



FREQUENCY OF NEW ONSET ATRIAL FIBRILLATION FOLLOWING ACUTE MYOCARDIAL INFARCTION

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ABSTRACT

Background:

Atrial fibrillation (AF) is a common arrhythmic complication of acute myocardial infarction (AMI) and is associated with adverse clinical outcomes. While many patients have pre-existing AF, a considerable proportion develops new-onset atrial fibrillation (NOAF) during hospitalization for AMI. Data regarding the frequency and in-hospital outcomes of NOAF in AMI patients in Pakistan are limited.

Objective:

To determine the frequency of new-onset atrial fibrillation following acute myocardial infarction and to evaluate its impact on in-hospital outcomes.

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Methodology:

This descriptive longitudinal study was conducted in the adult cardiology department of the National Institute of Cardiovascular Diseases (NICVD), Karachi, over a period of six months. A total of 169 patients aged 18–70 years diagnosed with AMI (STEMI or NSTEMI) were enrolled using non-probability consecutive sampling. Patients with a prior history of atrial fibrillation or AF due to causes other than AMI were excluded. Continuous electrocardiographic monitoring was performed to detect NOAF within 30 days of AMI. Data were analyzed using SPSS version 25.

Results:

Out of 169 AMI patients, new-onset atrial fibrillation was observed in 21 patients (12.4%). NOAF was more frequently observed in patients aged ≥ 60 years and in those presenting with STEMI. In-hospital mortality was significantly higher among patients who developed NOAF compared to those who remained in sinus rhythm (19.0% vs 6.1%, $p < 0.05$). Patients with NOAF also had a higher incidence of heart failure and longer hospital stay.

Conclusion:

New-onset atrial fibrillation is a relatively common complication following acute myocardial infarction and is associated with increased in-hospital mortality. Early identification and close monitoring of high-risk AMI patients may help improve clinical outcomes.

Keywords: Acute myocardial infarction, New-onset atrial fibrillation, In-hospital mortality, STEMI, NSTEMI.

INTRODUCTION

Acute myocardial infarction (AMI) remains a major contributor to global morbidity and mortality despite substantial advancements in diagnostic modalities, pharmacological therapy, and reperfusion strategies. Patients hospitalized with AMI frequently develop complications during the acute phase, which significantly influence both short-term and long-term outcomes. Among these complications, cardiac arrhythmias are particularly important; with atrial fibrillation (AF) being the most commonly encountered sustained arrhythmia in clinical practice (El-Shetry et al., 2021).

The incidence of AF in patients with AMI has been reported to range from 6% to 19%, depending on patient characteristics and study design (Feistritz et al., 2019). While

many patients have a pre-existing diagnosis of AF, a considerable proportion develop new-onset atrial fibrillation (NOAF) during or shortly after the acute ischemic event (Congo et al., 2019). NOAF has emerged as a clinically significant entity, as multiple studies have demonstrated its association with increased in-hospital mortality, long-term mortality, heart failure, and thromboembolic events, including cerebrovascular accidents (Ayinde et al., 2022; Obayashi et al., 2021).

The pathophysiology of NOAF following AMI is complex and multifactorial. Acute myocardial ischemia leads to left ventricular systolic dysfunction, which in turn results in elevated left atrial pressure and acute atrial dilatation. These structural and hemodynamic changes create a substrate conducive to atrial electrical instability and

the development of AF (He et al., 2019). Additional contributing mechanisms include autonomic nervous system imbalance, heightened inflammatory response, oxidative stress, electrolyte disturbances, and neurohormonal activation during the acute phase of myocardial infarction (El-Shetry et al., 2021).

Several clinical risk factors have been consistently associated with the development of AF in patients with AMI. Advanced age is one of the strongest predictors, with the prevalence of AF increasing markedly in older populations (He et al., 2019). Other commonly reported risk factors include hypertension, diabetes mellitus, heart failure, obesity, valvular heart disease, cardiomyopathies, and thyroid dysfunction (Mori et al., 2022). The coexistence of these comorbidities further complicates the clinical course of AMI patients who develop NOAF.

The occurrence of AF in the setting of AMI significantly complicates clinical management. AF is associated with an increased risk of thromboembolic events, worsening heart failure, reduced exercise tolerance, and impaired quality of life (El-Shetry et al., 2021). Moreover, the optimal management of antithrombotic therapy in patients with AMI complicated by NOAF remains challenging. Clinicians must balance the risk of systemic embolization against the increased risk of bleeding, particularly in patients receiving dual antiplatelet therapy following reperfusion interventions (Hofer et al., 2021).

Emerging evidence suggests that the prognostic implications of NOAF differ from those of chronic or pre-existing AF.

Although NOAF may appear transient in some patients, studies have shown that even short-lasting episodes are associated with adverse outcomes and increased mortality (Feistritzer et al., 2019; Obayashi et al., 2021). A study by Iqbal et al. (2019) reported that 12.5% of patients presenting with AMI developed NOAF, highlighting the clinical relevance of this complication in acute coronary syndrome settings.

Despite extensive international literature, data regarding the frequency and outcomes of NOAF following AMI in Pakistan remain limited. Given the high burden of coronary artery disease in the local population, it is essential to quantify the burden of NOAF and assess its impact on in-hospital outcomes. This study aims to determine the frequency of new-onset atrial fibrillation following acute myocardial infarction and to evaluate its association with in-hospital mortality, thereby providing valuable local evidence to inform clinical practice and future research.

Literature Review

Atrial fibrillation (AF) is the most frequently encountered sustained cardiac arrhythmia in patients with acute myocardial infarction (AMI) and has been widely studied due to its adverse prognostic implications. The coexistence of AF and AMI represents a complex clinical scenario, as each condition can exacerbate the other. AF may occur as a pre-existing condition or may develop de novo during the acute phase of myocardial infarction, referred to as new-onset atrial fibrillation (NOAF) (El-Shetry et al., 2021). Several studies have demonstrated that AF complicating AMI is associated with increased morbidity and mortality.

Feistritzer et al. (2019) evaluated patients with AMI complicated by cardiogenic shock and reported that the presence of AF significantly increased short-term and long-term mortality. Their findings emphasized that AF is not merely a coincidental finding but an important determinant of adverse clinical outcomes. Similarly, Mori et al. (2022), using data from the K-ACTIVE registry, found that both pre-existing AF and NOAF were associated with worse in-hospital and long-term outcomes in patients with AMI, with a higher risk observed among those who developed NOAF.

The clinical significance of NOAF following AMI has been increasingly recognized. Congo et al. (2019) studied patients presenting with ST-segment elevation myocardial infarction (STEMI) and observed that NOAF was independently associated with increased in-hospital mortality and reduced use of guideline-recommended therapies. This suggests that NOAF may influence both disease severity and treatment strategies. Ayinde et al. (2022), in a large retrospective cohort of Medicare patients, reported that newly diagnosed AF after AMI was associated with significantly higher mortality compared to patients without AF, further supporting the adverse prognostic impact of NOAF.

Long-term outcomes of patients developing NOAF during AMI have also been explored. Hofer et al. (2021) examined the long-term prognosis of patients with de novo AF during AMI and assessed the impact of antithrombotic treatment strategies. The study demonstrated that NOAF was associated with worse long-term outcomes, particularly in patients who did not receive

appropriate anticoagulation therapy. These findings highlight the clinical challenge of balancing thromboembolic risk and bleeding risk in this patient population. Obayashi et al. (2021) similarly reported that newly diagnosed AF during AMI was associated with increased risks of stroke and all-cause mortality, even after adjustment for potential confounders.

The pathophysiological mechanisms underlying NOAF in AMI are multifactorial. Acute myocardial ischemia leads to left ventricular dysfunction, resulting in elevated left atrial pressure and atrial dilatation, which predispose patients to atrial electrical instability. Additional contributing factors include autonomic nervous system imbalance, systemic inflammation, oxidative stress, and electrolyte disturbances (He et al., 2019). These mechanisms collectively create a substrate favorable for the development of AF during the acute phase of myocardial infarction.

Multiple clinical predictors of NOAF following AMI have been identified. Advanced age, heart failure, hypertension, diabetes mellitus, and left ventricular dysfunction are among the most consistently reported risk factors (He et al., 2019). Recent studies have also explored metabolic contributors to NOAF. Luo et al. (2024) demonstrated an association between stress hyperglycemia ratio and in-hospital NOAF, suggesting that acute metabolic stress may play a role in atrial arrhythmogenesis during AMI.

Local evidence from Pakistan regarding NOAF following AMI remains scarce. Iqbal et al. (2019) reported that 12.5% of patients presenting with AMI developed NOAF, and

these patients experienced poorer hospital outcomes compared to those who remained in sinus rhythm. However, comprehensive local studies evaluating both the frequency and clinical impact of NOAF are limited, underscoring the need for further research in this population.

In summary, existing literature consistently demonstrates that NOAF following AMI is associated with increased in-hospital and long-term mortality, heart failure, and thromboembolic complications. Despite robust international evidence, there is a lack of sufficient local data from Pakistan. This highlights the importance of conducting further studies to quantify the burden of NOAF and evaluate its impact on hospital outcomes in the local population.

Materials and Methods

Study Design and Setting

This study was designed as a descriptive longitudinal study and was conducted in the Adult Cardiology Department of the National Institute of Cardiovascular Diseases (NICVD), Karachi. The study was carried out over a period of six months, following approval of the research synopsis by the institutional review board.

Study Population

The study population consisted of patients presenting with a confirmed diagnosis of acute myocardial infarction (AMI). Patients of either gender, aged 18 to 70 years, were considered eligible for inclusion in the study. All participants were enrolled after obtaining written informed consent.

Inclusion Criteria

Patients meeting the following criteria were included:

- Diagnosed cases of acute myocardial infarction (STEMI or NSTEMI)
- Age between 18 and 70 years
- Either male or female
- Willing to participate and provide written informed consent

Exclusion Criteria

Patients were excluded if they had:

- A prior diagnosis of atrial fibrillation
- Atrial fibrillation due to causes other than AMI
- Acute infections
- Acute electrolyte imbalances
- Acute exacerbation of chronic systemic illnesses

Operational Definitions

Acute Myocardial Infarction (AMI):

AMI was diagnosed based on clinical presentation, electrocardiographic findings, and cardiac biomarkers.

- **ST-Elevation Myocardial Infarction (STEMI):** Typical chest pain lasting more than 20 minutes with new ST-segment elevation in at least two contiguous leads (>2 mm in men or >1 mm in women in leads V2–V3, or >1 mm in other contiguous leads).
- **Non-ST-Elevation Myocardial Infarction (NSTEMI):** Typical chest pain lasting more than 20 minutes, electrocardiographic changes such as ST depression or T-wave inversion, and a rise in cardiac troponin above the upper limit of normal.

New-Onset Atrial Fibrillation (NOAF):

NOAF was defined as atrial fibrillation occurring for the first time within 30 days of AMI, documented on electrocardiography

by the presence of an irregularly irregular rhythm, absence of distinct P waves, and fibrillatory baseline activity.

In-Hospital Mortality: Defined as death occurring within 30 days of the development of atrial fibrillation during hospitalization.

Sample Size and Sampling Technique:

The sample size was calculated using the Open Epi sample size calculator, taking an expected frequency of NOAF of 12.5%, a 95% confidence interval, and a 5% margin of error. The minimum required sample size was 169 patients. A non-probability consecutive sampling technique was used to enroll eligible patients.

Data Collection Procedure

After approval from the institutional review board, data collection was initiated in the emergency department. Baseline demographic and clinical data were recorded, including age, gender, body mass index (BMI), smoking status, comorbid conditions (diabetes mellitus, hypertension, previous cardiac disease), family history of atrial fibrillation, and type of AMI (STEMI or NSTEMI).

All patients received standard treatment according to institutional protocols, including medical therapy, thrombolysis with streptokinase, or percutaneous coronary intervention (PCI), as indicated. Continuous electrocardiographic monitoring was performed throughout hospitalization to detect the development of new-onset atrial fibrillation. Patients were followed until discharge or death to assess in-hospital outcomes.

Potential confounding factors and bias were minimized through strict adherence to inclusion and exclusion criteria.

Data Analysis

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Continuous variables were expressed as mean \pm standard deviation or median with interquartile range, depending on data distribution. Categorical variables were presented as frequencies and percentages.

Stratification was performed with respect to age, gender, type of AMI, and treatment modality. Post-stratification comparisons were conducted using the chi-square test, and a p-value $<$ 0.05 was considered statistically significant.

Results

A total of 169 patients diagnosed with acute myocardial infarction (AMI) were included in the study. The mean age of the study population was 56.4 ± 9.8 years. The majority of patients were male. New-onset atrial fibrillation (NOAF) was observed in 21 patients (12.4%), while 148 patients (87.6%) remained in sinus rhythm during hospitalization.

Table 1. Baseline Demographic Characteristics of Study Population (n = 169)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
18–39	18	10.7
40–59	83	49.1
≥ 60	68	40.2
Gender		

Male	121	71.6
Female	48	28.4
Smoking Status		
Smoker	64	37.9
Non-smoker	105	62.1

Table 2. Clinical Characteristics and Comorbidities

Variable	Frequency (n)	Percentage (%)
Hypertension	92	54.4
Diabetes Mellitus	78	46.2
Previous Cardiac Disease	34	20.1
Obesity (BMI ≥ 30 kg/m ²)	41	24.3
Family History of AF	19	11.2

Table 3. Type of AMI and Treatment Modalities

Variable	Frequency (n)	Percentage (%)
Type of AMI		
STEMI	103	60.9
NSTEMI	66	39.1
Treatment Strategy		
Medical Management	69	40.8
Thrombolysis (Streptokinase)	51	30.2
Percutaneous Coronary Intervention (PCI)	49	29.0

Table 4. Frequency of New-Onset Atrial Fibrillation (NOAF)

Rhythm	Frequency	Percentage
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Status	(n)	(%)
NOAF Present	21	12.4
No AF	148	87.6
Total	169	100

Table 5. Association of NOAF with Age and Type of AMI

Variable	NOAF Present n (%)	No AF n (%)	p-value
Age Group			
<60 years	6 (5.9)	95 (94.1)	
≥ 60 years	15 (22.1)	53 (77.9)	0.003
Type of AMI			
STEMI	16 (15.5)	87 (84.5)	
NSTEMI	5 (7.6)	61 (92.4)	0.041

Table 6. In-Hospital Mortality According to Rhythm Status

Outcome	NOAF (n=21)	No AF (n=148)	p-value
Survived	17 (81.0%)	139 (93.9%)	
Died	4 (19.0%)	9 (6.1%)	0.028

Narrative Summary of Results:

New-onset atrial fibrillation was significantly more common in patients aged 60 years and above and in those presenting with ST-elevation myocardial infarction. Patients who developed NOAF experienced a significantly higher in-hospital mortality rate compared to those who remained in sinus rhythm. These findings indicate that NOAF is an important marker of adverse short-term outcomes in patients with AMI.

Discussion:

The present study was conducted to determine the frequency of new-onset atrial fibrillation (NOAF) following acute myocardial infarction (AMI) and to evaluate its impact on in-hospital outcomes. In this study, NOAF was observed in 12.4% of patients admitted with AMI. This finding is consistent with previously published literature, which reports the incidence of NOAF after AMI to range between 6% and 19% (Feistritz et al., 2019; Congo et al., 2019).

The frequency of NOAF observed in the current study closely parallels the findings of Iqbal et al. (2019), who reported a NOAF incidence of 12.5% in patients presenting with AMI. This similarity supports the external validity of the present findings and suggests that NOAF is a common complication of AMI in the local population. The development of NOAF during the acute phase of AMI reflects underlying disease severity and acute hemodynamic stress.

In the present study, NOAF was significantly more frequent among patients aged 60 years and above. Advanced age is a well-established risk factor for atrial fibrillation due to age-related structural and electrical remodeling of the atria. This observation is consistent with findings from previous studies, which have demonstrated a strong association between increasing age and the development of AF in AMI patients (He et al., 2019; Mori et al., 2022). Elderly patients are more likely to have comorbid conditions such as hypertension, diabetes mellitus, and left ventricular dysfunction, all of which contribute to atrial arrhythmogenesis.

The current study also demonstrated a significantly higher occurrence of NOAF in patients presenting with ST-elevation myocardial infarction (STEMI) compared to those with NSTEMI. This may be explained by the larger infarct size, greater degree of myocardial injury, and more pronounced hemodynamic compromise typically associated with STEMI. Similar findings have been reported by Congo et al. (2019), who identified STEMI as an independent predictor of NOAF and associated it with worse in-hospital outcomes.

One of the most important findings of this study was the significantly higher in-hospital mortality observed among patients who developed NOAF compared to those who remained in sinus rhythm (19.0% vs 6.1%). This finding is in agreement with multiple studies that have demonstrated an increased risk of mortality in AMI patients complicated by NOAF (Ayinde et al., 2022; Obayashi et al., 2021). The increased mortality may be attributed to several factors, including worsening heart failure, reduced cardiac output, increased thromboembolic risk, and challenges in anticoagulation management.

The development of NOAF in AMI patients complicates clinical management, particularly with respect to antithrombotic therapy. The need to balance the risk of stroke against bleeding risk poses a significant challenge, especially in patients receiving dual antiplatelet therapy following thrombolysis or percutaneous coronary intervention. Hofer et al. (2021) emphasized that suboptimal anticoagulation strategies in patients with NOAF may contribute to poorer long-term outcomes.

The findings of the present study underscore the importance of early identification and close monitoring of AMI patients at high risk of developing NOAF. Continuous ECG monitoring, aggressive management of heart failure, and careful consideration of anticoagulation strategies may help reduce adverse outcomes in this population. Furthermore, recognizing NOAF as a marker of increased disease severity may aid clinicians in risk stratification and clinical decision-making.

Limitations

This study has certain limitations. Being a single-center study with a relatively small sample size, the findings may not be generalizable to all populations. Additionally, long-term follow-up outcomes beyond hospital discharge were not assessed. Despite these limitations, the study provides valuable local data regarding the burden and clinical impact of NOAF following AMI.

Conclusion

New-onset atrial fibrillation is a relatively common complication among patients presenting with acute myocardial infarction. In the present study, approximately one in eight patients developed new-onset atrial fibrillation during hospitalization. The occurrence of this arrhythmia was more frequent in elderly patients and in those presenting with ST-elevation myocardial infarction.

The development of new-onset atrial fibrillation was associated with significantly higher in-hospital mortality compared to patients who remained in sinus rhythm. These findings highlight that new-onset atrial fibrillation is not a benign or transient

phenomenon but rather an important marker of disease severity and adverse short-term outcomes in patients with acute myocardial infarction.

Early recognition of patients at risk for new-onset atrial fibrillation and prompt management may improve hospital outcomes. Continuous electrocardiographic monitoring and timely intervention are essential in reducing complications and mortality associated with this condition.

Recommendations

1. **Routine ECG Monitoring:** Continuous electrocardiographic monitoring should be ensured for all patients admitted with acute myocardial infarction, particularly elderly patients and those with ST-elevation myocardial infarction.
2. **Early Risk Stratification:** Patients at higher risk for developing new-onset atrial fibrillation should be identified early to allow closer monitoring and timely management.
3. **Optimized Management Strategies:** Clear institutional protocols should be developed for the management of atrial fibrillation in acute myocardial infarction patients, including appropriate rate or rhythm control and anticoagulation strategies.
4. **Multidisciplinary Approach:** Collaboration between cardiologists, intensivists, and nursing staff is essential for early detection and effective management of arrhythmias in acute myocardial infarction patients.

5. **Further Research:** Large-scale, multicenter studies with long-term follow-up are recommended to better understand the predictors, management strategies, and long-term outcomes of new-onset atrial fibrillation following acute myocardial infarction in the local population.

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