ORIGINAL ARTICLE

In-Hospital Outcomes of ST-Segment Elevation Myocardial Infarction Patients Presenting with Sustained Ventricular Arrhythmias before Revascularization

IRFAN ALI[1], ASHOK KUMAR[2], NAVEED AHMED SHAIKH[3], MUHAMMAD ADEEL QAMAR[4], AMJAD ALI[5], RAJESH KUMAR[6]
[1]Fellow cardiac imaging, Adult Cardiology NICVD Karachi
[2]Assistant Professor, (Adult Cardiology) NICVD Hyderabad
[3,4,5]Post Fellow in interventional cardiology, NICVD Karachi
[6]Assistant Professor, NICVD Karachi
Corresponding authors: Irfan Ali, Email: dr.doctor70@gmail.com

ABSTRACT

Objective: To determine the in-hospital outcomes after primary percutaneous coronary intervention (PCI) of patients with acute ST-segment elevation myocardial infarction (STEMI) and develop sustained ventricular arrhythmia before revascularization.

Methodology: This prospective observational study was conducted at the Department of Adult Cardiology, National Institute of Cardiovascular Diseases, from August 31, 2019, to February 29, 2020. All patients with STEMI who had developed sustained ventricular arrhythmias and underwent revascularization via primary PCI were included. The patients were kept under observation during their hospital stay to document in-hospital mortality. Data analysis was done using SPSS version 20.

Results: Total 146 patients were included with a mean age of 54.41±12.75 years. There were 93 (63.7%) males and 53 (36.3%) females. When risk factors were assessed, hypertension was noted in 82 (56.2%) patients, diabetes mellitus in 62 (42.5%), 65 (44.5%) were smokers., and 49 (33.6%) were obese. There were 53 (36.3%) patients with a family history of ischemic heart disease. In-hospital mortality was documented in 28 (19.2%) patients. When stratification was done, significant associations were seen with hypertension (p=0.025), diabetes mellitus (p=0.002), and family history (p=0.003).

Conclusion: It is to be concluded that mortality is considerably high after PCI in patients with STEMI who developed sustained ventricular arrhythmia before revascularization. Obesity, family history, and diabetes contribute directly to the development of MI. More epidemiological studies are necessary to evaluate risk factors of in-hospital mortality in this already compromised group of patients

Keywords: Revascularization, Myocardial Infarction, Sustained Ventricular Arrhythmias, ST-Segment

INTRODUCTION

Cardiovascular diseases are one of the leading causes of mortality worldwide, especially in third-world countries. This contributes to the significant burden on public health and the overall global burden to health resources.[1,2] Among the various cardiovascular diseases, acute myocardial infarction (MI) is said to be the most fatal.[3,4] There are several ways to define MI according to the biochemical and pathological attributes. According to the present guidelines, patients with ischemic symptoms with a persistent ST-segment elevation on the electrocardiogram (ECG) would be classified as patients having acute MI. Many patients would show an expected elevation of the biomarkers and would progress to the Q waves on ECG as well.[5] One of the most frequent complications encountered by cardiologists when managing an acute MI is arrhythmia.[6] Even though the incidence of ventricular arrhythmia has decreased to a large extent because of the improved pharmacotherapies, aggressive thrombolytic techniques employed nowadays, and percutaneous coronary intervention (PCI).[7-9] According to a study conducted by Mehta et al, almost 5% of individuals do experience ventricular arrhythmia following an MI.[10-12] This is worth noting that one-third of all these events were found to have occurred before the end of cardiac catheterization. Although increasing age and associated comorbidities were associated with the increased mortality in these patients

even after accounting for all these variabilities, any ventricular arrhythmia remained associated with a 3-fold higher risk of 90-day mortality in patients undergoing primary PCI. This statistic is supplemented by another study by Liang et al.[12] These arrhythmias are often due to ischemia and they generally do not pose a threat as far as long-term prognosis is concerned.[11] One study showed that patients presenting with acute ST-segment elevation myocardial infarction (STEMI) having sustained ventricular arrhythmia and undergoing revascularization by PCI had worse outcomes than patients without sustained ventricular arrhythmia. In-hospital mortality was 16.3% for the patient who underwent PCI for acute MI and developed sustained ventricular tachycardia (VT) or ventricular fibrillation (VF) before revascularization.[13] The current study was designed to study the characteristics of patients reporting to the hospital with symptoms of MI and having an established diagnosis of STEMI by ECG. This study intricately details the attributes of patients such as obesity, age, family history, hypertension, and mortality rate. This study would help in the identification of areas where public health interventions can be made to effectively decrease the burden of cardiovascular emergencies. To the best of our knowledge and based on literature search no prior data were available, in the context of our population, regarding the outcomes in patients presenting with sustained ventricular arrhythmias undergoing revascularization.

MATERIAL AND METHODS

This prospective observational study was conducted at the Department of Adult Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi from August 31, 2019, to February 29, 2020. Non-probability consecutive sampling technique was used. All the patients of either gender, with age 18-70 years and diagnosed with MI later developing sustained ventricular arrhythmia before revascularization were included. Those with a prior history of ventricular arrhythmias or those getting ventricular arrhythmias after 48 hours of revascularization were excluded. Patients refusing to give consent were also not taken into consideration. The study was started after approval from the College of physicians and surgeons Pakistan. The approval of the ethical review committee of NICVD was taken before the data collection. For this study, we included all patients with STEMI who had developed sustained ventricular arrhythmias and underwent revascularization via primary PCI at the adult cardiology department. Informed consent was taken from all patients by the principal investigator. After taking demographic details, the history of the patients was taken regarding hypertension, diabetes mellitus, family history, obesity, and smoking status. All primary PCI procedures were performed by the consultant cardiologists having minimum experience of more than five years. All patients were kept under observation during their hospital stay (maximum of 48 hours) and in-hospital mortality was recorded. Patient information was kept secured and available to authorized people only. Data were entered and analyzed using SPSS version-21.

RESULTS

Table 1: In-hospital mortality according to age groups, gender, smoking status, family history, and comorbids (n=146)

Variables		In-hospital mortality		p-value
		Yes	No	
Age group (years)	18 – 50	10 (6.8%)	38 (26.0%)	0.722
	> 50	18(12.3%)	80 (54.8%)	
Gender	Male	22(15.16%)	71 (48.6%)	0.069
	Female	6 (4.1%)	47 (32.2%)	
Hypertension	Yes	21(14.4%)	61 (41.8%)	0.025
	No	7 (4.8%)	57 (39.0%)	
Diabetes Mellitus	Yes	19(13.0%)	43 (29.5%)	0.002
	No	9 (6.2%)	75 (51.4%)	
Smoking status	Yes	16 (11.0%)	49 (33.6%)	0.135
	No	12 (8.2%)	69 (47.3%)	
Family History	Yes	17(11.6%)	36 (24.7%)	0.003
	No	11(7.5%)	82 (56.2%)	
Obesity	Yes	13(8.9%)	36 (24.7%)	
	No	15(10.3%)	82 (56.2%)	0.109

In this study, 146 patients were included with a mean age of 54.41±12.75 years, mean weight of 73.74±10.05 kg, mean height of 167.97±7.72 cm, and mean BMI of 26.70±3.87. There were males and females. Hypertension was noted in 82 (56.2%) patients and diabetes mellitus in 62 (42.5%). Out of 146 patients, 65 (44.5%) were smokers. When BMI was assessed, 49 (33.6%) were obese. There were 53 (36.3%) patients with a family history of ischemic heart disease. In-hospital mortality was documented in 28 (19.2%) patients. The stratification of the age group, gender, smoking status, diabetes mellitus, hypertension, obesity, and family history was done with respect to in-hospital mortality to find the statistical difference as shown in Table 1.

DISCUSSION

Coronary artery diseases arise mainly due to an atherosclerotic disease that results in narrowing of the artery lumen, thereby causing a decrease in the blood flow to the myocardial tissue. Myocardial infarction arising because of the interrupted blood flow is divided into STEMI and non-STEMI (NSTEMI). STEMI is the most dreaded manifestation of MI because of transmural ischemia and magnitude of the tissue death.[14] Early initiation of reperfusion holds vital importance in limiting the extent of damage and preserves cardiac functionality.[14] Emergency treatment in the setting of STEMI is focused on restoring blood flow which can either be done by lysing the clot or PCI. If primary PCI cannot be performed within 2 hours of reporting to the hospital, fibrinolysis should be initiated provided there are no contraindications to it.[15] Time always plays a crucial role in minimizing mortality, which is evident by the data provided by Rathore SS et al[16] observed that patients hospitalized with ST elevation myocardial infarction, any delay in initial percutaneous coronary intervention after they arrive at the hospital are linked to a greater hospital death rate. In this study, patients presenting with STEMI and having arrhythmias before revascularization were evaluated, and even after PCI, 28 (19.2%) died before discharge. Due to the advent of new therapies, round-the-clock availability of PCI, and guideline-based management, mortality has plateaued but despite this, there's a substantial number of patients who do encounter post-STEMI complications. Primary PCI is increasingly becoming the recommended method, according to a new GRACE (Global Registry of Acute Coronary Events) research.[17] As per findings of retrospective analysis by Krishnan U et al[18] reported that n-hospital mortality rate was 3.9% in 2004 and 4.7% in 2012, which is much lower than our results. This huge difference can be confidently attributed to the lack of proper emergency medical services in our settings and the lack of world-class therapeutic services in our Hospitals.

In our study patients aged over 50 were seen to have a lower mortality rate, which is consistent with the study of Bagai A et al[19] as regardless of sex, age, presence of ST elevation, or comorbidities (DM or CKD), cases having MI who got a PCI upon hospital admission had a decreased risk of in-hospital mortality. In our study, the number of female patients reported to the center was substantially low, which could be due to the already established protective role of estrogen in developing cardiovascular diseases.[20]

Obesity can be highlighted as the single most important risk factor as it contributes to other comorbid as well such as hypertension, diabetes and predisposes many individuals to develop cardiovascular diseases if it runs in a family.[21] In our study, 36.3% had a positive family history, which is less than what was reported in a study by Nepper-Christiensen et al[22] of 50%. In the same study, 35 % of patients were found to be hypertensive, which is less than

our study where 56.2 % of patients were hypertensive. There is a worth noting statistic regarding obesity that a paradox discovered in 1996 called "The obesity paradox" suggests that obese patients could have a favorable outcome. A thorough half-decade study by Gruberg et al suggested that overweight patients had a lower rate of complications including cardiac mortality.[23] We could not have a long-term follow up hence long-term implications of arrhythmias cannot be talked about in great detail as we missed out on the long-term prognosis post-discharge. Despite significant findings, the element of bias also cannot be excluded as patients having developed sustained arrhythmia with spontaneous termination are less likely to have been diagnosed with it which could have influenced our data.

CONCLUSION

STEMI is the most dreaded subtype of myocardial infarction, while PCI is the most effective therapeutic intervention in its management. There is a precise window from reporting to the medical center and PCI, which directly influences the patient outcome. It is to be concluded that mortality is considerably high after PCI in STEMI patients who developed sustained ventricular arrhythmia before revascularization. Obesity, family history, and diabetes contribute directly to the development of MI. More epidemiological studies are necessary to evaluate risk factors of in-hospital mortality in this already compromised group of patients.

REFERENCES

1   Rehman H, Samad Z, Mishra SR, Merchant AT, Narula JP, Mishra S, et al. Epidemiologic studies targeting primary cardiovascular disease prevention in South Asia. Indian Heart J. 2018;70(5):721-30.
2   Vos T, Barber RM, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015;386(9995):743-800.
3   Rosselló X, Huo Y, Pocock S, Van de Werf F, Chin CT, Danchin N, et al. Global geographical variations in ST-segment elevation myocardial infarction management and post-discharge mortality. Int J Cardiol. 2017;245:27-34.
4   Sanchis-Gomar F, Perez-Quilis C, Leischik R, Lucia A. Epidemiology of coronary heart disease and acute coronary syndrome. Ann Transl Med. 2016;(13):256.
5   Van de Werf F, Bax J, Betriu A, Blomstrom-Lundqvist C, Crea F, Falk V, et al. Management of acute myocardial infarction in patients presenting with persistent STsegment elevation: the task force on the management of ST-Segment elevation acute myocardial infarction of the European Society of Cardiology. Eur Heart J. 2008;29(23): 2909-45.
6   Osmancik PP, Stros P, Herman D. In-hospital arrhythmias in patients with acute myocardial infarction—the relation to the reperfusion strategy and their prognostic impact. Acute Card Care. 2008;10(1):15-25.
7   Goldberg RJ, Yarzebski J, Spencer FA, Zevallos JC, Lessard D, Gore JM. Thirty-year trends (1975–2005) in the magnitude, patient characteristics, and hospital outcomes of patients with acute myocardial infarction complicated by ventricular fibrillation. Am J Cardiol. 2008;102(12):1595-601.
8   Liang JJ, Prasad A, Cha YM. Temporal evolution and implications of ventricular arrhythmias associated with acute myocardial infarction. Cardiol Rev. 2013;21(6):289- 94.
9   Henkel DM, Witt BJ, Gersh BJ, Jacobsen SJ, Weston SA, Meverden RA, et al. Ventricular arrhythmias after acute myocardial infarction: a 20-year community study. Am Heart J. 2006;151(4):806-12.
10 Mehta RH, Starr AZ, Lopes RD, Hochman JS, Widimsky P, Pieper KS, et al. Incidence of and outcomes associated with ventricular tachycardia or fibrillation in patients undergoing primary percutaneous coronary intervention. JAMA. 2009;301(17):1779-89.
11 Mehta RH, Yu J, Piccini JP, Tcheng JE, Farkouh ME, Reiffel J, et al. Prognostic significance of postprocedural sustained ventricular tachycardia or primary percutaneous coronary intervention (from the HORIZONS-AMI Trial). Am J Cardiol. 2012;109(6):805-12.
12 Liang JJ, Hodge DO, Mehta RA, Russo AM, Prasad A. Outcomes in patients with sustained ventricular tachyarrhythmias occurring within 48 h of acute myocardial infarction: when is ICD appropriate? Europace. 2014;(12):1759-66.
13 Piccini JP, Berger JS, Brown DL. Early sustained ventricular arrhythmias complicating acute myocardial infarction. Am J Med. 2008;121(9):797-804.
14 Bolognese L. Treatment of ST-elevation myocardial infarction: state of the art and new horizons. Giornale Italiano di Cardiologia (2006). 2021 Mar 1;22(3):167-80.
15 Vogel B, Claessen BE, Arnold SV, Chan D, Cohen DJ, Giannitsis E et al. ST-segment elevation myocardial infarction. Nature Reviews Disease Primers. 2019 Jun 6;5(1):1-20.
16 Rathore SS, Curtis JP, Chen J, Wang Y, Nallamothu BK, Epstein AJ et al. Association of door-to-balloon time and mortality in patients admitted to hospital with ST elevation myocardial infarction: national cohort study. BMI 2009;19;338.
17 Eagle KA, Nallamothu BK, Mehta RH. Trends in acute reperfusion therapy for STsegment elevation myocardial infarction from 1999 to 2006: we are getting better but we have got a long way to go Eur Heart J 2008;29:609–17.
18 Krishnan U, Brejt JA, Schulman-Marcus J, Swaminathan RV, Feldman DN, Goyal P et al. Temporal trends in the clinical acuity of patients with ST-segment elevation myocardial infarction. AJM 2018;1;131(1):100-e9.
19 Bagai A, Dangas GD, Stone GW, Granger CB. Reperfusion strategies in acute coronary syndromes. Circulation research. 2014 Jun 6;114(12):1918-28.
20 Iorga A, Cunningham CM, Moazeni S, Ruffenach G, Umar S. The protective role of estrogen and estrogen receptors in cardiovascular disease and the controversial use of estrogen therapy. Biology of sex differences. 2017;;8(1):1-6.
21 Powell-Wiley TM, Poirier P, Burke LE, Després JP, Gordon-Larsen P, Lavie CJ. Obesity and cardiovascular disease: a scientific statement from the American Heart Association. Circulation. 2021 May 25;143(21):e984-1010.
22 Nepper-Christensen L, Lønborg J, Høfsten DE, Ahtarovski KA, Bang LE, Helqvist S, et al. Benefit from reperfusion with primary percutaneous coronary intervention beyond 12 hours of symptom duration in patients with ST-segment–elevation myocardial infarction. Circ Cardiovasc Interv. 2018;11(9):e006842.
23 Gruberg L, Weissman NJ, Waksman R, Fuchs S, Deible R, Pinnow EE, Ahmed LM, Kent KM, Pichard AD, Suddath WO, Satler LF. The impact of obesity on the short-term andlong-term outcomes after percutaneous coronary intervention: the obesity paradox?. Journal of the American College of Cardiology. 2002 Feb 20;39(4):578-84.