion of supraventricular tachycardia associated with high-dose epinephrine therapy for cardiac arrest. Prehosp Disaster Med. 1999;14:65–67
16. Bhatia S, Mandal RN, Jhamb U, Agarwal A, Bhatia P. Clinico-etiological profile of arrhythmia in children. Current Pediatric Research. 2021.
17. Sachetti A, Moyer V, Baricella R, et al. Primary cardiac arrhythmias in children. Pediatr Emerg Care 1999; 15(2): 95-8
18. Rinee Harris, Ravindra Nath Sahay. Clinical profile of patients diagnosed with supraventricular tachycardia: a descriptive study at a tertiary care hospital. Int J Adv Med. 2022 Mar;9(3):317-321
19. Atta BT, Mohamed MA, Mahmoud SM. Evaluation of Pediatric Bradycardia: A Single Center Experience. The Egyptian Journal of Hospital Medicine. 2022 Jan 1; 86(1):804-9.
20. Ross BA, Gillette PC. Clinical paediatric arrhythmias. 2nd ed. Philadelphia: WB Saunders company; 1999. Atrioventricular Block and Bundle Branch Block. In: Gillette PC, Garson A, editors; pp. 63–74.