DOI: https://doi.org/10.54393/pjhs.v5i11.2204

PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (P): 2790-9352, (E): 2790-9344
Volume 5, Issue 11 (November 2024)

Original Article

OPEN ACCESS

Atrial Fibrillation in Patients with Acute ST Elevation Myocardial Infarction

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ARTICLE INFO

Keywords:
Heart, Myocardial Infarction, Atrial Fibrillation, Acute ST Elevated Myocardial Infarction.

How to Cite:
Ullah, Z., Alam, S., Rehman, J. U., Khan, Y., Khan, K., Qaisar, O., Awais, M., & Ullah, Z. (2024). Atrial Fibrillation in Patients with Acute ST Elevation Myocardial Infarction: Atrial Fibrillation in Acute ST Elevation MI. Pakistan Journal of Health Sciences, 5(11), 236-240, https://doi.org/10.54393/pjhs.v5i11.2204

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Received Date: 25th September, 2024
Acceptance Date: 23rd November, 2024
Published Date: 30th November. 2024

ABSTRACT

Atrial fibrillation (AF) can lead to complications such as stroke and heart failure. The prevalence of AF in patients with MI has garnered increasing attention due to its significant impact on clinical outcomes. Understanding its prevalence and associations with various risk factors is crucial for improving patient management and outcomes. **Objective:** To determine the frequency of atrial fibrillation in acute ST elevation myocardial infarction. **Methods:** Descriptive cross-sectional study, conducted at Department of Cardiology, Mardan Medical Complex, Mardan from September 2023 to August, 2024. About 118 patients, already diagnosed cases of acute ST segment elevation myocardial infarction, were enrolled in the study. Atrial fibrillation was considered positive on the absence of P waves and irregularly irregular QRS complexes on surface electrocardiography. Data were collected under the supervision of expert consultant and analyzed using SPSS version 20. **Results:** Atrial fibrillation was observed in 14% (n=17) of the patients with STEMI. The mean age of the cohort was 55 years (SD±9.29). The study population was predominantly male (66%) with a high prevalence of diabetes (71%) and hypertension (78%). Despite these factors, no significant correlation was found between atrial fibrillation and diabetes, smoking status, BMI, or hypertension ($p>0.05$). **Conclusions:** Our study concludes that the frequency of atrial fibrillation was found to be 14% in the participants presenting with acute STEMI. Identifying no significant associations between AF and the common risk factors analyzed, these findings underscore the necessity for more research to investigate additional factors and mechanisms that connect AF with STEMI.

INTRODUCTION

Myocardial infarction (MI), commonly known as a heart attack, occurs due to restricted blood supply causing damage or death of the heart muscle [1]. It is a key manifestation of acute coronary syndromes (ACS), which include unstable angina (UA), non-ST-elevation MI (NSTEMI), and ST-elevation MI (STEMI) [2]. While STEMI typically develops Q-waves, NSTEMI and UA are diagnosed based on cardiac enzyme levels. Globally, myocardial infarction is a significant contributor to cardiovascular morbidity and mortality, with approximately 1.5 million cases reported annually in the United States alone [3]. According to the World Health Organization (WHO), cardiovascular diseases (CVDs) are the leading cause of death globally, taking an estimated 17.9 million lives each year [4]. The 2019 Global Burden of Disease study reported that the age-standardized incidence of CVD in Pakistan was 918.18 per 100,000 population (compared to the global rate of 684.33 per 100,000), while the age-standardized mortality rate was 357.88 per 100,000 (global rate: 239.85 per 100,000) [5]. Atrial fibrillation (AF), the most commonly

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encountered clinical arrhythmia, often coexists and complicates acute myocardial infarction (AMI) with an incidence between 6 and 21% [6, 7]. STEMI was reported in 44.9% while AF in 12.5% in Karachi while in Peshawar, STEMI in about 62.5% and new onset AF about 7.19% [8, 9]. AF is characterized by disorganized atrial activity and rapid, irregular ventricular response, leading to impaired atrial function. Its occurrence in AMI is often linked to localized necrosis, ischemic damage to the atria, or left ventricular failure. Recent studies have highlighted the prognostic significance of AF in AMI, with affected patients experiencing increased risks of thromboembolism, heart failure, and mortality [10]. Despite advancements in diagnostic tools such as ECG monitoring and echocardiography, AF remains underdiagnosed in AMI cases, especially in asymptomatic individuals [11]. In Pakistan, limited research has been conducted on the occurrence and implications of AF in STEMI patients. However, the growing burden of cardiovascular diseases, coupled with an aging and population growth [12], underscores the need for local studies. Data from Pakistan reveal similar trends but lack specificity regarding the role of arrhythmias like AF [13].

This study aimed to assess the frequency of AF in patients with acute STEMI and its association with clinical outcomes. By identifying the prevalence and risk factors of AF in this population, we hope to enhance early diagnosis and management strategies. Furthermore, the findings will contribute to the existing literature and guide targeted awareness and prevention programs tailored to the Pakistani context.

METHODS

This descriptive cross-sectional study was conducted in the Cardiology Department at Mardan Medical Complex over twelve (n=12) months, from September 2023 to August, 2024. The sample size of 118 was calculated using the WHO sample size calculator, based on a 26.6% prevalence rate of atrial fibrillation (AF) in acute STEMI cases, with a 95% confidence interval and an 8% margin of error [14]. A non-probability consecutive sampling technique was employed. Patients aged 30–70 years, of either gender, presenting with a confirmed diagnosis of acute STEMI were included in the study. Patients with a history of coronary artery bypass surgery, chronic renal failure, or previous percutaneous coronary intervention were excluded to minimize confounding factors and bias. Upon receiving approval from the hospital's Institutional Review Board (Ref. No: 570), data collection commenced. Eligible patients were enrolled through the cardiology department. The purpose of the study was explained to all participants, and informed written consent was obtained from those willing to participate. A detailed medical history was taken, including information on prior cardiac events, comorbid conditions (e.g., diabetes mellitus, hypertension), medication use, family history of cardiovascular diseases, and lifestyle factors such as smoking status. Routine investigations included complete blood count (CBC), fasting blood sugar (FBS), serum electrolytes, renal function tests, and cardiac enzyme levels. A thorough clinical examination included assessment of vital signs (heart rate, blood pressure), auscultation for murmurs or abnormal heart sounds, and evaluation for signs of heart failure, such as edema or jugular venous distension. Atrial fibrillation was diagnosed using a 12-lead ECG and rhythm strip analysis. Diagnostic criteria included the absence of P waves, irregularly irregular QRS complexes, and the presence of fibrillatory waves, particularly in lead II. All ECG findings were confirmed by a consultant cardiologist with over five years of experience. Patient demographic and clinical data, including age, gender, height, weight, body mass index (BMI), diabetes mellitus, hypertension, and smoking status, were meticulously recorded in a pre-designed proforma. Data were analyzed using SPSS version 20. Quantitative variables (e.g., age, height, weight, BMI) were expressed as mean ± SD, while categorical variables (e.g., gender, diabetes, hypertension, smoking status, and AF) were reported as frequencies and percentages. Stratification of AF by demographic and clinical factors was performed, and chi-square tests were used to assess associations, with statistical significance set at $p \leq 0.05$.

RESULTS

The study enrolled 118 participants, in which 66% (n=78) were male while female were about 34% (n=40). The majority, 84% (n=99) were falling within the 51-70 years age group, while 16% (n=19) were aged between 30-50 years. The mean age of the participants was 55 years±9.29. Regarding Body Mass Index (BMI), 22% had a BMI of 25 kg/m^2 or less (n=26), while 78% had a BMI greater than 25 kg/m^2 (n=92). The average BMI was 26 kg/m^2 ± 5.56. Additionally, the mean weight was 70.8 kg ± 9.5, and the mean height was 1.65 meters (SD ± 0.08). Diabetes mellitus was present in 71% of the patients (n=84), with 29% not having diabetes (n=34). Smoking was reported by 42% of the participants (n=50), while 58% were non-smokers (n=68). Hypertension was prevalent in 78% of the patients (n=92), and 22% did not have hypertension (n=26). Figure 1 illustrates the demographic characteristics of the participants.

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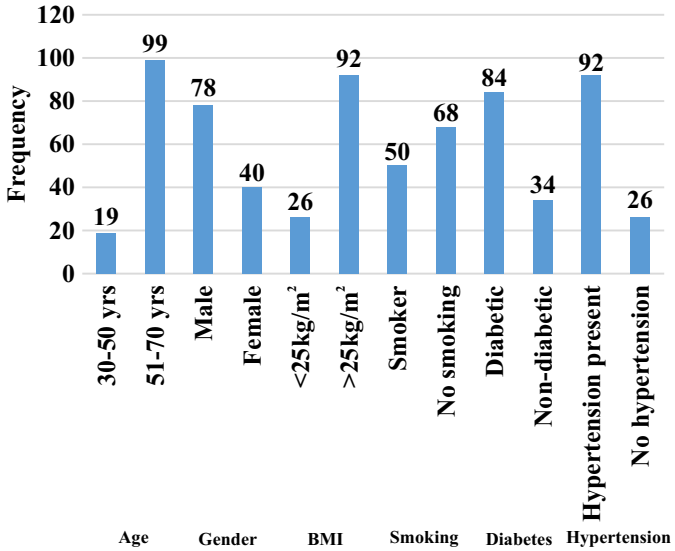

Figure 1: Demographic characteristics of the participants

AF was detected in 14% of the patients (n=17), while 86% did not exhibit signs of atrial fibrillation (n=101), as shown in figure 2.

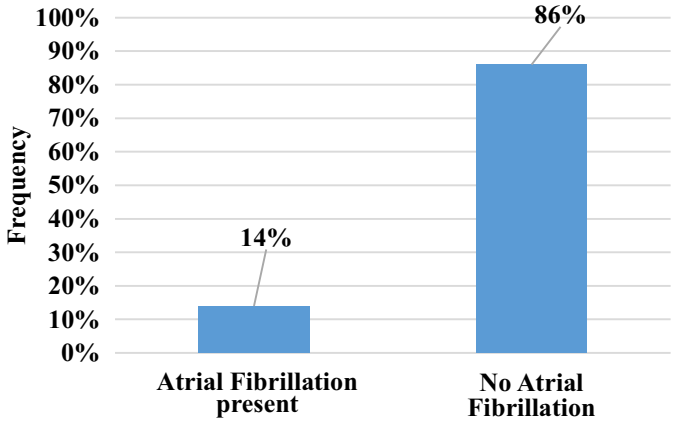

Figure 2 : Prevalence of Atrial Fibrillation

Table 1 shows the stratification of atrial fibrillation (AF) by demographic and clinical factors. Our study found no significant difference in AF prevalence across age groups (p=0.8513), 15.8% (n=3) in 30-50 years age group and 14.1% (n=14) in 51-70 years age group. No significant difference in AF prevalence between men and women (p=0.4932). 13% (n=10) of male patients, and 17% (n=7) of female patients. The chi-square test revealed no significant associations between AF and age or gender in our study population. Among the participants, 42% (n=50) were smokers, while 58% (n=68) were non-smokers. Atrial fibrillation was found in about 14% (n=7) of smokers and 14.7% (n=10) of non-smokers. There was no significant relationship between smoking status and atrial fibrillation (p=0.9140), suggesting that smoking did not have a significant impact on the likelihood of developing AF. Additionally, 78% (n=92) of the patients had hypertension, and 22% (n=26) did not. Atrial fibrillation was present in 14.1% (n=13) of those with hypertension and 15.4% (n=4) of those without hypertension. No significant association between hypertension and atrial fibrillation (p=0.8722), suggesting that hypertension did not notably affect the prevalence of AF in this cohort.

Table 1: Correlation of AF with Demographics and Risk Factors

Variables		Atrial Fibrillation		
		Yes	No	p-Value
Age	30-50 years	3	16	0.851
	51-70 years	14	85	
	Total	17	101	
Gender	Male	10	68	0.493
	Female	7	33	
	Total	17	101	
BMI	<25 kg/m²	4	22	0.872
	>25 kg/m²	13	79	
	Total	17	101	
Diabetes	Diabetic	12	72	0.953
	Non-Diabetic	5	29	
	Total	17	101	
Smoking	Yes	7	43	0.914
	No	10	58	
	Total	17	101	
Hypertension	Yes	13	79	0.872
	No	4	22	
	Total	17	101	

DISCUSSION

The frequency of atrial fibrillation (AF) in individuals experiencing an acute STEMI (heart attack) was examined in our study. It was noted that AF coexisted in 14% of individuals with acute STEMI. This finding was higher than report by Shakeel et al., who observed an incidence of AF in 6.5% of patients admitted with acute MI [15]. The prevalence was lower than reported Imran K *et al.*, discovered that the incidence of AF in STEMI patients was 26.6%, with 7.9% having pre-existing AF and 18.7% developing new-onset AF [16]. Similarly, 12.5% of AMI patients had new-onset AF, and there was a strong correlation seen between AF and hypertension, according to Iqbal Z *et al.* The research comprised 216 patients, with a mean age of 50.76 years ± 6.00 and about 54.2% men. Of the patients, 64.8% had diabetes, and 75.9% had hypertension [17]. Zhang *et al.* reported that age and male gender are among the risk factors for AF in patients with acute STEMI. However, our analysis did not find a significant correlation between AF and these risk factors. Despite the strong evidence from Zhang *et al.*, our findings suggest that age and gender may not be as influential in predicting AF in our patient population [18]. Elliott *et al.* identified increased BMI, smoking, and diabetes mellitus as significant risk factors for AF in patients with acute STEMI. While our study did not find a significant association between AF and these

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risk factors. Specifically, while Elliott *et al.* highlighted the impact of elevated BMI, smoking, and type 2 DM, our findings did not reveal a clear correlation between these factors and the occurrence of AF in our patient cohort [19]. Dai *et al.* identified increasing age, male gender, and elevated BMI as significant risk factors for AF. However, in our study, while AF was observed in 14% of patients with acute STEMI, we have not found any statistically significant association between these risk factors and the presence of AF [20]. Our study has limitations, including a small sample size, which hinders the applicability of our findings to larger populations. Additionally, the cross-sectional design limits our ability to establish cause-and-effect relationships between atrial fibrillation and its risk factors in STEMI patients. Future studies of larger sample size recommended with longitudinal study designs. Furthermore, it is recommended accurate and early diagnosis of patients lead to timely treatment in these high-risk people can to reduce the incidence, and better the management of AF in these patients.

CONCLUSIONS

This study findings shows 14% of patients with acute STEMI (heart attack) also had atrial fibrillation (AF). This prevalence is consistent with other studies, highlighting the importance of monitoring for AF in STEMI patients. Early detection and management of AF in STEMI patients is crucial for improving outcomes and reducing complications.

Authors Contribution

Conceptualization: KK, YK, MA, SA
Methodology: JUR, OQ, ZU[1]
Formal analysis: MSK, JT
Writing, review and editing: SA, MA, ZU[2], KK

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

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