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Original Research Article

CLINICAL PROFILE AND MANAGEMENT OF CARDIAC DYSRHYTHMIA IN THE ED – AN OBSERVATIONAL STUDY

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ABSTRACT

Background: Cardiac dysrhythmia is a major cause of morbidity and mortality in patients presenting to the Emergency Department (ED). It is important for emergency physicians to rapidly differentiate between life-threatening and benign dysrhythmia in order to accurately determine the course of treatment.

Objective: This study aimed to describe cardiac dysrhythmia characteristics in adults admitted to the ED and its management.

Methods: In this prospective observational study, after screening 365 patients presented to the Department of Emergency Medicine, AIIMS, New Delhi, with features consistent with cardiac dysrhythmia, 350 patients were included. Data were collected from May 2019 to June 2021. The test data were expressed as frequencies for nominal variables and as mean ± SD or median with a range for continuous variables.

Results: Tachdysrhythmia (67%) was the most common form of cardiac dysrhythmia, followed by Bradydysrhythmia (21%) and cardiac arrest (11.7%). Statistically significant independent predictors of mortality among patients with cardiac dysrhythmia were complaint of dyspnea at presentation (OR- 3.4 (1.6-7.5), p value= 0.002) and increased delay in presentation to the emergency (OR- 1.2 (1.1-1.3), p value= 0.00).

Conclusion: This study demonstrated that tachydysrhythmia was the most common dysrhythmia encountered in the ED. Further, this study shows that increased delay in presentation and presence of dyspnea on presentation to the ED are the independent risk factors for death among patients with dysrhythmia.

Keywords: Dysrhythmia, tachydysrhythmia, bradydysrhythmia, cardiac arrest, dyspnea, Emergency Department.

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INTRODUCTION

Cardiac dysrhythmia is a major cause of morbidity and mortality in patients presenting to the Emergency Department (ED). Worldwide the most common dysrhythmia of clinical significance is atrial fibrillation (AF), which is responsible for 0.5% of all ED visits[1]. Among patients presenting to the ED, only 27% were eventually diagnosed to have dysrhythmia[2]. For emergency physicians, it possesses a challenge in the form of resuscitative measures, prompt identification of rhythm abnormality and specific treatment. Therefore, it is important for emergency physicians to rapidly differentiate life-threatening and benign dysrhythmia in order to accurately determine the course of treatment.

In India, the first study conducted to characterize the demographic and cardiovascular profiles of patients with cardiac dysrhythmia and/ or heart failure symptoms was the PANARM HF registry[3]. There are only limited studies available regarding the clinico-epidemiological characteristics of cardiac dysrhythmia in adults and the management of cardiac dysrhythmia. The objective of this study is to describe cardiac dysrhythmia characteristics in adults admitted to the ED and its management.

METHODS

In this prospective observational study, after screening 365 patients presented to Department of Emergency Medicine, AIIMS, New Delhi, with features consistent with cardiac dysrhythmia, 350 patients were included.15 patients presented with sinus tachycardia were excluded from this study. Data were collected from May 2019 to June 2021.All relevant data were collected in pre-designed proforma, which included demographic characteristics, symptomatology, addiction history, procedural history, medication history, findings of general physical and systemic examination, the treatment received in AIIMS and disposition from the ED. Collected data included socio-demographic profile, presenting symptoms, drug history, addiction history, family history, precipitating factors, predisposing conditions, electrocardiograph findings, relevant investigations, treatment given in the ED and outcome. All the data were entered into Microsoft Excel and kept confidential. Ethical clearance was obtained from Institute Ethics Committee obtained in June 2019 (IECPG-353/27.06.2019). Written informed consent was obtained from all the study subjects/ guardians/ legally accepted representatives.

SAMPLE SIZE:

The sample size for the study has been computed as in a prospective cohort study by estimating the percentage of AF in the ED from prior studies as 35% (P) of all cardiac dysrhythmia cases and taking the confidence interval at 95% and experimental error as 15% of P (L) and by using the formula 4xPx (100-p)/L^2.

INCLUSION CRITERIA:

1. Patients of age ≥ 18 years
2. Patients diagnosed with cardiac dysrhythmia in the ED.

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EXCLUSION CRITERIA:

1. Out of hospital cardiac arrest
2. Traumatic cardiac arrest
3. Sinus dysrhythmia
4. Sinus tachycardias due to fever, pain, anxiety, any obvious infection and dehydration

The diagnosis of cardiac dysrhythmia was made by the senior resident or consultant of emergency medicine.

STATISTICAL METHODS

The test data were expressed as frequencies for nominal variables and as mean ± SD or median with range for continuous variables. The association of each clinical variable with the outcome was assessed by Pearson chi-square test/Fisher exact test for categorical variables. Univariate and stepwise multivariable logistic regression analysis was carried out to find the independent predictor of poor outcome using unadjusted and adjusted odds ratio with 95% CI. A p-value less than 0.05 was considered significant. All tests were two-tailed and all analysis were carried out by Stata 14 (StatCorp® LP 4905 lakeway drive, Texas)

RESULTS

Table1: Patient demographics

Variables	Characteristics	N(%)
Age	18-39 yrs. 40-60 yrs. >60 yrs. 51.17±17.29 yrs.	87(25%) 133(38%) 130(37%) Range:18-91
Mean ±SD		
Gender	Male Female	201(57%) 149(43%)
Educational status	Illiterate primary school middle school high school post-high school graduate postgraduate	16(4.6%) 42(12%) 54(15.4%) 76(21.7%) 85(24.3%) 62(17.7%) 15(4.3%)
Occupational status	Unemployed, Unskilled, Semiskilled, Skilled, self-employed, semi-professional professional	103(29.4%) 45(12.9%) 32(9.1%) 32(9.1%) 90(25.7%) 35(10.0%) 13(3.7%)
Geographic location	Delhi Uther Pradesh Haryana	165(47.7%) 71(20.3%) 49(14%)

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	Bihar Other states	37(10.6%) 28(7.4%)
Addiction history	Smoking Alcohol Smoking and alcohol Tobacco chewing None	60(17.2% 16(4.6% 7(2% 7(2% 259(74%

As per the study findings, the prevalence of cardiac dysrhythmia increased steadily with age which was more common among middle-aged adults than among elderly patients 18-39 yrs 87(25%)40-60 yrs133(38%)>60yrs 130(37%) respectively. The prevalence of cardiac dysrhythmia was higher among males (57%) than in females (43%) with a male: female ratio of 1.34:1. 48% of patients were residents of Delhi. Only 22% of patients were educated beyond class 12 and 29% of patients were unemployed. Around 17.2 % of the study subjects were addicted to tobacco smoking and 4.6% were addicted to alcohol. (Table 1)

Table 2: Patients symptoms and medication history

variables	Characteristics	N(%)
symptoms	Dyspnea Chest pain Palpitation Restlessness Syncope Others	122(34.9% 83(23.7% 55(15.7% 27(7.7% 20(5.7% 43(12.3%
Delay in presentation to the emergency Mean± SD	4.95±12.168	
Medication history	Drug Beta blockers Drug CCB Drug ACEI/ARB Diuretics Drug anticoagulant other drugs	146(41.7% 65(18.6% 70(20% 54(15.4% 135(38.6% 55(15.7%

The findings of this study showed that Dyspnea (49.4%) was the most common presenting complaint followed by restlessness (38.3%). 30% of patients had at least one addiction, smoking being the most common (19.4%). The median delay in presentation of dysrhythmia from symptom onset was two days. Almost 41.7% of the study population had a history of Beta-blocker medication followed by anti-coagulant drug 38.6% and Drug ACEI/ARB 20% respectively. (Table 2)

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Table 3: Characteristics of dysrhythmia

variables	Characteristics	N(%)
Distribution of cases	Tachy dysrhythmia Brady dysrhythmia Cardiac Arrest	(67%) (21%) (11.7%)
Distribution of tachy dysrhythmia	sinus tachycardia AF with RVR Atrial flutter AVNRT VT Others	(32.5%) (30.3%) (19.2%) (8.5%) (6%) (3.5%)
Distribution of Brady dysrhythmia	bradycardia CHB 1st degree AV block 2AVB AF with SVR SND Brady others	(29.3%) (29.3%) (13.3%) (6.7%) (8%) (8%) (5.3%)
Distribution of cardiac arrest	PEA Asystole Ventricular fibrillation Pulseless	(39%) (29.3%) (17.1%) (14.6%)

As per the study result, tachydysrhythmia (67%) was the most common form of cardiac dysrhythmia, followed by bradydysrhythmia (21%) and cardiac arrest (11.7%). Sinus tachycardia and atrial fibrillation with rapid ventricular response were the most common tachydysrhythmia among the study subjects. Sinus bradycardia and complete heart block were the most common bradydysrhythmia among the study subjects. The non-shockable rhythm was the most common cardiac arrest rhythm among the study subjects. Acute coronary syndrome (ACS) was the most common precipitant for cardiac dysrhythmia among the study subjects. (Table 3)

Table 4: Association of Predictors with mortality

Predictors	**OR (95 % CI)**	**P value**
Age	1.01 (0.99-1.03)	0.101
Palpitations	0.63 (0.35-1.15)	0.139
Dyspnea	3.43 (1.57-7.50)	0.002
Delay	1.21 (1.10-1.33)	0.000

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Univariate logistic regression was applied for all the factors that could affect the outcome. It was found that age, dyspnea and palpitations at presentation, and increased delay in presentation to the ED were statistically significant predictors of outcome (p value<0.05). On applying multivariate regression of significant covariates derived from univariate analysis, it was found that presence of dyspnea at presentation (OR- 3.4 (1.6-7.5), p value=0.002) and increased delay in presentation (OR- 1.2 (1.1-1.3), p value=0.00) were statistically significant independent predictors of mortality in patients with cardiac dysrhythmia. (Table 4)

Table 5: Disposition of study population

Outcome	Bradydysrhythmia	Cardiac arrest	Tachydysrhythmia	Total
Admission	35 (46.7%)	6 (14.6%)	75 (32.1%)	116 (33.2%)
Referral	23 (30.7%)	-	75 (32.1%)	98 (28%)
Abscond	3 (4%)	-	6 (2.5%)	9 (2.5%)
Discharge	6 (8%)	-	59 (25.2%)	65 (18.6%)
Death	8 (10.6%)	35 (85.4%)	19 (8.1%)	62 (17.7%)
Total	75 (100%)	41 (100%)	234 (100%)	350 (100%)

As per the study result, about 25% of the patients with tachydysrhythmia were discharged whereas only about 11% of patients with bradydysrhythmia could be discharged from the emergency. Approximately 85% of patients with cardiac arrest died in the ED. (Table 5)

MANAGEMENT OF CARDIAC DYSRHYTHMIA

First-line treatment for patients with sinus tachycardia was oral metoprolol (63 patients (82.9%)) and oral carvedilol (8 patients). First-line treatment for patients with atrial fibrillation (AF) and rapid ventricular response (RVR) was diltiazem (52 patients (73%)) and metoprolol (17 patients (24%)). A second line agent for rate control was required in ten patients with AF and RVR (14%). Also, cardioversion was performed in five (7%) patients with AF and RVR after failure of first- or second-line therapy. First-line treatment for patients with atrial flutter was diltiazem (30 patients (66.7%)) and metoprolol (13 patients (28.9%)). However, asecond-linee treatment was required for patients with atrial flutter who received diltiazem (two patients (4.4%)). Also, cardioversion was performed in four (8.9%) patients with atrial flutter.First-linee treatment for patients with atrioventricular nodal re-entrant tachycardia (AVNRT) was adenosine (16 patients (80%)). However, 3 patients with AVNRT (15%) were treated with Valsalva maneuvers and one patient received adenosine after failure of Valsalva maneuver. First-line treatment for patients with ventricular tachycardia (VT) was amiodarone (13 patients (92.9%)) and cardioversion was performed in three (21.4%) patients with VT. First-line treatment for patients with sinus bradycardia was atropine (9 patients (40.5%)). However, treatment for hyperkalemia was given to four

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(18.2%) patients with sinus bradycardia. First-line treatment was given for eighteen (81.8%) patients with complete heart block (CHB). Treatment for hyperkalemia was given in four (18.2%) patients with CHB. Second-line treatment with Epinephrine was given in nine (40.9%) patients and dobutamine was given in three (13.6%) patients with CHB. Percutaneous pacing was done in twelve (54.5%) patients and transvenous pacing was done in sixteen (72.7%) patients. First-line treatment for patients of first-degree AV block was atropine (2 patients (20%)). One patient (10%) with first-degree AV block was treated with hyperkalemia.

Atropine was given as the first-line agent in all patients with AF with slow ventricular response (AF SVR). Transvenous pacing was done in one (16.7%) patient. Atropine was the first-line agent in all patients with Sinus node dysfunction (SND)-Bradycardia. Second-line treatment with epinephrine was given in four (66.7%) patients with SND-Bradycardia. Transcutaneous pacing followed by transvenous pacing was done in four patients (66.7%). Atropine was given as the first-line agent in all patients with 2nd degree AV block. Transcutaneous pacing was performed in one (20%) patient with 2nd degree AV block and transvenous pacing was performed in four (80%) patients with 2nd degree AV block. This study's findings may help emergency physicians in the prediction, early identification and better management of dysrhythmia.

DISCUSSION

The current study is a prospective observational study of 350 patients who were diagnosed with cardiac dysrhythmia in the ED of AIIMS, New Delhi.

As per the study findings, cardiac dysrhythmia was more commonly encountered in males (57%) than in females and prevalence increased dramatically with age, with most patients being in the middle-aged and elderly age group. The present study agrees with the result of the study conducted by Weber BE et al and Vora A et al [2,3]. In the present study majority of the patients who had rhythm abnormalities were unemployed (29.4%), either housewives or those who lost their jobs during the covid pandemic. A study by Rørth R et al showed that unemployment and job loss drastically worsen cardiovascular health as it independently increases the risk of acute myocardial infarction and increases mortality by as much as 50% in patients with heart failure[4].

In this study, the level of education of 90.5% of patients that were non-compliant with treatment was found to be below class 12th. A study by Schultz WM et al, demonstrated that there is also a strong correlation between education and health literacy[5]. The most common comorbidity encountered among the patients in the study was hypertension (26.3%). Other major comorbidities include rheumatic heart disease (22.6%) and ACS (20.9%). A study by Afzal MR et al showed that major factors contribute to the complex pathophysiology of arrhythmogenesis in hypertensive patients[6].

A study by Kupari M et al, demonstrated that AF is commonly found in younger men who consume alcohol[7]. The present study is in line with this study. In the present study around

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30% of patients with cardiac dysrhythmia were found to have at least one addiction, with smoking being the most common (19.4%) and about 17% of patients with AF had a history of chronic alcohol consumption.

In this study, tachydysrhythmia (67%) was the most common form of cardiac dysrhythmia followed by bradydysrhythmia (21.4%) and Cardiac arrest. Sinus tachycardia and AF with RVR were the most common tachydysrhythmia identified in this study. Tachydysrhythmia were more common in males (52%) than females (48%). The most common presenting complaint among patients with tachydysrhythmia was dyspnea (52%) whereas palpitations were noted in only 20% of patients with tachydysrhythmia. The median age of tachydysrhythmia was 49 years, which is much younger than patients with bradydysrhythmia and cardiac arrest (median age: 60 years), this is due to the high prevalence of patients with rheumatic heart disease presenting with AF with RVR and patients with AVNRT. The present study results agree with the study by Kusumoto FM et al . This study demonstrated that bradydysrhythmia are more common in the elderly due to increased incidence of sinus node dysfunction and AV blocks with age[8].

The most common precipitant identified for cardiac dysrhythmia by this study was ACS. This is due to the fact that AIIMS is a tertiary referral center with a high caseloa of ACS patients. Sinus tachycardias (22%) were the most commonly identified rhythm abnormality overall with a majority (86%) being precipitated by ACS. According to a study by Meltzer LE et al Sinus tachycardia is known to be one of the most common dysrhythmias in ACS[9]. Sinus bradycardia and complete heart block were the most commonly identified bradydysrhythmia in this study. ACS (46%) was the most commonly identified precipitant for sinus bradycardia. It occurs due to sinus node dysfunction[10].

Cardiac arrest rhythms were present in 41 patients included in the study. Non-shockable rhythms (68%) constituted the majority of cardiac arrest rhythms. The most common cardiac arrest rhythm was Pulseless electrical activity (PEA) (39%) followed by asystole (29%). In a multicentre prospective observational study among in-hospital cardiac arrest, the most common rhythm identified was asystole[11].

As per the study result, independent predictors of mortality among patients with cardiac dysrhythmia were complaint of dyspnea at presentation and increased delay in presentation to the emergency. Disposition from ED (discharged, admitted, died, left against medical advice (LAMA), absconded, or transferred to another hospital) were taken as primary outcome. As per the study findings, about 25% of the patients with tachydysrhythmia were discharged whereas only about 11% of patients with bradydysrhythmia could be discharged from the emergency. Approximately 85% of patients with cardiac arrest died in the ED.
Among the study population, first-line treatment for patients with sinus tachycardia was oral metoprolol and oral carvedilol. In most patients, sinus tachycardia does not warrant treatment but in this study, as ACS was the major precipitant, oral beta-blockers were given

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in majority of the cases. A study by López-Sendón J et al showed that oral beta-blockers decrease oxygen demand due to the reduction in heart rate, blood pressure, and contractility, and the consequent relief of ischemic chest pain[12]. Most patients (91%) needed admission due to the underlying ACS or pulmonary embolism and two patients died in the emergency. Sinus tachycardia is poor prognostic indicator in patients with ACS[13]. First-line treatment given for patients with AF with RVR was diltiazem and metoprolol in some patients. A randomised control trial by Fromm C et al, revealed that diltiazem was more effective in achieving rate control in patients with AF with FVR[14]. Cardioversion was performed in some patients after failure of first- or second-line therapy.

First-line treatment for patients with atrial flutter was diltiazem and metoprolol. A second-line treatment was required for some patients who received diltiazem. A study by Fuster V showed that management of atrial flutter is similar to that of AF[15]. First-line treatment for patients with AVNRT was adenosine and a few patients were treated with valsalva maneuvers. A study by Smith GD et al demonstrated that valsalva maneuver is known to be effective in 20-50% of hemodynamically stable patients[16].

First-line treatment for patients with VT was amiodarone. Amiodarone can be given for the prevention of recurrence of ventricular tachycardia/ventricular fibrillation (VT/VF) during an electrical storm or after the dysrhythmia has subsided[17]. Cardioversion was performed in a few patients with VT. Most patients with stable VT required admission. First-lineine treatment for sinus bradycardia was atropine. Treatment for hyperkalemia was given for some patients with sinus bradycardia. As per the study by Kusumoto FM et al sinus bradycardia usually does not warrant treatment unless it is symptomatic[18]. Most patients needed admission for management of underlying ACS or management of drug toxicities. Two patients with sinus bradycardia were discharged from the ED after correction of hyperkalemia. Treatment for hyperkalemia was given to some patients with CHB. Second-line treatment with Epinephrine was given to a few patients with CHB and dobutamine was given to some patients with CHB. Most patients with CHB required admission.

First-line treatment for first-degree AV block (1AVB) was atropine. Temporary pacing was required in some patients of 2nd degree AV block (2AVB). Among patients with 1AVB, 80% needed admission for management of ACS. Among patients with 2AVB, most needed admission. A study by Stankovic N demonstrated that for patients with second-degree atrioventricular block and hemodynamic compromise refractory to anti-bradycardic medical therapy, temporary transcutaneous pacing may be considered until a temporary transvenous is placed or the bradydysrhythmia resolves[19].

The average duration of CPR among patients with a shockable rhythm was 33 minutes, whereas it was 22.5 minutes in patients with a non-shockable rhythm. The average dose of adrenaline in patients with a non-shockable rhythm was 4 mg and it was 2.5 mg in patients with a shockable rhythm. None of the patients with non-shockable rhythms survived to

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hospital discharge, whereas 2 patients with shockable rhythms survived to hospital discharge. In a prospective observational study conducted in Denmark, the 30-day survival among patients with an initial shockable rhythm was 57% whereas, among patients with an initial non-shockable rhythm, survival was 16%[19]. The survival rates in this study are much lower, this can be attributed to the worse baseline health of the patients with cardiac arrest included in this study. It can also be attributed to sub-optimal post-cardiac arrest care provided to the patients.

LIMITATIONS OF THE STUDY:

1) Not all patients in the ED with cardiac dysrhythmia were included in this study.
2) There was no follow up for patients who were discharged from the ED or referred to other hospitals.
3) Out of hospital cardiac arrests were excluded from the study.

CONCLUSION

This study demonstrated that tachydysrhythmia is the most common dysrhythmia encountered in the ED. The prevalence of dysrhythmia in this study was highest in the middle-aged population. This is a deviation from prior studies where the prevalence of dysrhythmia increased with age. Further, this study showed that increased delay in presentation and presence of dyspnea on presentation to the ED were independent risk factors for death among patients with cardiac dysrhythmia in the ED. This can be overcome by providing awareness to the general population about cardiac dysrhythmia. Improving health literacy among the general population will avoid delays in the presentation of the patients with dysrhythmia and help early identification of symptoms.

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