

MEASURING MAJOR ADVERSE CARDIOVASCULAR EVENTS (MACE) IN MALE VS FEMALE PATIENTS SUFFERING FROM ACUTE ST-ELEVATION MYOCARDIAL INFARCTION UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION IN PIC, LAHORE

Kamran Dawood Ahmad^{a*}, Khurram Shahzad^b, Maryam Mansoor^c, Sadaf Naeem^b, Samra Yasmin^b, Sajjad Ahmad^b

^aRehmatul Iil Alameen Institute of Cardiology, Lahore. ^bPunjab Institute of Cardiology, Lahore. ^cAl Aleem Medical College, Gulab Devi Educational Complex.

Date of Submission: 04-01-2023; Date of Acceptance: 16-01-2023; Date of Publication: 10-03-2023

ABSTRACT:

BACKGROUND: Coronary Artery Disease (CAD) causes significant disability and death. Primary PCI (PPCI) is the gold-standard of emergency care in management of patients suffering from STEMI. Gender-differences may be present in the major adverse cardiovascular outcomes (MACE) of patients undergoing PPCI.

AIMS & OBJECTIVE: We aimed to compare MACE among patients undergoing PPCI, according to their gender.

MATERIAL & METHODS: This descriptive case series was carried out in Punjab Institute of Cardiology, Lahore. We recorded clinical factors, including demographics, risk factors such as diabetes, hypertension, familial IHD and active smoking. We recorded in-hospital outcomes post-pPCI: mortality, cerebrovascular accident, acute and subacute stent thrombosis, heart failure, acute kidney injury and arrhythmias (including both tachyarrhythmias (atrial and/or ventricular) as well as bradyarrhythmias).

RESULTS: Among all patients (n=245) mean age was 50.3 ± 9.7 years, 193 (78.8%) patients were men and 52 (21.2%) were women. Post PPCI in-hospital outcomes in 193 males were: mortality 0, heart failure 3 (1.6%), acute stent thrombosis 0 and acute kidney injury in 11 patients (5.7%). Among 52 females: mortality 2 (3.8%), heart failure 2 (3.8%), acute stent thrombosis 1 (1.9%) and acute kidney injury 3 (5.8%). Women had higher mortality after p-PCI (P=0.006).

CONCLUSION: Women presenting with acute STEMI had higher MACE and mortality following primary PCI. Also, a higher number of patients, aged 46-65 years, developed acute kidney injury after pPCI, compared to younger patients.

KEY WORDS: Primary PCI, Acute STEMI, MACE.

Correspondence : Kamran Dawood Ahmad, Rehmatul Iil Alameen Institute of Cardiology, Lahore. Email: dr.kda.88@gmail.com

Author's Contribution: KDA: Original author and drafting. KS: Study design and concept. MM: Data interpretation and referencing SN: Data Collection. SY: Questionnaire design. SA: Study supervisor.

INTRODUCTION:

ST-elevation MI (STEMI) is an emergency presentation of acute coronary syndrome (ACS), mainly because it shares an extraordinary burden of sudden cardiac death as well as significant morbidity. The guidelines on initial management of STEMI have been updated recently.^{1,2}

Primary percutaneous intervention (pPCI) is the preferred mode of reperfusion therapy and has also significantly improved patient outcomes in STEMI.^{3,4} More than 1 million procedures are currently being performed in the U.S. every year.⁵ Primary PCI offers significantly reduced mortality, re-infarction and stroke rates.³

A recent study carried out in this regard concluded that culprit vessel angioplasty in hemodynamically stable patients significantly improved in-hospital outcomes i.e. mortality⁶, arrhythmia especially VT and VF⁷, acute stent thrombosis⁸, stroke (both ischemic and hemorrhagic⁹; acute kidney injury, heart failure³ and post-pPCI moderate LVEF.⁴ There has been increased emphasis on the management of CAD among women, in the recent past. CAD is one of the most common causes of mortality in both males and females. About 6.6 million women suffer from CAD annually in the US. Despite a significant improvement in cardiovascular disease (CVD) mortality in both genders, the annual CVD mortality rate in Sweden remains significantly greater for women than for men during the previous three decades.¹⁰ After first MI, especially within the first year and up to 5 years of index cases, the mortality is significantly higher in women compared to men (women vs men: 26% vs 19% and 47% vs 36%, respectively), regardless of the age. Furthermore, data suggests that younger women are at particularly higher risk of mortality after MI compared to men.^{11,12} Women had higher incidence of morbidity and complication after interventional treatment for acute MI, as suggested by data from CADILLAC Trial.¹³

In Pakistan, as a developing country, we are experiencing a rise in the prevalence of coronary artery disease (CAD) in both genders. The onus is on the cost and staff of public health care sector, as staggering number of patients turn up in cardiovascular emergency units.^{6,9} In our tertiary-care public health sector, very few studies have been performed regarding primary PCI, despite its remarkable success rates (>98%) and survival rates (>94%) (8). Research focused on managing STEMI is urgently required to improve quality of

care with better utilization of resources.

We aimed to compare in-hospital major adverse cardiovascular outcomes (MACE) (mortality, heart failure, acute stent thrombosis and acute kidney injury) in patients undergoing pPCI for acute STEMI in both the genders.

Material and Methods:

This descriptive case series was conducted from 27-06-2019 to 26-12-2019 at Punjab Institute of Cardiology, Lahore. A total of 245 patients were included in the study with expected proportion of heart failure in patients with acute STEMI subjected to pPCI which was 6.1% (Table 1). Adult patients of both genders aged 18-65, patients with acute STEMI, LV ejection fraction $\geq 35\%$ were included in the study. Patients who had received fibrinolysis for index STEMI, patients in cardiogenic shock and chronic renal failure were excluded from the study.

Acute kidney injury would have been diagnosed as an increase in basal serum creatinine of 0.5 mg/dL during the period between two and seven days after performing the procedure.

DATA COLLECTION:

The study was approved by the institutional ethics committee. Demographic details followed by a comprehensive history regarding the cardiovascular and other comorbid illnesses were noted down. In addition, a detailed physical examination with special emphasis on CVS was performed. Information regarding every patient was recorded in their individual predesigned proforma.

Post-pPCI in-hospital outcomes recorded were: mortality, cerebrovascular accident (using CT brain), acute and subacute stent thrombosis (using coronary angiography), heart failure (clinically and on echocardiography), acute kidney injury (by monitoring of RFTs) & arrhythmias (ECG).

DATA ANALYSIS:

Data analysis was performed using SPSS version 22. Age was presented as mean and SD. Gender, comorbid illnesses (DM, HTN, IHD, smoking, history of IHD in family and post-PCI hospital outcome (Mortality, Heart failure, stent thrombosis, acute kidney injury were presented as frequency & percentages. Chi square test was applied to study associations. p-value ≤ 0.05 was recorded as significant.

RESULTS:

Among all patients (n=245) mean age was 50.3 \pm 9.7 years, 193 (78.8%) patients were men and 52 (21.2%) were women. In 193 male patients, mortality was 0 and none of the patients developed

Table: 1 Demographic and clinical factors

		Frequency (%)
Age	Mean+ SD	50.3±9.7
	25-45	82 (33.5%)
	46-65	163 (66.5%)
Gender	Male	193 (78.8%)
	Female	52 (21.2%)
Risk factors	Diabetes Mellitus	85 (34.7%)
	Hypertension	73 (29.8%)
	Smoking (> 5/pack per year)	81 (33.1%)
	Family History of IHD	23 (9.4%)
	BMI (>30)	47 (19.2%)
	Unemployment	77 (31.4%)

The results are shown in the Table 2.

In-hospital outcomes after primary PCI for STEMI (MACE)	Age			Gender		
	24-45 years (82)	46-65 years (163)	P-value	Male (193)	Female (52)	P-value
Mortality	0	2	0.314	0	2	0.006
Heart failure	1	4	0.519	3	2	0.3
Acute stent thrombosis	1	4	0.519	0	1	0.054
Acute kidney injury	1	13	0.032	11	3	0.985
Total	245			245		

acute stent thrombosis, however, 3 (1.6%) patients developed heart failure and 11 patients (5.7%) patients developed acute kidney injury. Among 52 females, mortality was 3.8% (2 patients died), 2 (3.7%) developed heart failure and 1 female patient (1.9%) developed acute stent thrombosis. 3 (5.8%) female patients developed acute kidney injury. Women had higher mortality after p-PCI (P=0.006).

Significant association was found between female gender and mortality (P=0.006) and acute kidney injury in patients of both genders aged 46-65 years (P=0.032) post-pPCI for STEMI.

DISCUSSION:

The incidence of STEMI¹⁴ has marginally declined over the last decades, however, it has remained stable in recent years¹⁵ and is a common cause of death.¹⁶ In STEMI, some of the most important and powerful predictors of negative outcomes are age, time lag to the start of treatment, mode of reperfusion, previous history of MI, diabetes mellitus (DM), chronic kidney disease (CKD) and the count of diseased coronary arteries. Another independent and unmodifiable predictor of undesired outcomes in this regard is the “female gender” which can influence early mortality

and bleeding complications.^{17,18} Therefore, to address the growing burden of the disease, the management of ACS underwent rapid changes in the last three decades that resulted in a significant decrease in the mortality due to IHDs in older patients and to a lesser extent in young women has also been observed.¹⁹

Our study presents data of acute management of STEMI patients of both genders by primary PCI and observes the development of in-hospital complications related to the procedure.

The results showed in Table 2 demonstrate that significant association exists between mortality and female gender (P = 0.006) where 2 out of 52 females died after primary PCI. None of the males included in the study died. These results can also be supported by existing literature, linking female gender to procedure-related mortality after STEMI.

In a study conducted by Mozaffarian et al, the annual CVD mortality rate has remained higher for women than for men in the last 30 years despite improvement in CVD mortality in both genders.¹⁰ Regardless of age, death within 1 (and up to 5 years) after the first MI, is significantly higher in women when compared to men (26% vs 19%

and 47% vs 36%, respectively). Furthermore, data collected from researches conducted by Lawesson et al and Vaccarino et al, suggested that the association between mortality and age and mortality with gender is significant, where younger women are particularly at higher risk of mortality after MI as compared to men.^{11,12}

In our study, 3 out of 193 male patients suffered from heart failure, while 11 out of 193 suffered from acute kidney injury, however, the association was found to be insignificant. None of the male patients suffered from acute stent thrombosis while 2 out of 52 female patients developed it as a complication after primary PCI.

The incidence of in-hospital primary PCI MACE was increased in the age group 46-65 in both genders. We found that 2 patients belonging to this age group died, 4 developed heart failure and 4 developed acute stent thrombosis. However, the only statistically significant association was found between patients of this age group and development of acute kidney injury, as 13 patients aging from 46-65 years developed it ($P = 0.032$). Acute kidney injury is a common complication of PCI and every one in five patients experience it and is related to substantial increase in both short-term and long-term mortality after the procedure.²⁰

STUDY LIMITATIONS:

Despite the fact that in this study we established a link between MACE and female gender, there were a few limitations:

1. The patient population ranged from 18-65 years because in our gradually growing setup, we are encountered with certain inevitable limitation of resources including the availability of stents and heavy patient turnout in the ER department due to which we have to triage the patients of relatively younger age groups to provide maximal judicious use of available resources.

2. We were unavailable to include patients with cardiogenic shock who, according to the literature and practical experience world over, should receive pPCI as the modality of choice for reperfusion in acute STEMI. Again, this situation often demands insertion of IABP (Intra-Aortic Balloon Pump) which is frequently unavailable. Hence, putting the patients on a disadvantage in terms of delayed reperfusion.

CONCLUSION:

Our study shows that women have higher mortality after pPCI. Also a higher number of patients, aged 46-65 years, developed acute kidney injury after pPCI, compared to younger patients.

References:

1. Bandara R, Medagama A, Munasinghe R, Dinamithra N, Subasmghe A, Herath J. Management and outcomes of acute ST-segment-elevation myocardial infarction at a tertiary care hospital in Sri Lanka: an observational study. *BMC Cardiovascular Disorders (BioMed Central)*. 2015;15:1-7.
2. Rahman M, Afrin S, Islam M, Shahriar M, Zahid M, Badiuzzaman M. Comparison of St-segment resolution influencing in hospital outcome after primary percutaneous coronary intervention and fibrinolysis (with streptokinase) in patients with acute ST-segment elevation myocardial infarction - Original article. *Bangladesh J Med Sci*. 2016;15:252-6.
3. Peiyuan H, Jingang Y, Haiyan X, Xiaojin G, Ying X, Yuan W. The Comparison of the Outcomes between Primary PCI, Fibrinolysis, and No Reperfusion in Patients ≥ 75 Years Old with ST-segment Elevation Myocardial Infarction: Results from the Chinese Acute Myocardial Infarction (CAMI) Registry. *PlosOne*. 2016;11:e0165672.
4. Petroni T, Zaman A, Georges J, Hammoudi N, Berman E, Segev A. Primary percutaneous coronary intervention for ST elevation myocardial infarction in nonagenarians. *Heart*. 2016;102:1648-54.
5. Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenland K, et al. Heart disease and stroke statistics. *Circulation*. 2007;115(5):e69-171.
6. Farman M, Sial J, Khan N, Rizvi S, Saghir T, Zaman K. Outcome of primary percutaneous coronary intervention at public sector tertiary care hospital in Pakistan. *J Pak Med Assoc*. 2011;61:575.
7. Gorenek B. Management of Cardiac Arrhythmias in Post-PCI Patients. *Emerging Pathologies in Cardiology*. Springer. 2005:231-9.
8. Clemmensen P, Wiberg S, Van't Hof A, Deliar-gyris E, Coste P, ten Berg T. Acute Stent Thrombosis After Primary Percutaneous Coronary Intervention Insights From the EUROMAX Trial (European Ambulance Acute Coronary Syndrome Angiography). *JACC: Cardiovascular Interventions*. 2015;8:214-20.
9. Myint P, Kwok C, Roffe S, Kontopantelis E, Zaman A, Bevy C. Determinants and Outcomes of Stroke Following Percutaneous Coronary Intervention by Indication on behalf of the Brit-

- ish Cardiovascular Intervention Society and the National Institute for Cardiovascular Outcomes Research. *Stroke*. 2016;47:1500-7.
10. Mozaffarian D, Benjamin E, Go A, Arnett D, Blaha M, Cushman M. Heart disease and stroke statistics--2015 update: A report from the American heart association. *Circulation*. 2015;131:e29-322.
 11. Lawesson S, Alfredsson J, Fredrikson M, Swahn E. A gender perspective on short- and long-term mortality in st-elevation myocardial infarction-References 71-a report from the swede heart register. *Int J Cardiol*. 2013;168:1041-7.
 12. Vaccarino V, Parsons L, Every N, Barron H, Krumholz H. Sexbased differences in early mortality after myocardial infarction. National registry of myocardial infarction 2 participants. *N Eng J Med*. 1999;341:217-25.
 13. Lansky A, Pietras C, Costa R, Tsuchiya Y, Brodie B, Cox D, et al. Gender differences in outcomes after primary angioplasty versus primary stenting with and without abciximab for acute myocardial infarction- results of the Controlled Abciximab and Device Investigation to Lower Late Angioplasty Complications (CADILLAC) Trial. *Circulation - Interventional Cardiology*. 2005;111:1611-8.
 14. Steg PG, James SK, Badano DALP, Blömmström-Lundqvist C, Borger MA, Mario CD, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology (ESC). *Eur Heart J*. 2012;33:2569-619.
 15. Widimsky P, Wijns W, Fajadet J, de Belder M, Knot J, Aaberge L. Reperfusion therapy for st elevation acute myocardial infarction in europe: Description of the current situation in 30 countries. *Eur Heart J*. 2010;31:943-57.
 16. Roth G, Huffman M, Moran A, Feigin V, Meh G, Naghavi M, et al. Global and Regional Patterns in Cardiovascular Mortality from 1990 to 2013. *Circulation*. 2015;132(17):1667-78.
 17. Mehran R, Pocock S, Nikolsky E, Clayton T, Dangas G, Kirtane A. A risk score to predict bleeding in patients with acute coronary syndromes. *J Am Coll Cardiol*. 2010;55:2556-66.
 18. Pancholy S, Shantha G, Patel T, Cheskin L. Sex Differences in Short-term and Long-term All-Cause Mortality Among Patients With ST-Segment Elevation Myocardial Infarction Treated by Primary Percutaneous Intervention: A Meta-analysis. *JAMA Intern Med*. 2014;174(11):1822-30.
 19. Gupta A, Wang Y, Spertus J, Geda M, Lorenze N, Nkonde-Price C. Trends in acute myocardial infarction in young patients and differences by sex and race 2001 to 2010. *J Am Coll Cardiol*. 2014;64:337-45.
 20. El-Ahmadi A, Abbasi M, Holmvang L. Acute kidney injury- A frequent and serious complication after primary percutaneous intervention in patients with ST-segment elevation myocardial infarction. *PloS One*. 2019;14(12):e0226625.