

## ORIGINAL ARTICLE

**In-Hospital Mortality of Patients with ST Elevation Myocardial Infarction in Diabetic Versus Non-Diabetic Patients**NOUMAN KHAN<sup>1</sup>, MUHAMMAD SHAFIQUE ARSHAD<sup>2</sup>, ABAT KHAN<sup>3</sup>, MUHAMMAD OMER HASHMI<sup>1</sup>, TASKIN NABIL YOUNAS<sup>1</sup>, AHMAD KHAN RATHORE<sup>4</sup><sup>1</sup>Resident Cardiology, Cardiac Centre, PIMS, Islamabad<sup>2</sup>Professor of Cardiology, Cardiac Centre, PIMS, Islamabad<sup>3</sup>Resident Cardiology, Khyber Teaching Hospital, Peshawar<sup>4</sup>Postgraduate Trainee, Cardiac Centre, PIMS, IslamabadCorresponding author: Nouman Khan, Email: [knouman38@yahoo.com](mailto:knouman38@yahoo.com)**ABSTRACT****Background and Aim:** Diabetic mellitus is an epidemic health issue causing almost twice the mortality compared to non-diabetic. Diabetes and non-diabetics with acute myocardial infarction were compared for in-hospital mortality and complications.**Material and Methods:** This comparative cross-sectional study was conducted on 264 successive diabetic and non-diabetic patients in the Department of Cardiology Pakistan Institute of Medical Sciences Islamabad with study duration of 6 months. All the acute myocardial infarction patients with ST-elevation were admitted and treated with thrombolytic agent such as streptokinase. Patients were categorized into two groups: 1) Diabetic patients 2). Non-diabetic patients. All the patients of either gender with age ranges from 15 years to 80 years and having chest pain for >30 minutes and <24 hours with ST-elevation were enrolled. After 60 minutes of thrombolysis, an ECG was taken to measure the baseline and the following day's ECG. SPSS version 26 was used for data analysis.**Results:** Out of 264 patients, there were 196 (74.2%) male and 68 (25.8%) females. Diabetic and non-diabetic group included 132 patients. Diabetic group patients had higher frequency of ST elevation in myocardial infarction than non-diabetic patients. Brady arrhythmias, post MI angina, LV failure, atrial fibrillation, and cardiogenic shock were the main complications observed in all the patients after ST Elevation MI. Diabetes patients are more likely to experience all these complications post MI angina than non-diabetics.**Conclusion:** The present study concluded that the prevalence of arrhythmias and left ventricular failure complications were higher in diabetic patients. Also, the mortality rate was significantly higher in diabetic patients. The non-diabetic patients had higher post MI angina than diabetic patients. It is also important to decrease the prevalence of diabetes mellitus in our population since it is a modifiable risk factor that leads to more complications following MI than non-diabetic patients.**Keywords:** In-hospital mortality, ST elevation, Myocardial infarction, diabetic and non-diabetic**INTRODUCTION**

The incidence of acute myocardial infarction (AMI) is growing significantly in developing countries, making it one of the leading causes of acute emergencies [1]. The occurrence of diabetes is increasing at an alarming rate, especially among the elderly and those who lead sedentary lifestyles [2]. Diabetes increases the risk of AMI by two to four times. Diabetics are much more likely to suffer from coronary artery disease, with approximately four times higher morbidity/mortality than non-diabetics [3, 4]. Cardiogenic shock, cerebral infarction, acute pulmonary edema, re-infarction, and arrhythmia are diabetic patient's severe complications [5]. Systolic or diastolic dysfunction characterized the heart failure in patients with acute myocardial infarction. Echocardiography is identified by systolic dysfunction developed in approximately 3% adult patients [6]. Blood cardiac markers increasing concentration, ST-segment re-elevation, and persistent chest pain usually diagnosed re-infarction. The mortality rate was significantly higher in patients with acute myocardial infarction (AMI) especially in elderly patients who are at 9 times higher risk of mortality than patients <60 years age [7]. The AMI symptoms generally appear late in diabetic patients causing PTCA and fibrinolytic therapy delay [8]. Thrombolytic agents should administrate the diabetic patients with AMI in turn reduce the mortality rate [9].

ST segment provides better prognosis indicator and supportive information that lag behind in alone coronary angiogram [10]. Schmucker et al [11] found that the most significant independent predictor for early mortality was ST segment absence. Patients at higher risk of developing complications could be significantly identified by ST resolution for early invasive procedures. Numerous studies reported various complications following the acute myocardial infarction in diabetic and non-diabetic patients [12, 13]. The present study aimed to compare the complications of diabetic and non-diabetic patients with elevated ST segment.

**METHODOLOGY**

This comparative cross-sectional study was conducted on 264 consecutive diabetic and non-diabetic patients in the Department of Cardiology Pakistan Institute of Medical Sciences Islamabad over a time frame of 6 months. All the acute myocardial infarction patients with ST-elevation were admitted and treated with thrombolytic agent such as streptokinase. Patients were categorized into two categories: 1) Diabetic patients 2). Non-diabetic patients. All the patients of either gender with age ranges from 15 years to 80 years and having chest pain for >30 minutes and <24 hours with ST-elevation were enrolled. After 60 minutes of thrombolysis, an ECG was taken to measure the baseline and the following day's ECG. Based on ST-elevation segments, patients were grouped into four categories. The anterior AMI, inferior AMI, Inferior + Right ventricular AMI, and Lateral AMI was referred as in V1-V6, II III aVF, II III aVF+V4R, and I, aVL, V5, V6 respectively. Each individual provided 5mL blood samples and analyzed serum Trop-T, CK-MB, and CK using available kits. Suspected diabetic patient's serum samples were tested for blood glucose using commercial kits. Whole blood samples were investigated for HbA1c. The diagnosis of diabetic patients was made based on fasting glucose >126 mg/dl at the time of admission. Based on HbA1c, patients with >7.0 HbA1c were considered as diabetic patients. Patients with prior myocardial infarction, valvular heart disease, end-stage disease, and unstable angina were excluded.

Streptokinase was administered in patients showing no contraindication to thrombolysis. Acute myocardial infarction standard treatment was administered in all patients and examined routinely for cardiac monitoring during 72 hours. LV systolic dysfunction was sorted as normal (EF>50%), mild (EF 40-49%), moderate (EF 30-39%), and severe (EF<30%). Doppler wave interrogation was used for measuring the velocity recorded E and A in order to determine the diastolic LV dysfunction. SPSS version 26 was used for data analysis. Qualitative variables were described as frequency and percentages whereas quantitative

variables were expressed as mean and standard deviation. Both groups were compared and analyzed using Chi-square test by taking 95% confidence interval and 5% level of significance.

**RESULTS**

Out of 264 patients, there were 196 (74.2%) male and 68 (25.8%) females. Diabetic and non-diabetic group included 132 patients. Diabetic group patients had higher magnitude of ST elevation in myocardial infarction than non-diabetic patients. Brady arrhythmias, post MI angina, LV failure, atrial fibrillation, and cardiogenic shock were the main complications observed in all the patients after ST Elevation MI. Diabetes patients are more likely to experience all these complications along post MI angina than non-diabetics. Table-I represents the demographic details of patients. Figure-1 depicts the age-wise distribution of all the patients. Comparison of mechanical, arrhythmias, and other complications in diabetic and non-diabetic patients are shown in Figure-2, Figure-3, and Figure-4 respectively. Table-II shows the comparison of mortality in diabetic and non-diabetic patients.

Table-1: Comparison of demographic details

Variables	Diabetic N=132 N (%)	Non-diabetic N=132 N (%)
Age (years)	52.84±7.68	53.42±5.67
Gender		
Male	110 (41.7)	86 (32.6)
Females	22 (8.33)	46 (17.4)
Family history	20 (15.2)	28 (21.2)
History of smoking	60 (22.7)	75 (28.4)

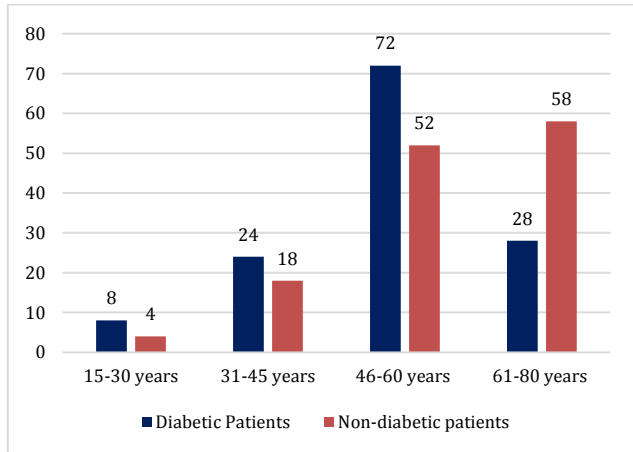


Figure-1: Age-wise distribution of patients

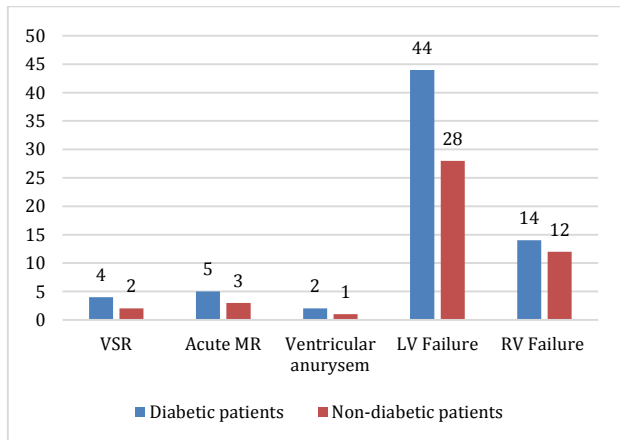


Figure-2: Comparison of mechanical complications in diabetic and non-diabetic patients

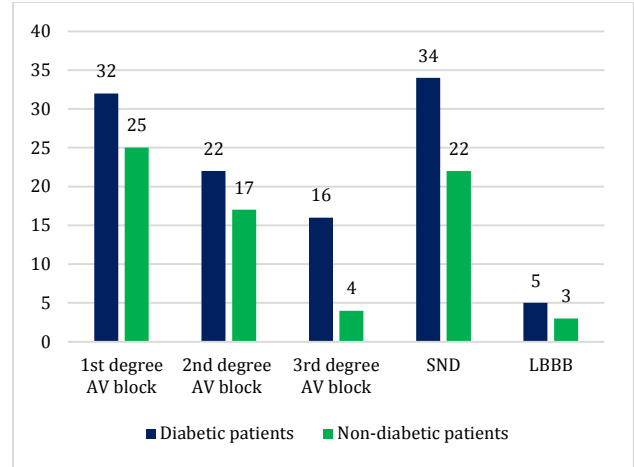


Figure-3: Comparison of arrhythmias complications in diabetic and non-diabetic patients

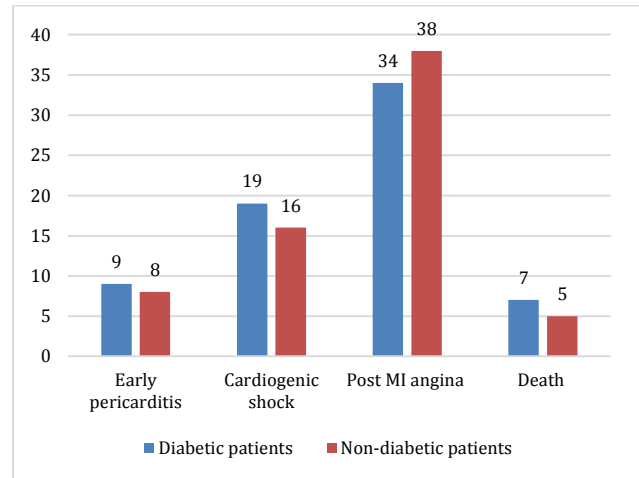


Figure-4: Comparison of others complications

Table-2: comparison of mortality in diabetic and non-diabetic patients.

	Diabetic patients	Mortality N (%)	Non-diabetic patients	Mortality N (%)
PPCI treatment	120	4 (3.03)	116	3 (2.3)
Without PPCI treatment	12	3 (2.3)	16	2 (1.5)
Total	132	7 (5.3)	132	5 (3.8)

**DISCUSSION**

The present study mainly focused on 264 consecutive patients divided into diabetic and non-diabetic groups and found that about 74.2% patients were male and 25.8% were females. The mechanical, arrhythmias, and other complications were compared in the present study. Diabetic patients had a higher prevalence of arrhythmias and complications from left ventricular failure. Diabetic patients also had a significantly higher mortality rate. Non-diabetic patients experienced more post-MI angina than diabetic patients. It is also critical to reduce the prevalence of diabetes mellitus in our population because it is a modifiable risk factor that causes more complications after MI than non-diabetic patients.

In the present study, the left ventricular failure were the most prevalent complications followed by arrhythmia whereas post-myocardial angina were the least common followed by ventricular septal defect, thrombo-embolic phenomenon, and re-infarction. Due to insignificant heterogeneity tests, diabetic and non-diabetic showed almost similar findings and complications patterns.

Another study conducted in Pakistan [14] suggested similar findings according to which ventricular tachycardia and ventricular failure were similar to the present study.

The current study reported that post MI angina was similar in both diabetic and non-diabetic cases. The post-myocardial infarction angina incidence rate must be clarified in both diabetic and non-diabetic patients. Furthermore, diabetes and arrhythmia showed significant association with each other. In diabetic patients, LV systolic dysfunction (moderate to severe) and diastolic dysfunction were the dominant problems evidenced by these findings indicating poor outcomes such as ventricular function and supported other study regarding decreased diastolic and LV systolic function [15, 16].

In the current study, the diabetic patient's mortality rate was two times higher than nondiabetic patients. The overall mortality rate was 4.5% which is lower than 16.7% reported in a previous study [17]. Similar findings were reported regarding mortality rate in another study [18]. Based on the previous study findings, diabetic patients are more susceptible to higher mortality than non-diabetic patients [19]. A diabetic patient with poor prognosis is difficult to manage once hospitalized. According to reports, diabetics are more likely to develop atherosclerosis, which can lead to significant mortality due to the involvement of multiple vessels [20-22].

Our findings revealed no statistically significant differences in mortality among diabetics, non-diabetics, or after controlling for diabetes due to infarction at different sites. However, we discovered that diabetics with inferior infarction had twice the mortality rate. Furthermore, most diabetic patients in the inferior infarction group suffered from cardiovascular complications, including cardiogenic shock, right ventricular failure, ventricular tachyarrhythmia, and which likely contributed to higher mortality. It may, however, be necessary to conduct further research to clarify the issues.

## CONCLUSION

The present study concluded that the prevalence of arrhythmias and left ventricular failure complications were higher in diabetic patients. Also, the mortality rate was significantly higher in diabetic patients. The non-diabetic patients had higher post MI angina than diabetic patients. It is also important to decrease the incidence of diabetes mellitus in our population since it is a modifiable risk factor that leads to more complications following MI than non-diabetic patients.

## REFERENCES

- Umair F, Sheikh KI, Ashraf N, Saeed A, Ali HR, Khalid MU. Impact Of Body Mass Index On In-Hospital Mortality In Patients Presenting With Acute ST Elevation Myocardial Infarction. *The Journal of Cardiovascular Diseases*. 2022 May 31;18(1).
- Hussain A, Sial JA, Kumar D, Ashraf SJ, Parkash C, Raza MT. Outcome of Patients Presenting with ST Elevation Myocardial Infarction among Diabetics and Non-diabetics.
- Schmucker J, Fach A, Osteresch R, Mata Marin LA, Ruehle S, Retzlaff T, Garstka D, Eitel I, Hambrecht R, Wienbergen H. Efficacy of drug-eluting stents in diabetic patients admitted with ST-elevation myocardial infarctions treated with primary percutaneous coronary intervention. *Journal of Cardiovascular Development and Disease*. 2021 Jul 21;8(8):83.
- Şaylık F, Çınar T, Selçuk M, Tanboğa İH. The predictive value of triglyceride-glucose index for in-hospital and one-year mortality in elderly non-diabetic patients with ST-segment elevation myocardial infarction. *Journal of Geriatric Cardiology*. 2022 Aug 28;19(8):610.
- Einarson, T.R.; Acs, A.; Ludwig, C.; Panton, U.H. Prevalence of cardiovascular disease in type 2 diabetes: A systematic literature review of scientific evidence from across the world in 2007–2017. *Cardiovasc. Diabetol*. 2018, 17, 1–19. [Google Scholar] [CrossRef][Green Version]
- Zheng, Y.; Ley, S.H.; Hu, F.B. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. *Nat. Rev. Endocrinol*. 2018, 14, 88–98.
- banez, B.; James, S.; Agewall, S.; Antunes, M.J.; Bucciarelli-Ducci, C.; Bueno, H.; Caforio, A.L.P.; Crea, F.; Goudevenos, J.A.; Halvorsen, S.; et al. 2017 ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The task force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European society of cardiology (ESC). *Eur. Heart J*. 2018, 39, 119–177.
- Bønnaa, K.H.; Mannsverk, J.; Wiseth, R.; Aaberge, L.; Myreng, Y.; Nygård, O.; Nilsen, D.W.; Kløw, N.E.; Uchto, M.; Trovik, T.; et al. Drug-eluting or bare-metal stents for coronary artery disease. *N. Engl. J. Med*. 2016, 375, 1242–1252
- Fach, A.; Backhaus, T.; Schmucker, J.; Zabrocki, R.; Garstka, D.; Stehmeier, J.; Fiehn, E.; Hambrecht, R.; Wienbergen, H. Bivalirudin versus heparin and provisional GP IIb/IIIa inhibitors in patients treated for ST-segment elevation myocardial infarctions: Comparison of outcomes in a "real-world" setting. *J. Interv. Cardiol*. 2017, 30, 301–308.
- Schmucker, J.; Seide, S.; Wienbergen, H.; Stehmeier, J.; Günther, K.; Ahrens, W.; Hambrecht, R.; Pohlmann-Busch, B.; Fach, A. Socially disadvantaged city districts show a higher incidence of acute ST-elevation myocardial infarctions with elevated cardiovascular risk factors and worse prognosis. *BMC Cardiovasc. Disord*. 2017, 17, 254.
- Schmucker, J.; Fach, A.; Becker, M.; Seide, S.; Buenger, S.; Zabrocki, R.; Fiehn, E.; Würmann-Busch, B.; Pohlmann, H.; Günther, K.; et al. Predictors of acute kidney injury in patients admitted with ST-elevation myocardial infarction—Insights from the bremen STEMI registry. *Eur. Heart J. Acute Cardiovasc. Care* 2018, 7, 710–722.
- Backhaus, T.; Fach, A.; Schmucker, J.; Fiehn, E.; Garstka, D.; Stehmeier, J.; Hambrecht, R.; Wienbergen, H. Management and predictors of outcome in unselected patients with cardiogenic shock complicating acute ST-segment elevation myocardial infarction: Results from the bremen STEMI registry. *Cardiology* 2018, 107, 371–379.
- Schmucker, J.; Fach, A.; Marin, L.A.M. Efficacy and safety of ticagrelor in comparison to clopidogrel in elderly patients with ST-segment-elevation myocardial infarctions. *J. Am. Heart Assoc*. 2019, 8, e012530.
- Ullah W, Saleem S, Zahid S, Sattar Y, Mukhtar M, Younas S, Pasha AK, Inayat A, Fischman DL, Alraies MC. Clinical outcomes of patients with diabetes mellitus and acute ST-elevation myocardial infarction following fibrinolytic therapy: a nationwide inpatient sample (NIS) database analysis. *Expert Review of Cardiovascular Therapy*. 2021 Apr 3;19(4):357-62.
- Chandrasekhar, J.; Dangas, G.; Baber, U.; Sartori, S.; Qadeer, A.; Aquino, M.A.; Vogel, B.; Faggioni, M.; Vijay, P.; Claessen, B.E.; et al. Impact of insulin treated and non-insulin-treated diabetes compared to patients without diabetes on 1-year outcomes following contemporary PCL. *Catheter. Cardiovasc. Interv*. 2020, 96, 298–308.
- Farkouh, M.E.; Domanski, M.; Dangas, G.D.; Godoy, L.C.; Mack, M.J.; Siami, F.S.; Hamza, T.H.; Shah, B.; Stefanini, G.G.; Sidhu, M.S.; et al. Long-term survival following multivessel revascularization in patients with diabetes: The FREEDOM follow-on study. *J. Am. Coll. Cardiol*. 2019, 73, 629–638.
- Räber, L.; Yamaji, K.; Kelbæk, H.; Engström, T.; Baumbach, A.; Roffi, M.; Von Birgelen, C.; Taniwaki, M.; Moschovitis, A.; Zaugg, S.; et al. Five-year clinical outcomes and intracoronary imaging findings of the COMFORTABLE AMI trial: Randomized comparison of biodegradable polymer-based biolimus-eluting stents with bare-metal stents in patients with acute ST-segment elevation myocardial infarction. *Eur. Heart J*. 2019, 40, 1909–1919.
- Bundhun, P.K.; Bhurtu, A.; Soogund, M.Z.; Long, M.Y. comparing the clinical outcomes between drug eluting stents and bare metal stents in patients with insulin-treated type 2 diabetes mellitus: A systematic review and meta-analysis of 10 randomized controlled trials. *PLoS ONE* 2016, 11, e0154064.
- Thygesen K, Alpert JS, Jaffe AS, et al. Fourth universal definition of myocardial infarction (2018). *J Am Coll Cardiol* 2018; 72: 2231–2264.
- Luo E, Wang D, Yan G, et al. High triglyceride-glucose index is associated with poor prognosis in patients with acute ST-elevation myocardial infarction after percutaneous coronary intervention. *Cardiovasc Diabetol* 2019; 18: 150.
- Trifunovic D, Stankovic S, Sobic-Saranovic D, et al. Acute insulin resistance in ST-segment elevation myocardial infarction in non-diabetic patients is associated with incomplete myocardial reperfusion and impaired coronary microcirculatory function. *Cardiovasc Diabetol* 2014; 13: 73.
- Qi LY, Liu HX, Cheng LC, Luo Y, Yang SQ, Chen X, Cai L. Prognostic value of the leuko-glycemic index in acute myocardial infarction patients with or without diabetes. *Diabetes, metabolic syndrome and obesity: targets and therapy*. 2022 Jan 1:1725-36.