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ORIGINAL ARTICLE

CARDIAC ARRHYTHMIA - ANALYSIS OF THE EPIDEMIOLOGICAL PROFILE OF PATIENTS CARE AT A PEDIATRIC CARDIOLOGY OUTPATIENT.

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Abstract

Cardiac arrhythmias are electrical alterations that may have varied clinical presentations according to their etiological origin, association with adjunct heart problems and degree of impairment of cardiac functioning. Therefore, the epidemiological profile of patients diagnosed with cardiac arrhythmia treated in a Pediatric Cardiology Outpatient Clinic was traced, identifying the most prevalent types of cardiac arrhythmias in these patients and also analyzed whether there are differences between the prevalence of types of arrhythmias in patients with heart disease and those with a structurally normal heart. The studied group comprises patients registered in the database of the Pediatric Cardiology Discipline, from January 1, 1996 to December 31, 2019. Their data were analyzed and subjected to appropriate statistical evaluation, considering a significance level of 5%. The variables analyzed were: Sex; Age; Type of Arrhythmia; Presence or not of Associated Heart Diseases. A total of 365 patients diagnosed with arrhythmia were evaluated, of which 15.9% had heart disease and 84.1% did not have heart disease. In patients with heart disease, there was no difference between the sexes, whereas in the group of patients without heart disease, there was a predominance of males. It was concluded that the most prevalent arrhythmias were atrial extrasystoles, ventricular extrasystoles and total atrioventricular block, considering both sexes. In females, the most prevalent were total atrioventricular block, atrial extrasystoles and ventricular extrasystoles. In males: ventricular extrasystoles, atrial extrasystoles and paroxysmal supraventricular tachycardia.

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INTRODUCTION

Cardiac arrhythmias are defined as changes in the heart's electrical activity, which compromise the normal rhythm of the heartbeat. These rhythmic disorders, when not diagnosed and treated correctly, can result in complications that can lead to death, sometimes suddenly.

Although not all arrhythmias present a high risk of death, the diagnosis of this condition is essential, given that many arrhythmias can be silent, that is, they do not manifest symptoms, making it difficult for the patient to seek a healthcare service for medical investigation of their condition.

The diagnosis of cardiac arrhythmia conditions is not easily determined, as many of the symptoms may appear vague or non-specific, while many patients experience malaise, chest pain, skin pallor and palpitations. Furthermore, some patients may present spontaneous resolution of the arrhythmia[1], or even present intermittent arrhythmias, making diagnosis difficult.

Literature data show that the scenario of cardiac arrhythmias in the pediatric age group is highly variable, presenting different patterns between children who have a structurally normal heart and those with congenital or acquired heart defects, as in these children, arrhythmias are usually secondary, associated with structural abnormalities, surgical interventions or chronic hemodynamic repercussions[2].

Among the causes of referral to specialized pediatric cardiology services, suspected arrhythmia is the third most frequent cause, with approximately 8% of referrals made by primary healthcare services, surpassed by heart murmurs and chest pain, with respectively 70% and 9% of referral reasons[3]. Based on a database from the Pediatric Cardiology Department of our hospital, the main causes of outpatient care, from 1996 to 2019, for a total of approximately 6,000 patients, were: heart murmurs (36.4%), congenital heart diseases (32.7%) and cardiac arrhythmias/changes in the electrocardiogram (12.5%).

Therefore, given the importance and complexity of cardiac arrhythmias in the pediatric age group and the few data available in the literature relating heart diseases and cardiac arrhythmias, it is justified to study and analyze the epidemiology of patients in this age group treated with a diagnosis of arrhythmia in a specialized service. From this analysis, we will seek to outline an overview of the most prevalent types of arrhythmias in our service, as well as describe whether there are correlations between these most prevalent changes and the profile of patients treated by the service, according to gender, age group and presence or not of heart disease.

In this sense, we outline the following objectives for this study:

1. Describe the epidemiological profile of patients diagnosed with cardiac arrhythmia treated at a pediatric cardiology outpatient clinic, from January 1, 1996 to December 31, 2019.

2. Identify the prevalence of types of cardiac arrhythmias.

3. Analyze whether there is a difference between the prevalence of types of arrhythmias in patients with a structurally normal heart and in those with congenital or acquired heart disease.

METHODS

We evaluated patients diagnosed with cardiac arrhythmia treated at the Pediatric Cardiology Outpatient Clinic from January 1, 1996 to December 31, 2019, registered in the Pediatric Cardiology Department database.

The following variables were analyzed: 1) Sex; 2) Age; 3) Type of arrhythmia; 4) Presence or absence of associated heart diseases.

The age of the patient was considered on the date of the initial consultation at the clinic.

The data were entered into an electronic spreadsheet for statistical analysis and evaluation considering a significance level of 5%. Statistical evaluation was performed using the Goodman Homogeneity Test and the Mann-Whitney Test[4,5]. The first was used to compare arrhythmias, both in patients with heart disease and in patients without heart disease, and also to compare arrhythmias according to gender. The second test was used to compare the ages of patients with heart disease and without heart disease.

RESULTS

365 patients diagnosed with arrhythmia were evaluated, 58 of them (15.9%) had heart disease and 307 (84.1%) did not have heart disease. Their ages ranged from 0.1 to 219 months, with statistical differences when comparing patients with and without heart disease, with lower values in patients with heart disease, who had a median of 52 months (interquartile range of 1.35 to 120 months); while patients without heart disease had a median of 102 months (interquartile range 49 to 143 months).

The heart diseases associated with arrhythmias were: Ebstein's Anomaly, Cardiomyopathies, Interatrial Communication (ASD), Interventricular Communication (VSD), Right Ventricular Double Outlet (RVSD), Atrioventricular Septal Defect (AVSD), Aortic Valve Stenosis (AS), Pulmonary Valvular Stenosis (PVS), Mitral Valve Insufficiency (MI), Tricuspid Valve Insufficiency (TI), Patent Ductus Arteriosus (PDA), Mitral Valve Prolapse (MVP), Aortic Valve Insufficiency (AI), Insufficiency Pulmonary Valve (IPV), Tetralogy of Fallot (T4F) and Transposition of the Great Arteries (TGA).

The following arrhythmias were diagnosed: 1st Degree Atrioventricular Block (AVB), Complete Atrioventricular Block (CAVB), Sinus Bradycardia, Atrial Extrasystoles (AS), Ventricular Extrasystoles (VE), Long QT, Atrial Ectopic Beat (AEB), Supraventricular Paroxysmal Tachycardia (SPT), Wolf-Parkinson-White Syndrome (WPW), Ventricular Tachycardia,

Sinus Tachycardia, Atrial Tachycardia, Junctional Rhythm, Atrial Flutter, Wandering Atrial Pacemaker and Coumel's Tachycardia.

In patients with heart disease, there was no difference between the sexes (50% for both). The most prevalent arrhythmias in the group of heart disease patients were: AS (23.3%), EV (23.3%) and CAVB (18.3%). Considering the sexes separately, in patients with heart disease, in females, CAVB (30%) was more prevalent followed by AS (23.3%) and EV (20%), while in males there was a predominance of EV (26.7 %), followed by EA (23.3%) and SVT (10%). It is also worth mentioning that, in this group of patients with heart disease, two patients presented two different forms of arrhythmias, one female and the other male, which is why we have a higher number of arrhythmias (60) than the number of patients (58). Only the AVB showed a significant difference between the sexes, with a predominance in females, as shown in table 1.

In the group of patients without heart disease, there was a predominance of males (190 patients - 61.9%), compared to females (117 patients -38.1%). The three most frequent arrhythmias, when analyzing both sexes, were: AE (23.9%), VE (20.9%) and SVPT (16.7%). The analysis based on sex showed differences in percentages, but the order of frequency of the most prevalent arrhythmias remained the same. In females, the most prevalent arrhythmias and their respective frequencies were AE (29.7%), VE (24.2%) and SVPT (16.4%); while in males the frequencies were: AE (20 .3%), VE (18.8%) and SVPT (16.9%). 1st Degree AVB and Atrial Flutter, more common in males, were statistically significant (Table 2). WPW syndrome was present in both sexes with some relevance and a slight predominance in males (12.6% versus 10.6%), but without statistical significance. Likewise, AEB predominated in male patients (10.6%) compared to female patients (5.5%), also without statistical significance.

Regarding arrhythmias in the group of patients without heart disease, a greater number of arrhythmias, there were more arrhythmias (335) than patients (307), because there were patients with more than one type of arrhythmia. In this sense, 12 female patients and 16 male patients were found with 2 different types of arrhythmias.

When arrhythmias were compared between individuals with heart disease and individuals without heart disease, from the point of view of statistical significance, CAVB was more frequent in those with heart disease while SVPT and WPW were more frequent in individuals without heart disease. (Table 3)

In the patients who had AVB (in both groups, patients with heart disease and non-cardiac disease), 4 were children of mothers with systemic lupus erythematosus, all 4 patients being female, 2 of these patients with heart disease and 2 without heart disease.

When the variables age and sex were analyzed together, there was no significant difference between those with heart disease and those without heart disease.

The analysis of heart diseases according to gender showed no significant differences. When comparing the relationship between the most frequent heart diseases and their prevalence in relation to each arrhythmia studied (table 4); PDA had a greater association with SVTP (25.0%) and CAVB (22.2%). In turn, VSD had a greater association with AEB (14.3%) and AE (13.3%). ASD was associated with the five most common types of arrhythmias (AE, VE, CAVB, AEB and SVPT), with a predominance of AE (53.3%) and AEB (42.8%) (table 4).

Table 1. Distribution of arrhythmias according to gender in patients with heart disease

Arrhythmia	Females	Males
	N (%)	N (%)
1st degree AVB	1 (3.3%)	0 (0%)
CAVB	9 (30.0%) *	2 (6.7%)
Sinus Bradycardia	1 (3.3%)	2 (6.7%)
AE	7 (23.3%)	7 (23.3%)
VE	6 (20.0%)	8 (26.7%)
Long QT	1 (3.3%)	0 (0%)
AEB	3 (10.0%)	2 (6.7%)
SVPT	1 (3.3%)	3 (10.0%)
WPW	1 (3.3%)	1 (3.3%)
Atrial Flutter	0 (0%)	1 (3.3%)
Wandering atrial pacemaker	0 (0%)	1 (3.3%)
Junctional rhythm	0 (0%)	1 (3.3%)
Atrial tachycardia	0 (0%)	2 (6.7%)
Total	30 (100%)	30 (100%)

N = number; % = Percentage, *p < 0.05 (Goodman homogeneity test)
AVB = atrioventricular block; CAVB = complete atrioventricular block; AE = atrial extrasystoles; VE = ventricular extrasystoles.

Table 2. Distribution of arrhythmias according to gender in patients without heart disease.

Arrhythmias	Females	Males
	N (%)	N (%)
1st Degree AVB	0 (0%)	6 (2.8%) *
CAVB	5 (3.9%)	3 (1.5%)
Sinus Bradycardia	5 (3.9%)	14 (6.8%)
AE	38 (29.7%)	42 (20.3%)
VE	31 (24.2%)	39 (18.8%)
Long QT	0 (0%)	3 (1.5%)
AEB	7 (5.5%)	22 (10.6%)
SVPT	21 (16.4%)	35 (16.9%)
WPW	14 (10.9%)	26 (12.6%)
Ventricular Tachycardia	2 (1.6%)	0 (0%)
Sinus Tachycardia	1 (0.8%)	2 (1.0%)
Atrial tachycardia	3 (2.3%)	1 (0.5%)
Junctional rhythm	1 (0.8%)	4 (1.9%)
Atrial flutter	0 (0%)	6 (2.9%) *
Wandering atrial pacemaker	0 (0%)	3 (1.5%)
Coumel's tachycardia	0 (0%)	1 (0.5%)
Total	128 (100%)	207 (100%)

N = number; % = Percentage, *p < 0.05 (Goodman homogeneity test)
AVB = atrioventricular block; CAVB = complete atrioventricular block; AE = atrial extrasystoles; VE = ventricular extrasystoles; AEB = atrial ectopic beat; SVPT = supraventricular paroxysmal tachycardia; WPW = Wolf-Parkinson-White syndrome.

Table 3. Distribution of arrhythmia according to the presence or absence of heart disease.

Arrhythmias	WITH cardiopathy	WITHOUT Cardiopathy
	N (%)	N (%)
1st degree AVB	1 (1.6%)	6 (1.8%)
CAVB	11 (18.3%) *	8 (2.4%)
Sinus Bradycardia	3 (5.0%)	19 (5.7%)
AE	14 (23.3%)	80 (23.8%)
VE	14 (23.3%)	70 (20.9%)
Long QT	1 (1.6%)	3 (1.0%)
AEB	5 (8.3%)	29 (8.7%)
SVPT	4 (6.7%)	56 (16.7%) *
WPW	2 (3.3%)	40 (11.9%) *
Ventricular tachycardia	0 (0%)	2 (0.6%)
Sinus tachycardia	0 (0%)	3 (1.0%)
Atrial tachycardia	2 (3.3%)	4 (1.2%)
Junctional rhythm	1 (1.6%)	5 (1.5%)
Atrial flutter	1 (1.6%)	6 (1.8%)
Wandering atrial pacemaker	1 (1.6%)	3 (1.0%)
Coumel's tachycardia	0 (0%)	1 (0.3%)
Total	60 (100%)	335 (100%)

N = number; % = Percentage, *p < 0.05 (Goodman homogeneity test)
AVB = atrioventricular block; CAVB = complete atrioventricular block; EA = atrial extrasystoles; EV = ventricular extrasystoles; RAE = ectopic atrial rhythm; TPSV = paroxysmal supraventricular tachycardia; WPW = Wolf-Parkinson-White syndrome.

Table 4. List of associations between heart diseases and the most prevalent arrhythmias.

Arrhythmia (N)	Cardiopathy				
	N (%)				
	ASD	VSD	PDA	MVP	CARDIOMYOPATHY
CAVB (18)	3 (16.7%)	2 (11.1%)	4 (22.2%)	1 (5.6%)	1 (5.6%)
AE (15)	8 (53.3%)	2 (13.3%)	0 (0.0%)	1 (6.7%)	2 (13.3%)
VE (15)	4 (26.7%)	1 (6.7%)	0 (0.0%)	2 (13.3%)	1 (6.7%)
AEB (7)	3 (42.8%)	1 (14.3%)	1 (14.3%)	0 (0.0%)	0 (0.0%)
SVPT (4)	1 (25.0%)	0 (0.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)

N = number; % = Percentage

CAVB = complete atrioventricular block; AE = atrial extrasystoles; VE = ventricular extrasystoles; AEB = atrial ectopic beat; SVPT = supraventricular paroxysmal tachycardia; ASD = atrial septal defect ; VSD = Ventricular Septal Defect; PDA = Persistent Ductus Arteriosus; MVP = Mitral Valve Prolapse;

DISCUSSION

The results found in this study are observational, based a convenience sample, and may not present external validity; however, they reflect the profile of patients treated in a specialized pediatric cardiology service.

Thus, we did come up with relevant insights.

The first of these insights is the fact that in the group of patients with heart disease, the percentage of female patients (50%) was equal to that of male patients; while in the group of patients with arrhythmias without heart disease, there was a predominance of males, but without significance, and we can infer that sex was not a factor that interfered in the presence or absence of arrhythmias.

In patients with heart disease, the prevalence of arrhythmias is variable and often depends on the period of analysis, whether before or after surgical treatment, and there is no data available in the literature regarding distribution according to sex.

In structurally normal hearts, a study by Niwa K et al.[6] with more than 150,000 children aged 5 to 6 years and 12 to 13 years, showed a slightly higher prevalence in males (2%) compared to females (1.38%).

The second insight refers to the fact that the three most prevalent arrhythmias change according to the focus of analysis on the group as a whole, and according to gender. If the entire group were analyzed, regardless of sex, we observed that AE and VE were the most prevalent arrhythmias (23.3% in both), followed by CAVB (18.3%). However, considering only females, the three most frequent arrhythmias overall remained, but CAVB was the most prevalent (30.0%), followed by AE (23.3%) and later by VE (20.0%), while the analysis of the male group showed changes in both the most frequent arrhythmias and their positions, with: VE being the most frequent arrhythmia (26.7%), followed by AE (23.3%) and SVPT (10%). Another highlight in this analysis is the fact that AE maintained the same frequency both in the analysis of both sexes and in each sex separately (23.3%).

Turner CJ and Wren C[7], carried out a study in England for 20 years, in which they evaluated more than 600,000 newborns through electrocardiographic examination and identified an incidence of 24.4 arrhythmias per 100,000 live births, with the most common arrhythmias being Tachycardia due to atrioventricular reentry with 16.3/100,000, CAVB with 2.1/100,000 and atrial flutter with 2.1/100,000.

Therefore, our data differ from the study by Turner and Wren[7]; however, our analysis used children from all pediatric age groups and not just newborns, in addition to analyzing patients with and without heart diseases.

Another insight worth highlighting is the correlation between heart disease and the most frequent arrhythmias. Thus, PDA was more associated with SVPT (25.0%) and CAVB (22.2%), but PDA was not associated with AE or VE. ASD was associated with the five main arrhythmias present in both sexes of cardiac patients (AE, EVV CAVB, AEB and SVPT), presenting a higher prevalence with AE (53.3%) and AEB (42.8%). VSD showed the highest correlation with AEB (14.3%), AE (13.3%) and CAVB (11.1%). MVP, in turn, was more associated with SVPT (25.0%) and VE (13.3%) but was not related to AEB. Finally, cardiomyopathies were most associated with AE (13.3%).

It is worth highlighting the association of CAVB in patients undergoing surgical treatment. Three patients, two females and one male, were treated at the outpatient clinic in the postoperative period and we believe that this did not influence the results, despite the significant predominance of CAVB in females (table 2), due to the low prevalence of CAVB in female patients undergoing surgical treatment.

In patients without heart disease, a different distribution of 1st Degree AVB arrhythmias and atrial flutter was observed between males and females, with a significant predominance in males. In the literature there is no data available that could justify the predominance of 1st degree AVB and atrial flutter in males.

There were no differences in age when we assessed age according to sex and whether or not the individual had heart diseases, but when we analyzed only age without differentiating sex, individuals without heart disease were significantly older than those with heart disease, and this can be explained by the fact that patients with heart disease

are evaluated at a younger age, as they often present cardiovascular signs or symptoms at younger ages, especially those with congenital heart disease.

LIMITATIONS

The study has some limitations that deserve to be mentioned.

- The sample was of convenience, taken from the database of the Pediatric Cardiology department.

- Because a database was used, no losses occurred, since all patients who were registered with arrhythmia in this database were used in the study. However, a patient may have been incorrectly registered in the database or even not registered at all.

- Not all patients underwent continuous electrocardiography (Holter type) examination, with the possibility of having other arrhythmias that could not have been documented when evaluated only by resting electrocardiogram.

CONCLUSIONS

1. There was no difference between sexes in the prevalence of arrhythmias in patients with heart disease.

2. In the group of patients without heart disease, there was a higher prevalence of males, without statistical significance.

3. Patients without heart disease were older than patients with heart disease.

4. The most prevalent arrhythmias were AE, VE and AVB when considering both sexes, while the most prevalent arrhythmias in females were AVB, AE and VE and in males: VE, AE and SVPT.

5. There were differences between the most frequent arrhythmias in those with heart disease compared to those without heart disease. In those with heart disease there was a significant predominance of CAVB, while in those without heart disease there was a predominance of SVPT and WPW syndrome.

6. In the group of non-cardiac patients, there was a significant difference in 1st Degree AVB and atrial flutter, with a prevalence in males.

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