Prospective Analysis of Different Types of Arrhythmias Presenting in National Heart Institute ER

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ABSTRACT
Background: The prevalence, presentation, complications and management of arrhythmia in Egyptian patients in ED hasn't been formerly recorded. Our study results will act as the local database for upcoming studies.
Objective: To assess the most common types of arrhythmias, their way of presentation, their management and outcome on discharge of these patients in day-to-day practice in one of the specialized centers of cardiology in Egypt.
Subjects and Methods: Data were collected from 403 patients with arrhythmia admitted to Cardiology Department of Ain-Shams University Hospital. The participants were then divided into 2 groups: tachy- and bradyarrhythmia groups.
Results: There were (45.1%) cases of bradyarrhythmias, (51.1%) of them were females and (48.9%) were males, also there were (54.9%) cases of tachyarrhythmias (52.9%) of whom were females and (47.1%) were males, with no significant difference (P=0.73). In the bradyarrhythmia group: mean age of the patients was 56.8 ± 12.2, while the tachyarrhythmia group: mean age of the patients was 49.2 ± 17.5. There were no significant differences between the 2 groups concerning history of DM, HTN, history of smoking and history of IHD (P>0.05), but there was a significant difference between the 2 groups concerning history of RHD. There was a significant difference between male and female number of cases in most types of arrhythmias.
Conclusion: Arrhythmia cases constitute a small percent of general cardiac patients. Both genders are equally affected by arrhythmias. A 12 lead ECG with a long strip rhythm is an important, rapid and inexpensive tool in diagnosing different types of arrhythmias.
Keywords: Cardiac arrhythmia, Ventricular tachycardia, AF, ECG.

INTRODUCTION

Cardiovascular diseases (CVD) remain a primary cause of natural death in developed countries despite advances in diagnostic technologies. Cardiac arrhythmias, which arise from abnormal electrical impulses in the heart, can result in irregular heartbeats, including bradycardic (slow) and tachycardic (fast) rhythms. Research from the Cleveland Clinic reveals that arrhythmias are responsible for over 50% of sudden cardiac arrests (SCA) without preceding symptoms such as palpitations or chest pain [1]. The introduction of the Apple Watch for arrhythmia detection has identified arrhythmias in 2,161 out of 419,297 participants, though issues such as data accuracy, sensor reliability, and false positives persist[2].

Management of complex arrhythmias in emergency settings continues to be a significant challenge despite therapeutic advancements. Ventricular arrhythmias (VAs) are often linked to poorer in-hospital outcomes, yet the specific relationships between VA types, timing, treatment strategies, and prognosis in cases with acute myocardial infarction (AMI) remain poorly defined [3].

The rising prevalence of arrhythmias in emergency departments (EDs) reflects demographic shifts and an increase in chronic health conditions. Pathological conditions, which include coronary artery disease (CAD), heart failure (HF), and previous MI predispose individuals to arrhythmias, while comorbidities like diabetes, hypertension (HTN), and chronic kidney disease further complicate management[4].

Demographic factors, including age and sex, also play a critical role, with older adults and males being particularly vulnerable due to age-related cardiac changes and lifestyle factors like tobacco smoking and alcohol consumption [5].

In the ED, rapid and accurate ECG interpretation is crucial for diagnosing arrhythmias and guiding treatment. Bradycardic and tachycardic rhythms, in particular, pose high mortality risks due to their potential to cause SCA [6].

Management strategies in the ED include pharmacological interventions, electrical cardioversion, and, when necessary, catheter ablation. The effectiveness of these treatments depends on timely administration and the patient's overall condition. A multidisciplinary approach involving cardiologists, emergency physicians, and critical care specialists is essential to optimize treatment outcomes[7].

Through this study, we aimed to evaluate the most common types of arrhythmias, their way of presentation, their management and outcome on discharge of these patients in day-to-day practice in one of the specialized centers of cardiology in Egypt.

SUBJECTS AND METHODS

Study population and design:

This was a prospective observational cohort study conducted in the Emergency Department of National Heart Institute in Egypt. After enrollment, the participants were followed up. Data were collected from 403 patients admitted to Cardiology Department of Ain Shams University Hospital for 6-month

duration, who were diagnosed as having arrhythmia. The participants were then divided into 2 groups: tachy- and bradyarrhythmia groups.

Study procedure:

This study was done in the Emergency Department of National Heart Institute in Giza, during the period of this study, all adult cases sought medical help in NHI with arrhythmia documented by an ECG, were included in the study.

We ruled out cases being unable/declined to consent, those below 15 years old and those being admitted for elective approaches. Each participant's admission 12-lead ECG tracing was interpreted by the admitting cardiology fellow and confirmed by an attending cardiologist. The participants were then divided into 2 groups: tachy- and bradyarrhythmia groups.

Other variables that were collected included: demographics, history of presenting symptoms, history of DM, HTN, smoking status, history of rheumatic heart disease, IHD, previous cardiac surgery, clinical characteristics, cardiac structure and function according to on echocardiography outcomes, treatment, and laboratory investigations (serum potassium level).

The dysrhythmias were classified widely into ventricular tachyarrhythmias, supraventricular tachyarrhythmias, bradyarrhythmia, sinus bradycardia or tachycardia, sinoatrial exit block, sinus pause, Mobitz I and II second-degree AV block, complete heart block (CHB), atrial fibrillation (AF), premature ventricular contractions (PVC) and ventricular fibrillation (VF). Hemodynamic stability was dichotomized at admission. Dysrhythmias were treated as per established guidelines or at the discretion of the attending cardiologist. Subjects were evaluated every day. An ECG was acquired on discharge to confirm if there was resolution of the dysrhythmia.

Ethical approval:
This study received ethical approval from Ain Shams University Research Committee. Each adult subject or caregiver of child participant provided written informed permission. The Helsinki Declaration was followed throughout the course of the investigation.

Statistical analysis

Data were entered into a Red Cap database and analysed by utilizing STATA version 15. Qualitative data were represented as frequencies and relative percentages. Chi square test ($\chi2$) to calculate difference between two or more groups of qualitative variables. Descriptive statistics, which included frequencies and proportions were utilized for categorical variables while means± standard deviation (SD), and range were utilized for continuous variables. P value < 0.05 was considered significant.

RESULTS

This study was done for 6-month duration, during the period of this study, about 8000 cases sought medical help in NHI from which 403 patients (5%) were arrhythmia cases and were included in this study. There were 182(45.1%) cases of bradyarrhythmias and also there were 221(54.9%) cases of tachyarrhythmias. Regarding gender distribution, there was no statistically significant difference detected **(Table 1).**

Table (1): Gender distribution of the studied groups.

		Brady		Tachy		Total		Chi-square	
		N	%	N	%	N	%	X^2	**P-value**
Sex	**Female**	93	51.10	117	52.94	210	52.11	0.136	**0.713**
	Male	89	48.90	104	47.06	193	47.89		

Brady: Bradyarrythmia group, **Tachy**: tachyarrythmia group.

There was a significant difference in the ages of cases of both types of arrhythmias included in the study. Mean age of the bradyarrythmia group was significantly more than that of the tachyarrythmia group **(Table 2)**.

Table (2): Age range in the study.

Group	Age (years)					T-test	
	Range			Mean	±	SD	t	**P-value**
Brady	19.0	-	82.0	56.857	±	12.217	4.906	**<0.001***
Tachy	16.0	-	80.0	49.299	±	17.578		

There were insignificant differences between the 2 groups concerning history of DM, HTN and history of smoking **(Table 3).**

Table (3): DM, HTN, and smoking history in the study.

		Brady		Tachy		Total		Chi-square	
		N	%	N	%	N	%	X^2	P-value
DM	Negative	151	82.97	166	75.11	317	78.66	3.668	0.055
	Positives	31	17.03	55	24.89	86	21.34		
HTN	Negative	132	72.53	166	75.11	298	73.95	0.346	0.556
	Positives	50	27.47	55	24.89	105	26.05		
Smoking	Negative	119	65.38	163	73.76	282	69.98	3.329	0.068
	Positives	63	34.62	58	26.24	121	30.02		

No significant difference could be seen between the 2 groups concerning history of IHD **(Table 4).**

Table (4): IHD history in both study groups.

IHD		Group		
		Brady	Tachy	Total
Negative	N	135	152	287
	%	74.2%	68.8%	71.2%
Positive	N	47	69	116
	%	25.8%	31.2%	28.8%
Total	N	182	221	403
	%	100.00	100.00	100.00
Chi-square	X^2	1.418		
	P-value	0.234		

There was a significant difference between the 2 groups concerning history of RHD as in cases of bradyarrhythmia only 3.8% had +ve history of valvular heart disease (VHD), while in cases of tachyarrhythmia, 25.3% had +ve history of valvular heart disease **(Table 5)**.

Table (5): History of RHD in both groups.

RHD		Group		
		Brady	Tachy	Total
Negative	N	175	165	340
	%	96.15	74.66	84.37
Positive	N	7	56	63
	%	3.85	25.34	15.63
Total	N	182	221	403
	%	100.00	100.00	100.00
Chi-square	X^2	34.958		
	P-value	**<0.001**		

Concerning gender, significant differences were detected between male and female number of cases concerning Mobitz type 2, pacemaker and slow AF. Concerning RHD, a significant relationship was recorded between slow AF and RHD.

Concerning IHD, there was a significant relation between CHB and IHD, 21 cases (29.2%) of CHB out of 72 had history of IHD. Also, between Mobitz type 2 and IHD, out of 24 cases of Mobitz type 2, 10 cases (41.6%) had history of IHD.

Concerning mean age, malfunctioning PM group were oldest group with a mean age of 61 years and the youngest group were slow AF with a mean age of 38 years (Table 6).

Table (6): Types of bradyarrhythmias.

		CHB		S. Brady		MALF PM		S. Pause		Slow AF		Mobitz 1		Mobitz 2	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Sex	Female	42	58.4%	23	45.1%	12	66.7%	0	0%	9	69.3%	1	33.3%	4	16.7%
	Male	30	41.6%	28	54.9%	6	33.3%	1	100%	4	30.7%	2	66.7%	20	83.3%
IHD	Negative	51	70.8%	45	88.3%	14	78.8%	1	100%	12	92.4%	2	66.7%	14	58.4%
	Positive	21	29.2%	6	11.7%	4	22.2%	0	0%	1	7.6%	1	33.3%	10	41.6%
RHD	Negative	72	100%	49	96.1%	18	100%	1	100%	8	61.6%	3	100%	24	100%
	Positive	O	0%	2	3.9%	0	%	0	0%	5	38.4%	0	0%	0	0%
Mean±SD Age (years)		52.4±12.8		46.4±10.2		61.2±12.4		60±11.3		38.2±12.4		58.6±6.6		59.5±11.4	

Concerning gender, in VF, there was a significant difference between males and females. Concerning RHD, a significant relationship was detected between AF and RHD. Concerning IHD, there was a significant relation between VT and IHD. Concerning mean age, VT group was the oldest group with a mean age of 62 years and the youngest group were SVT group with a mean age of 33 years (Table 7).

Table (7): Types of tachyarrhythmias.

		AF		VF		VT		PVC		S. TACHY		SVT	
		N	%	N	%	N	%	N	%	N	%	N	%
Sex	Female	42	60%	1	16.6%	5	50%	21	50%	34	51.5%	14	51.9%
	Male	28	40%	5	83.4%	5	50%	21	50%	32	48.5%	13	48.1%
IHD	Negative	58	82.9%	1	16.6%	2	20%	26	61.9%	40	60.6%	25	92.6%
	Positive	12	17.1%	5	83.4%	8	80%	16	38.1%	26	39.4%	2	7.4%
RHD	Negative	33	47.1%	5	83.4%	8	80%	40	95.3%	57	86.4%	22	81.5%
	Positive	37	52.9%	1	16.6%	2	20%	2	4.7%	9	13.6%	5	18.5%
Age (years)		41.2±14.2		55.6±8.8		62±8.4		54.2±10.8		57.4±11.4		33.6±12.2	

DISCUSSION

Cardiac dysrhythmias include a broad spectrum of situations with alterations in the normal cardiac rhythm affecting millions all over the world and significantly participating in morbimortality [8]. Cardiac dysrhythmias could be classified into three primary groups: supraventricular, ventricular, and bradyarrhythmias. Each group has its distinctive manifestations, and therapeutic plans. Efficient management of cardiac dysrhythmias is essential secondary to their likelihood to induce significant morbimortality [9]. Untreated arrhythmias could be accompanied by critical adverse events, which include stroke, HF, and SCA. For example, AF is a major predisposing factor for stroke, increasing the risk by five-fold. Ventricular arrhythmias, particularly VF, could be accompanied by SCA, a primary reason of death. Adequate management could enhance life quality, decrease the possibility of adverse events, and improve survival rates [10].

The current study reported on the presentation of the most common types of arrhythmias, their management, and the outcome on discharge of these patients in one of the specialized centers of cardiology in Egypt. It was found that 8000 cases sought medical help in NHI from which 403 patients (5%) had arrhythmia. There were (45.1%) cases of bradyarrhythmias, (51.1%) of them were females and (48.9%) were males, also there were (54.9%) cases of tachyarrhythmias, (52.9%) of whom were females and (47.1%) were males, with no statistically significant difference detected (P=0.713).

In agreement, **Doku et al.** [11] found that tachyarrhythmia was the prevalent arrhythmia observed among the patients (66.7%). **Alassouli et al.** [12] found that dysrhythmia was present in 74.6% of the studied cases, in which tachyarrhythmia and bradyarrhythmia represented 57.6% and 26.4%, respectively.

On the other hand, a global meta-analysis recorded bradyarrhythmias (4.8%) as the most common fatal dysrhythmias compared with tachyarrhythmias (2.6%) among cases presenting with syncope [13]. The noticed difference may be secondary to changes in the study designs utilized.

However, we found a significant difference in the ages of patients of both types of arrhythmias included in the study. In the bradyarrhythmia group: mean age of the cases was 56.8±12.2, while the tachyarrhythmia group: mean age of the cases was 49.2±17.6.

The high prevalence of dysrhythmia indicates the structurally different cardiac pathological conditions in Middle East, in which RHD remains an enormous burden, being more predominant in younger and female cases [14,15]. Also, studies from HICs report a high prevalence of dysrhythmia. For instance, in two research, the prevalence was 10% in the Tokyo CCU registry and 17.1% in the North American study [16,17].

A novel study recorded a rising prevalence of dysrhythmia in Africa [18]. This could reveal either a true rising prevalence or improved diagnostic capacity [19]. On the other hand, the current outcomes indicate the requirement for screening for dysrhythmias in cases with a serious illness.

Our study reported no significant differences between both groups concerning history of diabetes, HTN, history of smoking and history of IHD (P>0.05), but there was a significant difference between the 2 groups concerning history of RHD as out of 182 cases of bradyarrhythmia only 7 cases (3.8%) had +ve history of valvular heart disease, while of the 221 cases of tachyarrhythmia, there were 56 cases (25.3%) who had +ve history of valvular heart disease (P<0.001).

In harmony with our findings, **Doku et al.** [11] reported structural cardiac diseases (52.4%) to be the main underlying pathology of dysrhythmias among the cases, with hypertensive heart disease (40.9%), ischemic heart disease (27.3%) and dilated cardiomyopathy (18.2%) were the common forms of structural cardiac diseases recorded among the cases.

Arrhythmias in emergency departments are worsened by demographic changes and increasing chronic illnesses. Conditions such as diabetes, HTN, and chronic kidney disease heighten both the occurrence and complexity of arrhythmias. Lifestyle factors such as smoking and alcohol use amplify these risks, particularly in older adults and males vulnerable to age-related heart changes [1].

Interestingly, the current study found that, among bradyarrhythmias, concerning gender, in Mobitz type 2, there was a significant difference between male and female number of cases (majority were males). In male, pacemaker, there was a significant difference between male and female number of cases (majority were females). In slow AF, there was a significant difference between male and female number of cases (majority were females). Concerning RHD, there was a significant relation between slow AF and RHD. Concerning IHD, there was a significant relation between CHB and IHD. Concerning mean age, malfunctioning PM group was oldest group. Among tachyarrhythmias, concerning gender, in VF, there was a significant difference between males and females (majority were males). Concerning RHD, there was a significant relation between AF and RHD. Concerning IHD, there was a significant relation between VT and IHD. Concerning mean age, VT group was the oldest group.

In consistence with our findings, atrial fibrillation was influenced by several cardiovascular risk factors, including aging, diabetes, HTN, congestive HF, CAD, and VHD [20]. Additional risks include male sex, obesity, excessive alcohol intake, and left ventricular hypertrophy [21]. Preventive strategies focus on addressing these factors early. For example, significant weight loss following bariatric surgery can reduce AF

risk by 20% in obese individuals, though lifestyle changes show mixed results [22].

Studies recommend that there are intrinsic sex-related changes in tendency toward VA. One study carried out on cases with CAD and ICDs, found that even following controlling for factors often accompanied by VA recurrence, which include inducibility during electrophysiology studies and electrocardiographic factors, men were still two times more likely than women to have an event needing ICD management [23]. Further research revealed that males had a 6-fold greater incidence of VT/VF compared with females following an MI [24].

There is a well-identified association between myocardial ischemia and dysrhythmia. In cases with recorded VAs, females are more likely to have non-ischemic cardiomyopathy, and men are more likely to have ischemic cardiomyopathy (ICM) [13]. In the MADIT-CRT trial of patients with ICM, females were 49% less likely to experience VA compared to males [25].

Our study is not without limitations. First, this study is an observational study, we cannot totally manage confounders and cases weren't matched at enrollment. Second, the death rate was not properly evaluated.

CONCLUSIONS

Cardiac dysrhythmias remain a serious threat, especially during AMI and other severe cardiovascular conditions. Ventricular arrhythmias during AMI are particularly concerning due to their association with worse outcomes and higher mortality rates in hospitals. Despite advances in treatment, managing these arrhythmias in emergencies remains challenging. Arrhythmia cases constitute a small percent of general cardiac patients. Both genders are equally affected by arrhythmias. A 12 lead ECG with a long strip rhythm is an important, rapid and inexpensive tool in diagnosing different types of arrhythmias. Patients with tachyarrhythmias are more symptomatic than patients with bradyarrhythmias.

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