



Incidence of New-onset Atrial Fibrillation in Patients Presenting with Acute ST-elevation Myocardial Infarction

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Authors' contributions

This work was carried out in collaboration among all authors. All authors of this article/paper have directly participated in the planning, execution or analysis of this study. All authors read and approved the final manuscript.

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ABSTRACT

Aim: This study aims to find out the incidence of atrial fibrillation new onset in STEMI patients receiving primary PCI

Sample: A total of 169 patients have included after sample size calculation by using WHO sample size calculator version 2.0.

Study Design: Descriptive cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Interventional Cardiology at the National Institute of Cardiovascular Disease (NICVD), Karachi, Pakistan from April 18th, 2020, to October 17, 2020.

Methodology: The inclusion criteria set for data collection were as; all the patients undergoing Primary PCI with age between 40 to 80 years, males and females, patients presented with 12 hours of the onset of chest pain with STEMI to enroll in the study. Whereas, patients who had a previous history of any cardiac-related surgery and known AF, also all the patients suffered AF after trial of cardioversion, and those patients who had ejection fraction less than 20% were excluded from the study.

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Result: The demographic classification showed the mean age of the patients was 55.96 ± 8.9 with a CI of 54.60 to 57.33 years. The mean height of the patients was 167.34 ± 0.56 with CI of 166.2 to 168.46. The mean weight of the patients was 74.84 ± 0.7 with CI of 73.39 to 76.29 kg. The average BMI of all the patients was 26.7 ± 0.28 with CI of 26.2 to 27.33. The analysis of the data revealed that Atrial fibrillation is more common in people who don't smoke tobacco and are non-diabetic. Diabetic patients are less prone to atrial fibrillation in MI.

Conclusion: The prevalence of new-onset of atrial fibrillation was found to be high in elderly age group patients.

Keywords: *Atrial Fibrillation (AF); Primary Percutaneous Coronary artery Intervention (PPCI); acute ST segment Elevation Myocardial Infarction (STEMI).*

1. INTRODUCTION

Atrial fibrillation is known to be the most common barrier in the setting of ST elevation myocardial infarction (STEMI). In AF, Thromboembolic events are among the most common complications, which ultimately can cause disability, impaired quality of life, and death [1]. It has been reported that 2.3% to 21% of patients who are treated with thrombolytic therapy are prone to AF, whether it's a new or old one [2]. However, many treatment patterns are currently being used, such as Percutaneous Coronary Interventions (PCI) and thrombolytic therapy to demonstrate the occurrence of AF. However, mixed results has been shown i.e. some with worse outcomes, while others with better ones therefore it can be said the role of AF in the setting of STEMI is debatable.

Atrial Fibrillation (AF) prevalence is said to be progressed with the increase number of years in age. Beside it is also been predicted that by the year of 2050, the estimated rate of the atrial fibrillation suspected individuals will be double or triple in each year. Up till now the rate of the atrial fibrillation is 1 percent of the total burden of cardiovascular disease. In addition patients with the age of 75 years resulted more prone towards atrial fibrillation and by the age of 80 years, the development of atrial fibrillation crosses over to 22%. Epidemiology of atrial fibrillation states that association of atrial fibrillation are more abundant in male gender and black color skin is more sustainable than white skin. Several factors contribute to the critical illness of AF, such as ischemia, anaerobic glycolysis pathways, atrial hypopharyngeal, inflammation, neurotrophic factors, autonomic nervous system regulation, and left ventricular terminal and elevated atrial pressure and stress [3,4]. Patients with Atrial fibrillation are at high risk of congestive heart failure and also have a high probability of strokes. Several studies have shown that AF is

linked with age, and the risk gradually increases with age and by the age of 80, it becomes as high as approximately 10%. Most of the patients have pre-existing AF and remain asymptomatic until it is diagnosed. The data have shown that the new on-set of AF can become as high as 5%.

The pathophysiology of AF in STEMI remains a conventional topic to talk about because there is not a single cause, rather it is known to be multifactorial, which makes it hard to identify the exact determinants. On the other hand, the information and the data that exist about its mechanism are quite limited. The most contributing factor is the damage of myocardial tissues which is responsible for creating atrial stretch, inflammation, and neurohormonal inactivation [5]. These structural defects are involved in the remodeling of both ventricles and atriums, which cause electrical imbalance and therefore initiate the process of AF [6].

The purpose of this study was to investigate the incidence of atrial fibrillation new onset among STEMI patients receiving primary PCI. Cardiovascular disease is the leading cause of health issues and economic burden in developing countries like ours where private treatment is very costly, and patients prefer to visit public sector hospitals. In our local population, the greater proportion of patients visiting public sector hospitals is due to heart disease. However, there is a paucity of local data with regards to new onset Atrial Fibrillation. Under the sub-optimal health care facilities, less health care awareness, and late arrival of patients at the health care center, we expected variation in results of our population as compared to that other part of the developed countries. Furthermore, this study will help out to plan appropriate management in order to reduce the disease burden, hospital stay and increase the quality of life.

2. MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at the Department of Interventional Cardiology at the National Institute of Cardiovascular Disease (NICVD), Karachi, Pakistan. The data collection was conducted within six months duration starting from April 18th, 2020 to October 17, 2020. The targeted population was the patients undergoing primary PCI after STEMI at the Department of Interventional Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan. All participants were recruited on voluntary basis. Among those who agreed to participate, written informed consent was taken. Total 169 patients have included after sample size calculation by using WHO sample size calculator version 2.0.

The sampling technique was non-probability, and consecutive. The inclusion criteria set for data collection were as; all the patients undergoing Primary PCI with age between 40 to 80 years, males and females, patients presented with 12 hours of the onset of chest pain with STEMI in accordance with operational definition and voluntarily gave their consent to enroll in the study. All the patients who had a previous history of any cardiac-related surgery and already diagnosed with AF or who were still in AF after trial of cardioversion, and patients who had ejection fraction less than 20% were excluded from the study. Variables were entered as per the operational definition i.e., ASTEMI was when Persistent chest pain for more than 30 minutes, Elevated cardiac enzymes (CK-MB>200 and TROP I>0.04ng/ml), ECG changes indicative of new ischemia. New Onset of Atrial Fibrillation was when ECG evidence of irregular sustained rhythm with no evidence of discrete atrial activity within 48 hours of post surgery in patients with negative history of persistent or permanent AF. Smoking status was considered if an individual smoke > 10 pack- year either currently smoking for >1 years or quit smoking since < 6 months.

Before sampling or data collection, the study was approved by the ethical review committee of NICVD, Karachi, Pakistan. The research questionnaire was pre-designed in which the demographic profile of the patients was recorded including age, gender, hypertension, diabetes mellitus, smoking status. Prior to the inclusion of patients a verbal informed consent was taken by explaining the purpose, procedure, risks, and benefits of the study to all participants. Data was

recorded into a Performa. The detailed history and clinical examination of all the included patients were also done. Patient height and weight were measured at the time of presentation to find out BMI. Electrocardiogram (ECG) was done on all the patients to assess the outcome variable i.e. new onset of atrial fibrillation (yes/no) by the researcher himself under the supervision of consultant > 5 years of experience. Confounding or explanatory variables and biases were controlled by strictly following inclusion and exclusion criteria.

The collected data was analyzed in SPSS version-23 (IBM Corp. released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). For the hypothesis analysis, Shapiro-Wilk test was applied to check the normality of quantitative (continuous) variables like age (years) followed by descriptive statistics such as mean \pm SD, median (IQR), skewness, maximum and minimum was calculated appropriately. For categorical variables such as gender, age group, hypertension, diabetes mellitus, smoking, family history of CAD and outcome variable i.e. new onset of AF (yes/no) frequency and percentages were calculated. While effect modifiers like age groups, hypertension, diabetes mellitus, smoking, and family history of CAD were controlled through stratification. Data post stratification was interpreted on application of chi-square test or Fisher exact test. P value of ≤ 0.05 two sided was selected as highly statistically significant. Data graphical representation was done with bar chart graph with standard error.

3. RESULTS

A total of 169 patients with new-onset Atrial fibrillation admitted between April 18th, 2020 to October 17, 2020. Baseline demographics and clinical characteristics of 169 patients with or without the new onset of AF are summarized in Table 1. The age range of the patients was between 18 - 65 years and as per inclusion and exclusion criteria. In 169 patients, 76.9% were male and 23.1% were female (Fig. 1). The demographic classification showed the mean age of the patients was 55.96 ± 8.9 with a CI of 54.60 to 57.33 years. The mean height of the patients was 167.34 ± 0.56 with CI of 166.2 to 168.46. The mean weight of the patients was 74.84 ± 0.7 with CI of 73.39 to 76.29 kg. The average BMI of all the patients was 26.7 ± 0.28 with CI of 26.2 to 27.33. The time duration in hours of the initial chest pain was 14 ± 1.2 with (32%) were smokers

while 115 (68%) were non-smoker of 11.81 to 16.57 hours. All the demographic features along with their stratifications are presented as a bar chart in Fig. 1.

The descriptive analysis was done on SPSS and the analysis of the data revealed several important features and the presence of ST-segment resolution in the patients of myocardial infarction. The gender-wise analysis shows that atrial fibrillation is more found in females. The smoking status showed that people who smoke tobacco are less prone to atrial fibrillation while Atrial fibrillation was found to be more common among non-smokers. However, other important features such as Hypertension did not make any difference in the presence of atrial fibrillation. After doing statistical analysis of the

demographic features of patients with Atrial fibrillation, such as gender, BMI, Duration, hypertension, diabetes mellitus, family history, and smoking status showed non-significant results in Atrial fibrillation (Table 1). The Age group showed significant results in the patients of AF, the data showed that the age group of 40 to 65 and >65 years showed significant results with a *p*-value of 0.022, which suggests that the presence of Atrial fibrillation is solely related to age. The non-diabetic patients were also found to be among those with AF, while family history didn't seem to play any role in the formation of AF. The analysis of the data revealed that Atrial fibrillation is more common in people who don't smoke tobacco and are non-diabetic. Diabetic patients are less prone to atrial fibrillation in myocardial infarction.

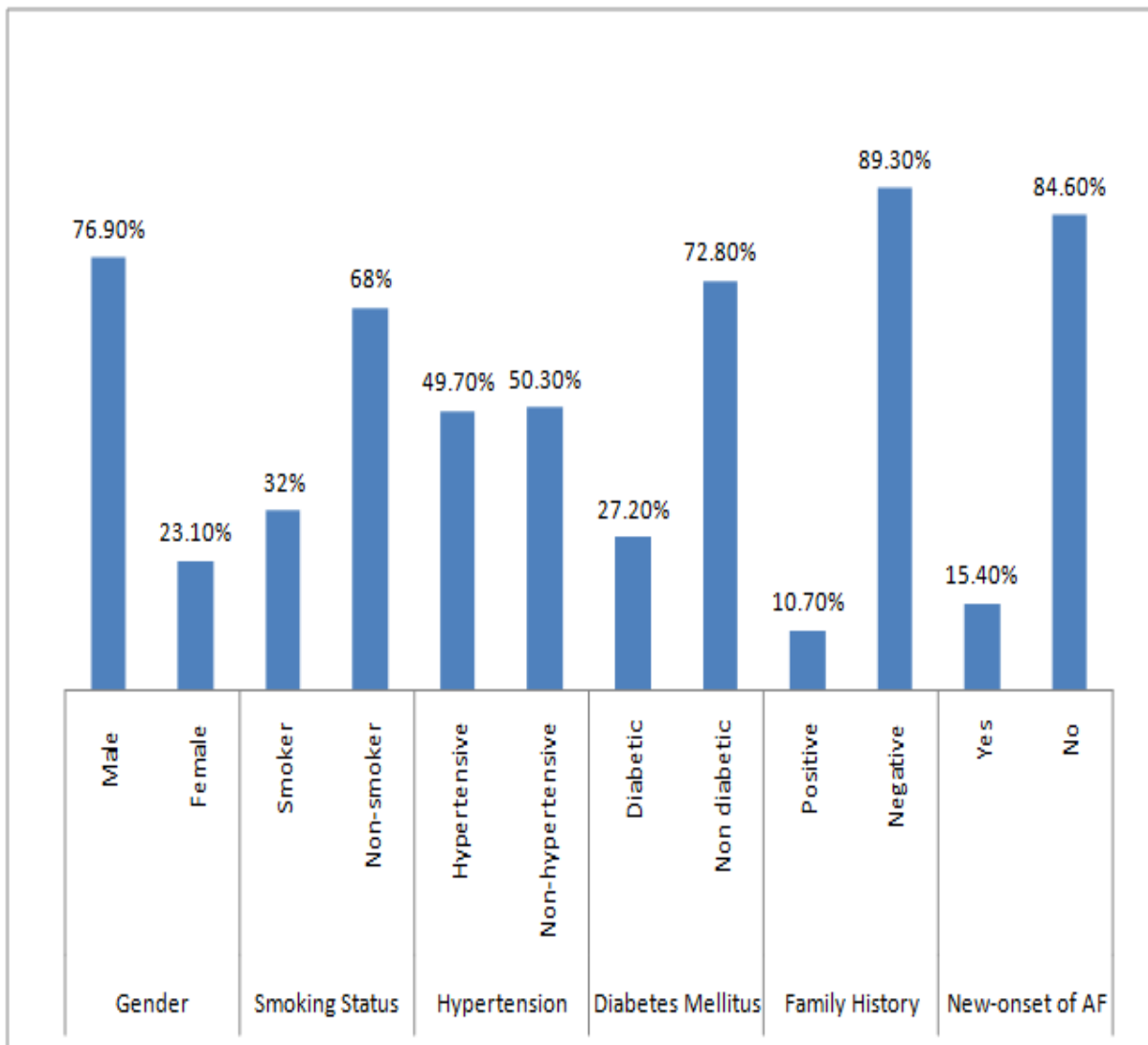


Fig. 1. The Demographic stratification of 169 Patients with Atrial Fibrillation

Table 1. Stratification of different demographic features with Atrial Fibrillation with their p values

Atrial Fibrillation		Yes [n (%)]	No [n (%)]	P value
Age Group [In Years]	40 – 65	19 (11.2%)	128 (75.7%)	0.022
	> 65	7 (4.1%)	15 (8.9%)	
Gender	Male	17 (10.10%)	113 (66.9%)	0.129
	Female	9 (5.3%)	30 (17.8%)	
BMI [In Kg/M ²]	18 – 24	5 (3%)	31 (18.3%)	0.506
	> 24	21 (12.4%)	112 (66.3%)	
Duration of Chest Pain [In Hours]	2 – 12	15 (8.9%)	100 (59.2%)	0.218
	> 12	11 (6.5%)	43 (25.4%)	
Hypertension	Hypertensive	13 (7.7%)	72 (42.6%)	0.974
	Non-Hypertensive	13 (7.7%)	71 (42%)	
Diabetes Mellitus	Diabetic	8 (4.7%)	38 (22.5%)	0.658
	Non-Diabetic	18 (10.7%)	105 (62.1%)	
Family History	Positive	4 (2.4%)	14 (8.3%)	0.291
	Negative	22 (13%)	129 (76.3%)	
Smoking Status	Smoker	10 (5.9%)	44 (26%)	0.439
	Non-Smoker	16 (9.5%)	99 (58.6%)	

4. DISCUSSION

In Pakistan, the cases of atrial fibrillation are increasing day by day. The initial diagnosis and immediate treatment are necessary to decrease the related mortality. Due to the higher death rate in patients of AF with acute ST-elevated Myocardial Infarction, it is becoming one of the biggest health concerns these days. Patients with Atrial fibrillation have constantly been diagnosed and many reports have shown the immediate-,short or long-term mortality with a presence of adverse events such as thromboembolic events in AMI and AF patients, including heart failure, poor quality of life, left ventricular dysfunction, and increased athletic performance.

Our study showed the data of six months which revealed the incidence of new-onset AF was 15.4% and 84.6% for old AF. The overall low number of AF new onset as compared to the pre-existing AF, which is consistent with previous studies [7–9]. The main reason associated with the low number of new-onset AF is the lack of diagnosis and most often misdiagnosis, which results in late identification and leads to poor outcomes [10,11].

The other disease linked with AF such as acute coronary syndrome (ACS) is known to be associated with new atrial fibrillation, even transient, frequent AF recurrences, an increased risk of developing the disease (especially paralysis), and prolonged recurrence and death

[12]. However, Milika AR, et al reported that episodes of new-onset AF, with the risk of stroke or any other AF recurrence which occur during 48 hours and last for more than 3.5 hours were not associated. Similarly, other clinical reports have shown the same thresholds associated with AF leading to worse outcomes [13,14].

Based on our results, parameters which would be associated with shorter and older declines such as AMI, thrombolysis, lower left ventricular wall movement index, increased Left Ventricular Outflow Fraction (LVEF), lower heart rate, small left atrial size, and less frequent heart failure showed decreased in AF new onset.. The factors such as diabetes, hypertension, stroke, and heart failure in the new on-set AF were found to be more common in elderly patients and women with higher CHA₂ DS₂-VASc levels. According to Schmidt et al., The use of interventional coronary arteries is associated with a significant reduction in the incidence of atrial fibrillation [15]. However, one of the key findings of this study is that the newly developed atrial fibrillation aggravating STEMI-induced myocardial infarction is unrelated to reperfusion strategies. Both groups achieved reperfusion and there was no difference in the type of reperfusion and there was no difference in the number of affected or treated groups.

In AF complicating STEMI signed with heart rate or rhythm control have been referenced very low number in literature. Other than beta-blockers, the use of antiarrhythmic drugs was usually limited to amiodarone [16]. The emergence of atrial fibrillation is associated with a higher

incidence of complications, including heart failure, stroke, cardiogenic shock, cardiac arrest, arrhythmia, mechanical complications, hemorrhage, and hospital death, but is not independent of mortality. In previous studies, poor clinical status was described in relation with that new atrial fibrillation and myocardial infarction (STEMI) [17,18]. Studies in critically ill patients show that new-onset atrial fibrillation is an indicator of clinical severity and poor prognosis [19,20]. The new-onset of AF is most common in patients over the age of 50 years, which is also consistent with our study and other studies [7,8,21]. As far as genders are concerned, in our study, out of 169 patients, 76.9% were male while 23.1% were female. It is already evident from many studies that AF is more common in males than females [7,8,21,22].

The study in Japan was conducted on the risk of AF in smokers and they concluded that smoking is associated with a high risk of AF [23], but our study has a contradictory finding and shows 32% were smokers while 68% were non-smoker which makes it obvious that AF is more common in a non-smoker. On the other hand, several studies have shown less frequency of smokers with AF [7,8,21,22,24]. Apart from other factors, hypertension is the most known, and its association with AF is discussed very often. Patients who have comorbid hypertension with Atrial Fibrillation have 1.7 fold at the higher risk as compared to the non hypertensive patients. Among those ratio was found 1 in 6 of AF with hypertensive cases [25]. In the present study, hypertension was noted in 50.3% of patients, which is consistent with other studies as well [7,8,21,22,24]. Along with hypertension, diabetes mellitus is the most common condition in the population and affects almost 20% of the people that are above the age of 50 years [26]. As most people are already suffering from diabetes it's not new to relate the new-onset AF with it. In our study, diabetes mellitus was documented in 27.2% of patients, which does not show any visible association with AF. However, many studies showed a higher percentage [7,8,21,22].

In the light of the family history of CAD, it was found that AF doesn't seem to run in families, which is evident from our data and other reports as well [7,8,21]. In our study, stratification of confounders/effect modifiers with respect to atrial fibrillation, a significant difference was noted in age group ($P=0.022$) while the insignificant difference was noted in gender ($P=0.129$), body mass index ($P=0.506$), duration of chest pain

($P=0.218$), hypertension ($P=0.974$), diabetes mellitus ($P=0.658$), family history of CAD ($P=0.291$) and smoking status ($P=0.439$). Study design which was cross sectional was our main limitation of the study. This type of study required strength of evidence and strong analysis which was limited in this design. In addition the sample size of this type of study design do not require prior sample calculation which was another drawback of our study. Limited of outcome of the study was selected, other factors and variables which can be included to find out the cause and effectiveness which can be said another limitation.

5. CONCLUSION

It is to be concluded that, as per our findings, the prevalence of new-onset of atrial fibrillation was found to be high in younger age group patients. Epidemiological and research data on this problem with acute ST-elevation myocardial infarction should be expanded by further studies. As STEMI is associated with increased risk of mortality and complications, therefore, it is imperative to identify the underlying risk factors to address the burden of diseases and to optimize the management strategies for this already compromised cohort of patients.

ETHICAL APPROVAL

This study was extracted from the dissertation submitted at the College of Physicians and Surgeons Pakistan (CPSP). Ethical approval was obtained prior to the data collection from the Institutional Review Board-National Institute of Cardiovascular Disease (IRB-NICVD).

CONSENT

Before enrolling patients in the study, informed permission was obtained from them in both written and verbal form.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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