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INCIDENCE OF CARDIAC ARRHYTHMIAS IN ACUTE MYOCARDIAL INFARCTION IN A TERTIARY CARE CENTRE

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ABSTRACT

Background: Cardiac arrhythmias are a prevalent and potentially grave consequence in patients with acute myocardial infarction (AMI), especially during the initial 48 hours following symptom onset. These arrhythmias may substantially affect short-term morbidity and death. Timely interventions depend on early detection through ongoing cardiac monitoring. Comprehending the prevalence and classifications of arrhythmias in acute myocardial infarction might enhance management strategies and outcomes, particularly for high-risk patients at tertiary care facilities.

Objectives: To determine the incidence and pattern of cardiac arrhythmias within the first 48 hours of hospitalization in patients diagnosed with acute myocardial infarction.

Methods: A prospective observational study was conducted at a tertiary care hospital involving 90 patients admitted with a confirmed diagnosis of AMI. Continuous cardiac monitoring was performed for the first 48 hours of admission. Demographic details, clinical presentation, ECG findings, and type and timing of arrhythmias were recorded. Data were analyzed using descriptive statistics.

Results: Out of the 90 patients enrolled in the study, cardiac arrhythmias were observed in 24 (26.67%) patients within the first 48 hours of admission. The most common arrhythmia was ventricular premature complexes (VPCs), seen in 10 (11.11%) patients, followed by atrial fibrillation in 5 (5.56%), ventricular tachycardia in 4 (4.44%), complete heart block in 3 (3.33%), and other arrhythmias such as sinus bradycardia and junctional rhythms in 2 (2.22%) patients. Arrhythmic events were more frequently noted in patients with anterior wall myocardial infarction and those who presented within six hours of chest pain onset. Additionally, advanced age, diabetes mellitus, and hypertension were found to be associated with a higher incidence of arrhythmias.

Conclusions: Cardiac arrhythmias are common in the early phase of AMI, with VPCs and atrial fibrillation being the most frequent. Continuous ECG monitoring during the initial 48 hours is essential for early identification and intervention, especially in high-risk patients. Early risk stratification can significantly reduce morbidity and mortality associated with arrhythmic complications.

Keywords: Acute myocardial infarction, atrial fibrillation, cardiac arrhythmias, ventricular tachycardia.

INTRODUCTION

Acute myocardial infarction (AMI), remains a significant contributor to morbidity and mortality globally. This occurs because to a sudden decrease in coronary blood flow, typically caused by plaque rupture and thrombus development in the coronary arteries. This results in ischemia and necrosis of the myocardium, subsequently impairing normal cardiac electrical conduction.[1] A prevalent and possibly fatal consequence of acute myocardial infarction is the emergence of cardiac arrhythmias, particularly in the initial hours after the start of chest discomfort.[2]

Cardiac arrhythmias associated with acute myocardial infarction can range from benign premature contractions to severe manifestations, including ventricular tachycardia, ventricular fibrillation, or total heart block. These arrhythmias can exacerbate myocardial ischemia, diminish cardiac output, and, in certain instances, lead to abrupt cardiac death. Research indicates that the peak occurrence of arrhythmias transpires within the initial 24–48 hours post-AMI, underscoring the necessity for early surveillance and immediate intervention.[3,4]

The etiology of arrhythmias in acute myocardial infarction is complicated. It encompasses modified autonomic tone, electrolyte disturbances, hypoxia, acidosis, myocardial distension, and direct ischemia damage to the cardiac conduction system.[5] The nature and intensity of arrhythmias are contingent upon the infarct's location, the extent of the ischemic region, the existence of pre-existing cardiac ailments, and the duration between the onset of symptoms and medical treatment.[6] Anterior wall infarctions are frequently linked to conduction abnormalities and total heart block, while inferior wall infarctions might result in bradyarrhythmias due to heightened vagal tone.[7]

In the field of advanced cardiac care, the early identification of arrhythmias with continuous electrocardiographic (ECG) monitoring has become essential in the management of AMI, particularly during the crucial initial 48 hours. This facilitates prompt intervention with anti-arrhythmic medications, pacing, or defibrillation if required.[8] Furthermore, the prompt identification of high-risk patients—characterized by variables such as advanced age, hypertension, diabetes mellitus, or prior cardiac incidents—can markedly affect outcomes by directing intensive monitoring and therapeutic approaches.[9,10]

Despite advancements in coronary care and reperfusion therapy, arrhythmias remain a considerable risk during the initial phases of acute myocardial infarction, especially in resource-constrained environments. Although prior research has investigated arrhythmias in AMI, there is a paucity of contemporary data from tertiary care institutions within the Indian demographic.

This study provides new insights by prospectively examining the incidence, kinds, and associated risk factors of arrhythmias in AMI patients within a modern tertiary care environment, aiding in the timely diagnosis, monitoring, and intervention techniques. The study aims to provide useful insights into the frequency and pattern of arrhythmias during this critical period, thereby strengthening professional vigilance, informing early therapeutic actions, and eventually improving patient outcomes in acute coronary care settings.

AIMS AND OBJECTIVES

- To determine the incidence and pattern of cardiac arrhythmias within the first 48 hours of hospitalization in patients diagnosed with acute myocardial infarction.

MATERIALS AND METHODS

This was a hospital-based, prospective observational study conducted in the Department of General Medicine/Cardiology at Sree Mookambika Institute of Medical Sciences, Kulasekharam, a tertiary care teaching hospital over a period of 10 months. Informed consent was obtained from all participants. The study included adult patients admitted with a diagnosis of AMI either ST-elevation myocardial infarction (STEMI) or non-ST-elevation myocardial infarction (NSTEMI), within 24 hours of the onset of chest pain.

Inclusion Criteria

- Patients aged ≥18 years.
- Patients presenting with AMI confirmed by clinical symptoms, ECG changes (ST elevation or depression, new left bundle branch block), and/or elevated cardiac biomarkers (troponin I/T, CK-MB).
- Patients admitted within 24 hours of onset of chest pain.

Exclusion Criteria

- Patients with pre-existing arrhythmias or pacemakers.
- Patients with known structural heart disease (e.g., valvular disease, cardiomyopathy).
- Patients on anti-arrhythmic drugs prior to admission.
- Patients who developed arrhythmias beyond the initial 48-hour monitoring period.

A total of 90 eligible patients were included in the study based on the inclusion and exclusion criteria. Upon admission, a detailed clinical history was recorded, including time of symptom onset, risk factors (e.g., smoking, hypertension, diabetes, dyslipidemia), and prior cardiac history. Physical examination findings were noted, and baseline investigations such as ECG, cardiac biomarkers, echocardiography, and routine blood tests were conducted.

All patients were continuously monitored using bedside cardiac monitors for the first 48 hours of hospitalization. Electrocardiographic changes were documented, and any arrhythmic event was recorded with its time of onset, type, duration, and any associated clinical symptoms (e.g., syncope, hypotension, chest pain). Management of arrhythmias was carried out as per hospital protocols and cardiologist discretion.

All collected data were compiled and entered into Microsoft Excel. Statistical analysis was performed using SPSS software 25.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were expressed as frequency and percentage (N [%]). The incidence of arrhythmias was calculated, and associations with clinical parameters (age, infarct location, risk factors) were analyzed using Chi-square test and Student's t-test where appropriate. A p-value of <0.05 was considered statistically significant.

OBSERVATION AND RESULTS

Of the 90 patients, 68 (75.6%) were males and 22 (24.4%) were females, with a mean age of 58.4 ± 10.2 years (range: 38–82 years). Most patients (61.1%) presented within the first 6 hours of chest pain onset**,** while the remaining presented between 6 and 24 hours. Hypertension and diabetes were common comorbidities, while **s**moking was the most prevalent risk factor (57.8%). (Table 1)

Variable	Number of Patients (N)	Percentage (%)
Hypertension	43	47.8%
Diabetes Mellitus	36	40.0%
Dyslipidemia	28	31.1%
Smoking History	52	57.8%
Family History of CAD	14	15.6%

Table 1: Descriptive analysis of comorbidities

STEMI was more common (71.1%) than NSTEMI. Among STEMI cases, anterior wall infarction was the most frequent subtype, observed in nearly 39% of patients. (Table 2)

	Number of Patients (N)	Percentage (%)
STEMI	64	71.1%
NSTEMI	26	28.9%
Anterior Wall MI	35	38.9%
Inferior Wall MI	22	24.4%
Lateral/Posterior MI	7	7.8%

Table 2: Type and Location of Myocardial Infarction

Cardiac arrhythmias were observed in 24 patients (26.67%) during the first 48 hours of admission with ventricular premature complexes (VPCs) being the most common. The distribution of arrhythmia types was given in table 3.

Type of Arrhythmia	Number of Patients (N)	Percentage (%)
Ventricular premature complexes (VPCs)	10	11.11%
Atrial fibrillation (AF)	5	5.56%
Ventricular tachycardia (VT)	4	4.44%
Complete heart block (CHB)	3	3.33%
Sinus bradycardia/Junctional rhythm	2	2.22%

Table 3: Type of Arrhythmia

Most arrhythmias (75%) occurred within the first 24 hours, emphasizing the importance of continuous cardiac monitoring during the early phase of hospitalization. (Table 4)

Time of Onset	Number of Patients (N)	Percentage (%)
Within 24 hours	18	75.0%
24–48 hours	6	25.0%

Table 4: Timing of Onset of Arrhythmias

Older age (>65 years) ($p = 0.031$) and reduced LVEF (<40%) ($p = 0.025$) were significantly linked, indicating increased electrical vulnerability in these groups. Although STEMI patients had a higher arrhythmia incidence (79.2% vs 66.7%), it was not statistically significant ($p = 0.24$).

Clinical Variable	Arrhythmia Present (n=24)	No Arrhythmia (n=66)	p-value
Age > 65 years	13 (54.2%)	19 (28.8%)	0.031
Male Gender	16 (66.7%)	43 (65.2%)	0.89
Hypertension	18 (75.0%)	40 (60.6%)	0.20
Diabetes Mellitus	12 (50.0%)	29 (43.9%)	0.60
Smoking	9 (37.5%)	24 (36.4%)	0.93
Dyslipidemia	8 (33.3%)	18 (27.3%)	0.57
STEMI	19 (79.2%)	44 (66.7%)	0.24
LVEF < 40%	14 (58.3%)	21 (31.8%)	0.025
Prior History of IHD	6 (25.0%)	12 (18.2%)	0.44

Table 5: Association of Clinical Variables with Arrhythmias

Most arrhythmias were managed successfully with medications. A few patients required cardioversion or temporary pacemaker insertion, especially in cases of sustained VT or heart block. (Table 6)

Management Strategy	Number of Patients (N)	Percentage (%)
Pharmacological Therapy	16	66.7%
Electrical Cardioversion	3	12.5%
Temporary Pacemaker Insertion	2	8.3%
No Active Intervention Required	3	12.5%

Table 6: Management of Arrhythmias

Patients who developed arrhythmias had a longer hospital stay compared to those who did not (7.6 ± 1.8 vs 5.9 ± 1.7). Importantly, there were no arrhythmia-related deaths, indicating effective monitoring and timely intervention.

DISCUSSION

The study population predominantly comprised male patients (75.6%) with a mean age of 58.4 years, aligning with the well-established male predominance and middle-to-older age distribution observed in AMI presentations. Similarly, Singh M et al.[11] reported 61.7% male patients (n=74) with the highest incidence of arrhythmia occurring in the 61–70-year age group (32.5%). Almani B et al.[12] noted a mean patient age of 48.23±12.9 years, with males representing 58.19% of their cohort.

Cigarette smoking emerged as the most frequently observed risk factor across multiple studies—reported in 54.23% by Almani B et al.[12] and in 57.8% of patients in the current study. Hypertension and diabetes mellitus were also prevalent comorbidities. A majority (61.1%) of patients presented within the first 6 hours of symptom onset, suggesting good awareness and timely healthcare-seeking behavior.

In the present study, STEMI was the most common AMI type, observed in 71.1% of patients, with anterior wall involvement being the most frequent (38.9%). This is consistent with global trends, as reported by Mc R et al.[13] who found a 71% arrhythmia incidence among STEMI patients, compared to 23% in NSTEMI and 6% in unstable angina (UA). Singh M et al.[11] observed anterior wall MI (AWMI) in 29.16% and inferoposterior MI in 21.6%, while Bhatti U et al. reported a distribution of 50.3% UA, 30.7% NSTEMI, and 19.1% STEMI cases.

Arrhythmias were observed in approximately 26.67% of patients during the initial 48

hours of hospitalization. Most arrhythmias (75%) occurred within the first 24 hours, underscoring the need for intensive cardiac monitoring during this critical period. Singh M et al.[11] found early arrhythmias in 40.8% of cases while Mc R et al.[13] reported arrhythmia onset within the first hour in 56% of patients.

The most frequently encountered arrhythmia was VPCs, followed by sinus tachycardia, AF, and VT. This pattern was supported by findings from multiple studies.

Singh M et al.[11] observed that ventricular premature complex was the most common arrhythmia, observed in 29.2%, followed by sinus tachycardia (20%). Tachyarrhythmias were more frequently observed in anterior infarction whereas bradyarrhythmias were more frequently observed in inferior infarction. 30.8% of patients had ejection fraction of <40%. Overall, mortality was 10% {5.8% in AWMI and 1.7% in IPWMI}.

Mc R et al.[13] observed VPC (24.36%), sinus tachycardia (16.67%), AF (15.38%), with 1st-degree heart block being least common (2.56%). Marangmei L et al.[14] VPC (23%), sinus tachycardia (21%), heart block (15%), bundle branch block (11%), and VT in 7% patients. IWMI was associated with higher rates of bradycardia and heart block; AWMI with tachyarrhythmias and VT.

Bhatti U et al.[15] in their study found that Arrhythmias were seen in 39 patients (20.6%), most commonly observed type of arrhythmia were premature ventricular contractions (12%), AF (9%), VT (7%), and ventricular fibrillation (5%).

In the study done by Asaad N et al.[16] AF was observed in 383 patients (18.1%). VT was found in 461 (21.8%), and ventricular fibrillation occurred in 526 patients (24.8%). Complete heart block was developed in 286 (13.5%) patients, 1st-degree atrioventricular (AV) block in 36 (1.7%), 2nd-degree AV block in 138 (6.5%), left bundle branch block in 81 (3.8%), and right bundle branch block in 118 (5.6%).

Advanced age (>65 years) and reduced left ventricular ejection fraction (LVEF <40%) were significantly associated with arrhythmia occurrence ($p = 0.031$ and $p = 0.025$, respectively). Other cardiovascular risk factors—such as hypertension, diabetes, dyslipidemia, and smoking—though prevalent, did not show a statistically significant association with arrhythmia onset in this cohort. Chu S et al.[17] reported higher arrhythmia incidence in patients with chronic renal dysfunction, COPD, infections, respiratory failure, and elevated cardiac biomarkers (all $p < 0.05$).

Most arrhythmias were managed pharmacologically (66.7%). More severe forms, such as sustained VT or high-grade AV block, required electrical cardioversion or temporary pacemaker insertion. There was no arrhythmia-related mortality in this cohort, reflecting the

effectiveness of early detection and intervention. Chu S et al.[17] reported more aggressive interventions (e.g., IABP, mechanical ventilation) and altered medication patterns among patients with arrhythmia, who were also less likely to be discharged on guideline-recommended therapies such as aspirin and ACE inhibitors.

Arrhythmias were associated with longer hospital stays (7.6 ± 1.8 vs 5.9 ± 1.7 days), indicating greater clinical complexity. Marangmei L et al.[14] reported high mortality in VT cases, with six of seven patients dying within 48 hours ($p < 0.01$). Similarly, Kurmi P et al.[18] found that 29 out of 37 deaths were linked to arrhythmias, with the highest mortality seen in extensive AWMI (37.24%) and IWMI (35.14%).

CONCLUSION

Cardiac arrhythmias are among the most frequent and serious complications observed during the acute phase of myocardial infarction, particularly within the first 24–48 hours of symptom onset. The study demonstrates that a significant proportion (26.67%) of AMI patients developed arrhythmias, highlighting the need for early risk stratification and real-time rhythm surveillance. Continuous cardiac monitoring using bedside telemetry plays a crucial role in identifying subtle or asymptomatic rhythm disturbances, allowing for immediate clinical intervention. In high-risk group, monitoring enables the care team to detect arrhythmic changes even before clinical deterioration occurs. This early recognition can facilitate life-saving treatments. It also minimizes the delay in resuscitative efforts in the event of a cardiac arrest, thus reducing in-hospital mortality and improving overall outcomes.

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CONFLICTS OF INTEREST

There are no conflicts of interest

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