DOI: https://doi.org/10.53350/pjmhs2023176112

ORIGINAL ARTICLE

Frequency of New Onset Atrial Fibrillation in patients presenting with ST-Segment Elevation Myocardial Infarction

ZAHID HUSSAIN[1], IFTIKHAR AHMED[2], FAIZA ALAM[3], ATTIYA MUSTAFA[4], NAVEED AHMED[5], ABDUL MANAF[6]
[1,2]Residents Cardiology, Armed Forces Institute of Cardiology/National Institute of Heart Diseases, Rawalpindi, Pakistan
[3]Resident Gynecology & Obstetrics, Bolan Medical Complex Hospital/Bolan University of Medical &Health Sciences, Quetta, Pakistan
[4]BDS Student, Bolan University of Medical &Health Sciences, Quetta, Pakistan
[5]MBBS Student, Dera Ghazi Khan Medical College, DG Khan Pakistan
[6]House Officer, Bolan Medical Complex Hospital/Bolan University of Medical &Health Sciences, Quetta, Pakistan
Correspondence to Dr. Iftikhar Ahmed, E-mail: driftikharahmed09@gmail.com

ABSTRACT

Aim: To study the magnitude of atrial fibrillation in patients with ST segment elevation myocardial infarction.
Study Design: Prospective analytic cross-sectional study.
Place and duration of study: Department of Cardiology of a Tertiary Cardiac Care Center of Pakistan from 1st June 2022 to 30th November 2022.
Methodology: Two hundred and thirty-six patients were selected through non-probability, consecutive sampling technique. Patients were divided into Group 1 who did not develop AF while group 2 included the new cases of AF during in-hospital stay for STEMI. All patients underwent clinical examinations, echocardiography, angiography and percutaneous coronary intervention.
Results: Forty five cases with an average age of 71±14 years developed atrial fibrillation. Female population 25(60%) was at higher risk than male 17(40%). In AF group, 22(53.3%) cases of dyslipidemia, 11(26.1%) cases of chronic renal disease, 4(8.8%) cases of prior myocardial infarction, 14(33.3%) cases of diabetes and a single case (2.2%) of implantable cardiac-defibrillator were observed when compared with the non-AF group.
Practical Implication: In-hospital complications are also highly associated with AF which may result in high Incidents of mortality.
Conclusion: Aging, comorbidities and inferior wall MI are the independent predictors of AF. In-hospital complications are associated with AF which may result in high incidents of mortality. Early diagnosis of STEMI patients with a high risk of developing AF is necessary to reduce the morbidity and mortality.
Keywords: Atrial fibrillation, ST-segment elevation, Myocardial infarction

INTRODUCTION

Coronary artery disease (CAD) is the single most common cause of death in the developed world and western countries, responsible for about 1 in every 5 deaths. In the past, CAD was thought to be a simple, inexorable process of artery narrowing, eventually resulting in complete vessel blockage and myocardial infarction. Atrial fibrillation is the most common cardiac arrhythmia which complicates the new onset acute myocardial infarction. Studies reported 6–21% cases of acute myocardial infarction showing symptoms of new onset of arterial fibrillation[1].

In clinical settings, a huge number of AF cases are reported because of coronary circulation impairments, however, the aetiology of critical AF involves multi factors including ischemia, autonomic regulation abnormalities, high left ventricular end-diastolic pressure, elevated atrial pressure, etc.2 Aging, increased basal metabolic index, diabetes mellitus, thyroid dysfunctions and hypertension are also important risk factors of atrial fibrillation for STEMI cases even causing death and other complications like cerebrovascular accidents and other thromboembolic events.3 Medical resources, diagnosis, and treatment must improve in developing countries. There are limited resources: access to medical and health resources; knowledge about disease; awareness, trainings and awareness about health[20,21,22,23,24,25].

Managing atrial fibrillation in patients hospitalized for Acute Myocardial Infarction (AMI) is the biggest challenge for cardiologists. The development of AF is also associated with poor prognosis and shows adverse effects on in-hospital mortality[4]. In the past, very few researchers observed the prevalence of the new onset of atrial fibrillation in patients with S-T segment elevation myocardial infarction. Therefore, it was necessary to fill this gap. This research was designed to study the magnitude of AF complications in patients with STEMI so that early detection can be used to avoid mortality.

Received on 13-12-2022
Accepted on 24-05-2023

MATERIALS AND METHODS

This single-centered cross-sectional study was carried out at a Tertiary Cardiac Care Center from June 2022 to October 2022. A sample size of 236 patients concerning the incidence of 17% new onset atrial fibrillation (AF) was calculated using CDC epi info calculator[5]. All the patients presenting with ST-segment elevation MI aged between 30 to 70 years were included. Patients with a prior diagnosis of atrial fibrillation, dilated cardiomyopathy, valvular heart disease, hypertrophic obstructive cardiomyopathy, and cases of hyperthyroidism were excluded. CAD was defined as atherosclerosis development in coronary arteries resulting in blockage of blood supply to the myocardium. In addition to this, electro-cardio-graphical assessment was used to define new S-T segment elevation at the J point of 1 mm or more in 2 or more contiguous leads often with reciprocal ST segment depression in contralateral leads. In leads V2-V3, S-T segment elevation of at least 2mm in men >40 years, 2.5mm in <40years and 1.5mm in women under the definition of new-onset STEMI. Atrial fibrillation was defined as supra-ventricular tachy-arrhythmia with uncoordinated atrial electrical activation. However, the absence of waves, on the electrocardiograph along with fine fibrillatory waves and irregularly irregular R-R intervals, were also considered atrial fibrillation[6].

All patients were divided in two groups; Group 1 consisted of STEMI patients (n=194) who did not develop AF during in-hospital stay while group 2 (n=42) was formed to separate the new cases of AF during in-hospital stay for STEMI. All patients underwent the baseline clinical examinations including patient demographic and medical history. Cardiovascular co-morbidities were accessed during this examination along with an examination of left ventricular function, angiography, and percutaneous coronary intervention. The endpoints of the study were mortality and complications. Complications like major bleeding, atrioventricular (AV) block, heart failure, stroke, ventricular tachycardia, cardiac arrest, and mechanical complications were analyzed. Independent

predictors of new-onset AF were observed by applying multivariate analysis on the outcomes of both groups.

Before initiating the research, ethical approval was obtained from the IERB board. Research objectives were well explained to the patients before collecting their signed written consents. The confidentiality of the patients was maintained throughout the study

The statistical analysis was performed using the SPSS 28.0. Chi-square or Fisher exact test was performed to draw a comparison between both groups. For continuous variables, a student t-test was performed to find the mean difference of continuous variables of both groups. For analyzing the predictor's logistic regression model was adjusted for the variables together with the likelihood-ratio test. For each variable, adjusted odd ratios and confidence intervals at 95% were also estimated. A p-value of ≤0.05 was used to estimate the statistical significance between both groups.

RESULTS

Forty two cases with an average age of 71±14 years developed atrial fibrillation. It was observed that the female population was at higher risk of AF development than the male (25 vs 17). In the AF group, 22(53.3%) cases of dyslipidemia, 11(26.1%) cases of chronic renal disease, 4(8.8%) cases of prior myocardial infarction, and a single case (2.2%) of implantable cardiac-defibrillator were observed without showing any statistical difference when compared with the non-AF group. Furthermore, it was observed that 14(33.3%) cases of diabetic STEMI patients developing AF. Co-morbidities like diabetes, peripheral artery disease, valvular heart disease, history of heart failure, percutaneous coronary intervention and coronary artery bypass graft showed significant statistical differences (p<0.05) between both groups (Table 1). Table 2 shows the clinical presentation of patients and in-hospital complications. It was observed that the AF group reported higher heart rates, low hemoglobin level, and systolic blood pressure than group 1. It was also observed that in-hospital complications were highly associated with the new onset of AF. Age, history of stroke, complete AV block, and inferior STEMI were the major independent predictors of the new onset of AF (Table 3).

Table I: Baseline characteristics of the patients (n=236)

Variables	Over all	Group 1 (without AF) (n=194)	Group 2 (New onset of AF) (n= 42)	Odd ratios (95% C.I)	p-value
Age (years)	63±15	62 ± 12	71 ± 14	3.24 (2.61 to 4.01)	< 0.001
Gender					
Male	159 (67.2%)	149 (77%)	17 (40%)	1.69 (1.35 to 2.12)	< 0.001
Female	77 (32.8%)	45 (23%)	25 (60%)		
Dyslipidemia	136 (57.6%)	114 (58.6%)	22 (53.3%)	0.86 (0.69 to 1.07)	0.186
Dementia	3 (1.2%)	1 (0.4%)	2 (4.76%)	3.18 (1.92 to 5.27)	< 0.001
Diabetes mellitus	45 (19.2%)	31 (16%)	14 (33.3%)	1.32 (1.04 to 1.67)	0.021
COPD	26 (11.2%)	23 (12.1%)	3 (6.6%)	2.23 (1.45 to 3.43)	< 0.001
Family history of coronary disease	9 (4%)	7 (3.9%)	2 (4.4%)	0.25 (0.12 to 0.53)	< 0.001
Chronic renal disease	98 (41.6%)	87 (45.3%)	11 (26.1%)	1.51 (0.88 to 2.59)	0.132
Prior MI	7 (2.8%)	3 (1.4%)	4 (8.8%)	0.97 (0.68 to 1.39)	0.881
ICD	32 (13.6%)	31 (16%)	1 (2.2%)	1.48 (0.35 to 6.32)	0.647
Prior PCI	38 (16%)	36 (18.5%)	2 (4.4%)	0.64 (0.41 to 1.00)	0.051
Peripheral artery disease	68 (28.8%)	63 (32.6%)	5 (11.1%)	2.06(1.25 to 3.40)	0.004
Prior CABG	54 (22.8%)	45 (23.4%)	9 (19.5%)	2.71 (1.33 to 5.52)	0.011
Previous stroke	51 (21.6%)	50 (25.8%)	1 (2.22%)	2.19 (1.53 to 3.12)	< 0.001
Valvular heart disease	26 (11.2%)	20 (10.2%)	6 (15.5%)	4.61 (2.41 to 8.81)	< 0.001
History of heart failure	20 (8.4%)	17 (8.7%)	3 (7.1%)	2.81 (1.55 to 5.11)	< 0.001

Key: COPD: Chronic obstructive pulmonary disease, ICD: Implantable cardioverter defibrillator, CABG: Coronary artery bypass graft, PCI: Percutaneous coronary intervention

Table 2: Clinical characteristics and in-hospital complications

Variables	All	Group 1	Group 2	p-value
Anterior infarction	110 (46.8%)	90(46.3%)	20 (48.8%)	0.806
Inferior infarction	119 (50.4%)	97 (50.2%)	21 (51.1%)	0.7
Left bundle branch block	3 (1.2%)	2 (1%)	1 (2.22%)	0.424
Hemoglobin (g/dL)	14.1±1.6	14.1±1.8	13.5±2	< 0.001
Heart rate (bpm)	77±19	77±15	79±24	0.066
Creatinine (mg/dL)	1±0.8	1±0.8	1.2±0.9	< 0.001
Systolic arterial pressure (mmHg)	135±30	135±30	126±28	< 0.001
Diastolic arterial pressure (mmHg)	80±12	80±18	76±17	< 0.001
In-hospital complications				
Major bleeding	6 (2.4%)	3 (1.4%)	3 (6.66%)	< 0.001
Left Ventricular Ejection fraction	107 (45.6%)	81(41.9%)	26 (62.2%)	< 0.001
Stroke	2 (0.8%)	1 (0.48%)	1 (2.22%)	0.001
Heart failure	48 (20.4%)	28 (14.6%)	20 (46.6%)	< 0.001
Mechanical complications	4 (1.6%)	2 (0.97%)	2 (4.4%)	0.002
Cardiogenic shock	19 (8%)	10 (4.9%)	9 (22.2%)	< 0.001
Cardiac arrest	14 (6%)	9 (4.8%)	5 (11.1%)	<0.001
Atrioventricular block	15 (6.4%)	9 (4.8%)	6 (13.3%)	< 0.001
Ventricular tachycardia	9 (3.8%)	5 (2.4%)	4 (8.8%)	< 0.001

Table 3: Independent predictors of atrial fibrillation

Predictors	Odd ratio (95% C.I)	p-value
Age	1.02(1.01 to 1.04)	< 0.001
Complete atrioventricular block	1.94(1.19 to 3.16)	0.008
Inferior located ST elevation myocardial infarction	1.57(1.13 to 2.18)	0.007
Prior stroke	1.87(1.09 to 3.21)	0.023

DISCUSSION

Population-based cross-sectional studies are more vigilant to represent real clinical practices than randomized controlled trials. We conducted this study to observe the new onset of atrial fibrillation in STEMI patients with an estimated 19% incident ratio. In our study, we found 42 cases of new-onset AF with an overall ratio of 17.8%. These results are within the range of old studies however, the results of new studies are in contradiction[1,7]. A study by Hyde and colleagues[8] reported 5.8% of new onset of atrial

fibrillation in STEMI cases. Despite the increasing number of older patients with a higher prevalence of co-morbidities, incidents of AF remain lower in many studies[9,10]. We observed that the older population had more incidents of new onset of atrial fibrillation. The female population of our study was more vulnerable to AF than males due to co-morbidities like hypertension, diabetes, previous stroke, and previous heart failure. The female population of our study had higher CHA2 DS2-VASC scores than the male.

By using logistic regression analysis we observed higher incidence of heart failure, stroke, major bleeding, and in-hospital mortality in the new onset of atrial fibrillation however these complications were not the independent predictors of mortality. These results suggested that the new onset of atrial fibrillation complicating the STEMI is the indicator of poor clinical status[11,12]. Studies conducted on critical cases of STEMI also observed similar results[4,13,14,15]. According to these studies, the new onset of AF is the indicator of disease severity and poor prognosis. Age, history of stroke, complete AV block, and inferior STEMI were the major independent predictors of the new onset of AF in our study. Patients of older age had a high number of co-morbidities and had a history of stroke. These results are in line with one of the systematic review[1] in which they conducted a review of 20 published studies. This systematic review revealed that elderly patients are at high risk of new onset of atrial fibrillation. Aging also causes abnormalities in atrial anatomy such as muscle cell proliferation. These abnormalities may provide an anatomic substrate for the multiple wavelet re-entry mechanisms of AF[16]. A study by Kyriakidis et al[17] observed right and left atrial ischemia and inferior STEMI in newly diagnosed cases of supraventricular arrhythmia. Their study concluded that ischemia of the sinus node is the underlying cause of fibrillation. On the other hand, a study by Liang et al[18] revealed that the anatomy of the coronary arterial branches is the major reason for atrial arrhythmia. Comparing our results with the previous GUSTO III[19] study both found similar results in terms of AV block. Both studies revealed that post-AMI complications such as AV block are the major reason for arterial fibrillation. These results are already validated by many previous studies by showing more incidents of AF in AH type of AV block. These blockages occurred due to the lesions occupying the atrial muscles including the inter-nodal tracts.

Limitations of study: The present study has some limitations. First, the study sample size was small. Second, it was a single cantered study. Third, the study was conducted for a short period of time, that's why it's results cannot be generalized on population.

CONCLUSION

Aging, co-morbidities and inferior STEMI are the independent predictors of AF. In-hospital complications are also highly associated with AF which may result in high Incidents of mortality. Early diagnosis of STEMI patients with a high risk of developing AF is necessary to reduce the morbidity and mortality rates.

Acknowledgment: I am deeply grateful to Dr Iftikhar Ahmed for his guidance, patience and support who provided insight and expertise that greatly assisted my research project.

REFERENCES

1. Obayashi Y, Shiomi H, Morimoto T, Tamaki Y, Inoko M, Yamamoto K, et al. Newly diagnosed atrial fibrillation in acute myocardial infarction. J Am Heart Assoc 2021;10(18).
2. Congo KH, Belo A, Carvalho J, Neves D, Guerreiro R, Pais JA, et al. New-onset atrial fibrillation in st-segment elevation myocardial infarction: predictors and impact on therapy and mortality. Arquivos Brasileiros de Cardiologia 2019;
3. Morseth B, Geelhoed B, Linneberg A, Johansson L, Kuulasmaa K, Salomaa V, et al. Age-specific atrial fibrillation incidence, attributable risk factors and risk of stroke and mortality: results from the MORGAM Consortium. Open Heart 2021; 8(2):e001624.
4. Dal Zotto B, Barbieri L, Tumminello G, Saviano M, Gentile D, Lucreziotti S, et al. New onset atrial fibrillation in stemi patients: main prognostic factors and clinical outcome. Diagnostics (Basel) 2023;13(4):613.
5. Iqbal Z, Mengal MN, Badini A, Karim M. New-onset atrial fibrillation in patients presenting with acute myocardial infarction. Cureus 2019.
6. 1.January CT, Wann LS, Calkins H, Chen LY, Cigarroa JE, Cleveland JC, et al. 2019 AHA/ACC/HRS focused update of the 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation. Circulation 2019; 140(2).
7. Gibson CM, Mehran R, Bode C, Halperin J, Verheugt F, Wildgoose P, et al. An open-label, randomized, controlled, multicenter study exploring two treatment strategies of rivaroxaban and a dose-adjusted oral vitamin K antagonist treatment strategy in subjects with atrial fibrillation who undergo percutaneous coronary intervention (PIONEER AF-PCI). Am Heart J 2015;169(4):472-8.
8. Congo KH, Belo A, Carvalho J, Neves D, Guerreiro R, Pais JA, et al. New-onset atrial fibrillation in st-segment elevation myocardial infarction: predictors and impact on therapy and mortality. Arq Bras Cardiol 2019; 113(5): 948-57.
9. Alasady M, Abhayaratna WP, Leong DP, Lim HS, Abed HS, Brooks AG, et al. Coronary artery disease affecting the atrial branches is an independent determinant of atrial fibrillation after myocardial infarction. Heart Rhythm 2011; 8(7):955-60.
10. Goldberg R, Yarzebski J, Lessard D, Wu J, Gore JM. Recent trends in the incidence rates of and death rates from atrial fibrillation complicating initial acute myocardial infarction: a community-wide perspective. Am Heart J 2002;143(3):519-27.
11. Jabre P, Roger VL, Murad MH, Chamberlain AM, Prokop L, Adnet F, et al. Mortality associated with atrial fibrillation in patients with myocardial infarction: a systematic review and meta-analysis. Circulation. 2011;123(15):1587-93
12. Batra G, Svennblad B, Held C, Jernberg T, Johanson P, Wallentin L, et al. All types of atrial fibrillation in the setting of myocardial infarction are associated with impaired outcome. Heart 2016;102(12):926-33.
13. Sibley S, Muscedere J. New-onset atrial fibrillation in critically ill patients. Can Respir J 2015;22(3):179-82.
14. Moss TJ, Calland JF, Enfield KB, Gomez-Manjarres DC, Ruminski C, DiMarco JP, et al. New-onset atrial fibrillation in the critically III. Crit Care Med 2017;45(5):790-7.
15. Bosch NA, Cimini J, Walkey AJ. Atrial fibrillation in the ICU. Chest 2018;154(6):1424-34.
16. Wong C-K, White HD, Wilcox RG, Criger DA, Califf RM, Topol EJ, et al. Significance of atrial fibrillation during acute myocardial infarction, and its current management: insights from the GUSTO-3 trial. Card Electrophysiol Rev 2003; 7(3):201-7.
17. Kyriakidis M, Barbetseas J, Antonopoulos A, Skouros C, Tentolouris C, Toutouzas P. Early atrial arrhythmias in acute myocardial infarction. Chest 1992;101(4):944-7.
18. Liang F, Wang Y. Coronary heart disease and atrial fibrillation: a vicious cycle. Am J Physiol Heart Circulatory Physiol 2020.
19. Wong C-K, White HD, Wilcox RG, Criger DA, Califf RM, Topol EJ, et al. Significance of atrial fibrillation during acute myocardial infarction, and its current management: insights from the GUSTO-3 trial. Card Electrophysiol Rev 2003;7(3):201-7.
20. Jabeen M, Shahjahan M, Farid G. Information Dissemination during COVID-19 Pandemic among Postgraduate Allied Health Sciences Students in Pakistan. Pakistan Journal of Medical & Health Sciences. 2022;16(11):366-.
21. Shahjahan M, Jabeen M, Farid G. Information Providing in COVID-19 by Health Professionals in Pakistan. Pakistan Journal of Medical & Health Sciences. 2022 Dec 12;16(10):641-.
22. Farid G, Zaheer S, Khalid A, Arshad A, Kamran M. Evaluating Medical College Lib Guides: A Usability Case Study. Pakistan Journal of Medical & Health Sciences. 2022 Aug 26;16(07):461-
23. FARID G, NIAZI AK, MUNEEB M, IFTIKHAR S. Attitude towards Utilization of e-Resources of Medical Images among Health Care Professionals. Pakistan Journal of Medical and Health Science. 2021 Sep 15 (9);261-263
24. Farid G, Iqbal S, Iftikhar S. Accessibility, Usage, and Behavioral Intention of Print Books and eBooks by Medical Students. Library Philosophy and Practice. 2021:1-25.
25. Farid G, Abiodullah M, Ramzan M. A comparative study of information seeking behaviors of medical faculty working in government and private run medical colleges. International Journal of Information Management Science. 2013;2(1):17-24.