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Original Research Article

Clinical Profile of Arrhythmias and Their Outcomes in Patients with Acute Myocardial Infarction: A Prospective Observational Study

Ranganatha M.[1], Amith Kumar[2], Eshwarappa P.[3], Raveendra N. Mudiyammanavara[4], Vikram Teja S.[5]

[1]Associate Professor, Department of General Medicine, Shimoga Institute of Medical Sciences, Shimoga
[2]Associate Professor, Department of General Medicine, Shimoga Institute of Medical Sciences, Shimoga
[3]Associate professor Department of General Medicine, Shimoga Institute of Medical Sciences, Shimoga
[4]Assistant Professor, Department of General Medicine, Shimoga Institute of Medical Sciences, Shimoga
[5]Junior Resident, Department of General Medicine, Shimoga Institute of Medical Sciences, Shimoga

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Corresponding author: Dr. Raveendra N. Mudiyammanavara
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Abstract

Background: Arrhythmias continue to be one of the most significant complications of acute myocardial infarction (MI) and are responsible for considerable morbidity, prolonged hospital stay and mortality. Despite progress in reperfusion therapy and cardiac monitoring, rhythm disturbances still determine the outcome of patients in the acute phase of MI.

Aims: To study the clinical profile, incidence, pattern and outcome of arrhythmias in patients of myocardial infarction and to correlate them with demographic characteristics, cardiovascular risk factors, serum troponin I levels, duration of hospital stay and mortality.

Materials & Methods: Material and methods: A prospective observational study was carried out on 370 patients of acute myocardial infarction admitted in a tertiary care teaching hospital. Patients were continuously monitored during hospitalization for the development of arrhythmias. Demographic data, clinical characteristics, cardiovascular risk factors, electrocardiogram findings, thrombolytic therapy, serum troponin I levels, duration of the hospitalization, and outcome were recorded. Statistical analysis was done with Epi Info software. Continuous variables were expressed as mean ± standard deviation and compared by Student's t-test. Analysis of categorical variables was performed using chi-square test. < 0.05 was considered to be statistically significant.

Results: The majority of patients were in the 51-70 year age group (62.9%) and males constituted 58.8% of the study population. Arrhythmias were observed in 143 patients (38.7%). Ventricular premature complexes were the most common arrhythmia (49.0%), followed by atrial fibrillation (11.2%). Age was significantly correlated with the occurrence of arrhythmia (p=0.018). Patients with arrhythmias had a higher mortality (13.2%) than those without arrhythmias (6.3%) (p=0.052). Mean serum troponin I level was significantly higher in patients with arrhythmias (9297.56 ± 12078.36) than in those without arrhythmias (609.60 ± 336.30; p<0.001). Hospital stay was significantly longer in patients with arrhythmia (7.09 ± 1.94 days vs. 6.52 ± 1.76 days; p=0.005).

Conclusion: Arrhythmias are common complications of acute myocardial infarction and correlate with increased myocardial injury, prolonged hospital stay and adverse clinical outcomes. Early identification and close follow-up of high-risk patients may improve prognosis.

Keywords: Myocardial Infarction, Arrhythmia, Troponin I, Mortality, Ventricular Premature Complexes, Acute Coronary Syndrome.

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Introduction

Cardiovascular diseases are still the main cause of death in the world and constitute a significant part of disability-adjusted life years. One of the most serious manifestations of coronary artery disease among cardiovascular disorders, acute myocardial infarction (AMI) remains a major public health challenge despite significant improvements in preventive cardiology and interventional management. Ischemic heart disease remains the leading cause of death worldwide, according to the World Health Organization, with increasing prevalence in low- and middle-income countries due to demographic transition, urbanization, and increasing prevalence of cardiovascular risk factors

such as hypertension, diabetes mellitus, obesity, smoking, and dyslipidemia [1]. Acute myocardial infarction is caused by an abrupt cessation of coronary blood flow, leading to myocardial ischemia and necrosis. The magnitude of myocardial damage depends on the duration of ischemia, adequacy of collateral circulation, and time to reperfusion therapy. One of the most feared complications of myocardial infarction (MI) is electrical instability of the ischemic myocardium, besides mechanical complications and pump failure. Arrhythmias may occur at any stage following myocardial infarction and range from benign premature beats to life-threatening ventricular tachycardia, ventricular fibrillation and complete heart block [2].

The pathophysiology of arrhythmogenesis following myocardial infarction is multifactorial. Acute ischemia alters transmembrane ion gradients, leads to areas of conduction delay and promotes heterogeneity of repolarization. Other factors involved in the development of arrhythmias are reperfusion injury, imbalance of autonomic nervous system, electrolyte abnormalities, inflammation and structural remodeling [3]. Both atrial and ventricular rhythm disturbances are produced by mechanisms that may act alone or in combination. The incidence of arrhythmias after MI has been reported to vary from 20% to 60%, depending on the patient population studied, the duration of monitoring and the definition of arrhythmia used [4,5]. Although sustained ventricular arrhythmias have been studied extensively because of their association with sudden cardiac death, less attention has been paid to the entire spectrum of rhythm disturbances occurring during the acute phase of MI. Benign arrhythmias may be a marker of extensive myocardial injury and may be associated with prolonged hospitalization and adverse outcome.

The advent of reperfusion strategies with thrombolytic therapy and primary percutaneous coronary intervention (PCI) has resulted in a marked reduction in mortality from acute MI. However, arrhythmias still occur in the modern reperfusion era and are still important determinants of prognosis [6]. Early detection of patients at risk for arrhythmias could lead to timely interventions, better use of resources, and potentially lower mortality.

Cardiac biomarkers, particularly troponin I, are sensitive markers of myocardial necrosis. Several studies have indicated that higher levels of biomarkers are associated with larger infarct size and increased risk of ventricular arrhythmias [7]. The predictive value of demographic variables, infarct location, comorbid conditions and reperfusion status for arrhythmic complications has also been examined with inconsistent results.

In developing countries, delayed presentation, limited access to reperfusion therapy and a high prevalence of modifiable risk factors may affect arrhythmias after MI. Data from Indian populations are limited, especially concerning the full spectrum of arrhythmias and their relationship with clinical outcomes.

Therefore, the present study was undertaken to evaluate the clinical profile of arrhythmias among patients with myocardial infarction, to assess their incidence and patterns and to determine their association with patient characteristics, serum troponin I levels, duration of hospitalization and mortality. The results are expected to improve risk stratification and management of patients with acute myocardial infarction.

Materials and Methods

Study Design: Prospective observational study.

Study Setting: Department of Cardiology, tertiary care teaching hospital.

Study Duration: One year.

Study Population: Patients admitted with acute myocardial infarction.

Sample Size: A total of 370 patients were enrolled.

Inclusion Criteria

- Age ≥18 years.
- Confirmed diagnosis of acute myocardial infarction.
- Willingness to participate.

Exclusion Criteria

- Age <18 years.
- Pre-existing chronic arrhythmias unrelated to acute MI.
- Incomplete records.

Data Collection

The following information was collected:

- Demographic variables
- Clinical presentation
- Cardiovascular risk factors
- ECG findings
- Serum troponin I
- Thrombolytic therapy
- Duration of hospital stay
- Mortality and outcomes

Statistical Analysis: Data were analyzed using Epi Info software. Continuous variables were expressed as mean ± SD. Student's t-test and Chi-square tests were used. Statistical significance was defined as $p<0.05$.

Results

Table 1: Age Distribution

Age Group (Years)	n	%
30–50	108	29.1
51–70	233	62.9
71–90	29	8.0
Total	370	100

The majority of MI patients belonged to the 51–70-year age group, highlighting increasing cardiovascular risk with advancing age.

Table 2: Sex Distribution

Sex	n	%
Male	216	58.8
Female	154	41.2
Total	370	100

Male predominance was observed, consistent with established epidemiological patterns of coronary artery disease.

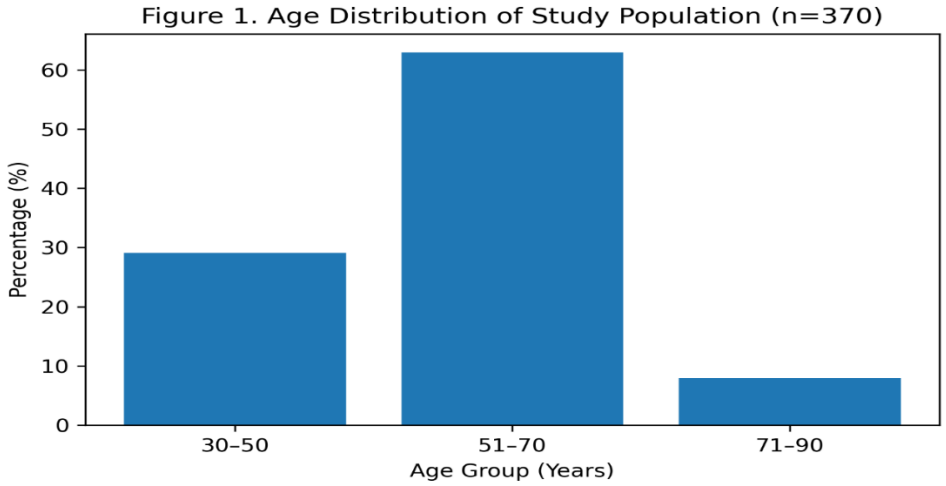

Figure 1: Age Distribution of Study Population

Table 3: Incidence of Arrhythmias

Arrhythmia Status	n	%
Present	143	38.7
Absent	227	61.3
Total	370	100

Nearly two-fifths of patients developed arrhythmias, emphasizing their continued clinical importance in acute MI.

Table 4: Types of Arrhythmias

Type	n	%
VPC	70	49.0
Atrial fibrillation	16	11.2
First-degree AV block	12	8.4
Sinus tachycardia	12	8.4
Sinus bradycardia	10	7.0
Complete heart block	9	6.3
Second-degree AV block	8	5.6
SVT	4	2.8
VT	2	1.4

Ventricular premature complexes represented nearly half of all arrhythmias, indicating heightened ventricular irritability following myocardial injury.

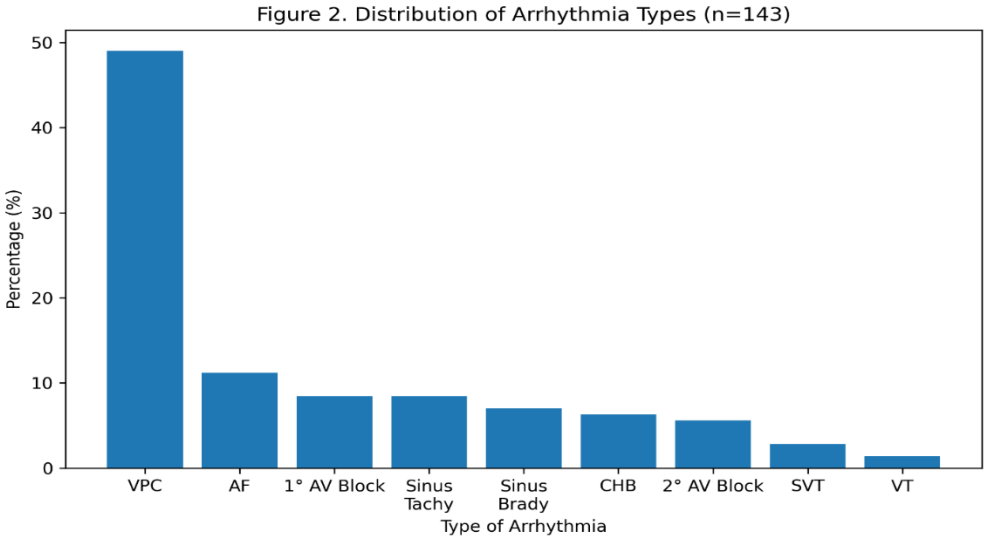

Figure 2: Distribution of Arrhythmia Types

Table 5: Mortality According to Arrhythmia Status

Outcome	Arrhythmia	No Arrhythmia
Death	30 (13.2%)	9 (6.3%)
Survived	113	218
p-value	0.052	

Mortality was approximately twofold higher among patients with arrhythmias, indicating adverse prognostic significance.

Table 6: Thrombolytic Therapy

Status	n	%
Thrombolysed	120	32.43
Not Thrombolysed	250	67.57

Only one-third of patients received thrombolysis, suggesting delayed presentation or barriers to reperfusion therapy.

Table 7: Serum Troponin I Levels

Group	Mean ± SD
Arrhythmia	9297.56 ± 12078.36
No Arrhythmia	609.60 ± 336.30
p-value	<0.001

Patients with arrhythmias demonstrated markedly elevated troponin I levels, reflecting larger infarct size and greater myocardial necrosis.

Table 8: Hospital Stay

Group	Mean ± SD (Days)
Arrhythmia	7.09 ± 1.94
No Arrhythmia	6.52 ± 1.76
p-value	0.005

Arrhythmias significantly prolonged hospitalization and increased healthcare utilization.

Discussion

The current prospective observational study assessed incidence, patterns and outcomes of arrhythmias in patients with acute myocardial infarction. Rhythm disorders are still frequent even with the latest cardiac care; arrhythmias occurred in 38.7% of patients. This incidence is comparable to that reported in previous studies, with rates of arrhythmia between 20% and 50% during the acute phase of myocardial infarction [2,4]. Most of the patients were in the age group of 51-70 years, reflecting the increasing burden of coronary artery disease with age. Arrhythmia occurrence was statistically associated with age. This finding may be explained by age related myocardial fibrosis, impaired autonomic regulation and increased susceptibility to conduction abnormalities.

Gheeraert et al. have also found age to be an important predictor of arrhythmic complications in the context of acute myocardial infarction [8].

The male preponderance observed in the present study is in accordance with known epidemiological trends. Sex did not significantly affect arrhythmia development, but men accounted for almost 60% of cases. This finding implies that the risk of electrical instability after myocardial infarction may be more dependent on infarct characteristics than on biological sex differences.

One of the important findings of the study was the high prevalence of conventional cardiovascular risk factors including hypertension, diabetes mellitus, smoking and dyslipidemia. These factors are important for atherosclerotic disease and myocardial infarction. However, arrhythmia occurrence was not statistically significantly associated. This finding supports the concept that arrhythmias are mainly driven by the extent of myocardial injury and not baseline cardiovascular risk burden. The commonest arrhythmia was ventricular premature complexes, which represented almost half of all rhythm disturbances. This observation is consistent with previous reports of increased ventricular ectopy following myocardial ischemia. VPCs are often indicative of the enhanced automaticity and triggered activity of ischemic myocardial tissue. While their presence is often benign, they may indicate increased electrical instability and should be closely monitored.

The second most common arrhythmia was atrial fibrillation. Development of atrial fibrillation after MI may be associated with elevated atrial pressures, autonomic dysfunction, inflammation and atrial ischaemia. Conduction abnormalities were also observed including AV blocks and complete heart block. These arrhythmias may arise from ischemic involvement of the conduction system, particularly in inferior wall infarctions.

Among the clinical findings, the most relevant was that arrhythmias were strongly associated with serum troponin I. Troponin I concentrations were significantly increased in patients with arrhythmias. Higher troponin levels are associated with larger infarct size and more extensive myocardial necrosis. The greater the myocardial damage, the more heterogeneous the conduction and repolarization, which predisposes patients to arrhythmogenesis. This finding supports prior reports of cardiac biomarkers as predictors of arrhythmic risk and adverse outcomes. The mortality was about twice as high for patients with arrhythmias as for those without arrhythmias. Although the statistical significance was borderline, the clinical importance of this finding is considerable. Hemodynamic instability, cardiogenic shock and sudden cardiac death may result directly from arrhythmias. They may also be markers of severe myocardial injury and extensive ischemic burden.

Hospital stays were significantly longer for patients with arrhythmias. Longer hospital stay probably indicates the need for continued monitoring, antiarrhythmic therapy, complication management, and delayed recovery. This finding underscores the major burden to health care from arrhythmias post-MI.

It is noteworthy that the rate of thrombolysis was low in this study. Early reperfusion is one of the most effective strategies for reducing infarct size and preventing arrhythmias. The low use of thrombolytic therapy may be due to delayed presentation, limited access to reperfusion facilities, and socioeconomic factors. Better systems for early recognition and treatment of MI may reduce myocardial damage and arrhythmic complications.

In conclusion, the results highlight the role of arrhythmias as determinants of prognosis in acute myocardial infarction. Improved outcomes rely on continuous cardiac monitoring, early identification of rhythm disturbances, and aggressive treatment of high-risk patients.

Conclusion

Arrhythmias are frequent complications of acute myocardial infarction and were observed in 38.7% of patients. Ventricular premature complexes were the most common rhythm disturbance. Patients with arrhythmias demonstrated significantly higher serum troponin I levels and longer hospital stays, indicating greater myocardial injury and increased morbidity. Mortality was also higher among patients with arrhythmias.

Early detection, intensive monitoring, timely reperfusion therapy, and prompt management of rhythm disturbances are crucial for improving outcomes in patients with myocardial infarction.

Strengths of the Study

1. Large sample size of 370 patients.
2. Prospective observational design.
3. Comprehensive assessment of arrhythmia patterns.
4. Evaluation of clinically relevant outcomes.
5. Inclusion of objective biomarker measurements.
6. Real-world hospital-based data.

Limitations

1. Single-center study.
2. Short-term in-hospital follow-up only.
3. Lack of long-term outcome assessment.
4. Absence of detailed echocardiographic correlation.

5. Grouping of benign and malignant arrhythmias together.
6. Limited evaluation of treatment-related variables.

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