ORIGINAL ARTICLE

COMPARISON OF CLINICAL AND ANGIOGRAPHIC CHARACTERISTICS OF DIABETIC AND NON-DIABETIC PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

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Objectives: In this study, we evaluated the differences in clinical and angiographic profiles of ST-segment elevation myocardial infarction (STEMI) patients with and without diabetes mellitus (DM) at a tertiary care cardiac hospital in Karachi, Pakistan.

Methodology: This descriptive cross-sectional study was conducted at a tertiary care cardiac hospital in Karachi, Pakistan. The study included consecutive adult patients (≥ 18 years of age) diagnosed with STEMI undergoing primary percutaneous coronary intervention (PCI). Diabetic and non-diabetic patients were compared for clinical and angiographic profiles.

Results: The study sample consisted of 43.8% (218) diabetic patients. The mean age was 59.03 ± 9.69 years vs. 49.54 ± 11.53 years; p<0.001, proportion of females was 35.3% (77) vs. 14.6% (41); p<0.001, Killip class III or IV was (17) vs. 2.5% (7), and hypertension was 83% (181) vs. 56.8% (159); p<0.001 among the diabetic and non-diabetic group, respectively. The frequency of multi-vessel disease was 50.9% (111) vs. 39.6% (111), the significant left main disease was 5% (11) vs. 2.5% (7), and initial TIMI III flow was 19.3% (42) vs. 25.4% (71) in diabetic and non-diabetic patients, respectively.

Conclusion: In conclusion, diabetes in STEMI setting is associated with complex coronary artery diseases, more hemodynamic instability at presentation, and the presence of multiple co-morbid conditions.

Keywords: Pakistan, diabetes mellitus, primary percutaneous coronary intervention, ST-segment elevation myocardial infarction

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INTRODUCTION

Diabetes mellitus (DM) has become a global pandemic with a prevalence estimate of 463 million people (9.3%) in the 2019 and burden of DM is expected to rise significantly with an estimate of 578 million individuals by the year 2030. Urban dwellers more than rural and high-income countries more than low-income countries are affected by DM.[1] The American Diabetes Association (ADA) estimated, that in 2017 the cost of the disease in the United States alone increased by 26% in a 5 years period with $90 billion due to productivity reduction and $237 billion accounting for direct medical costs related to the management of the diseases.[2] According to the National Diabetes Survey of Pakistan (NDSP), the estimated prevalence of diabetes was 26.3% out of which 7.1% were newly diagnosed, while, 19.2% were known cases of DM.[3] Another population based survey of 18,856 subjects estimated DM prevalence as 16.98% [16.44% - 17.51%], while, based on HbA1c levels the prevalence of pre-diabetes was 10.91% [10.46 - 11.36%].[4]

DM has been reported to be one of the major risk factors for the development of cardiovascular diseases (CVD) which eventually become the major cause of death among these patients across gender and various ethnicities.[5] As compared to non-diabetic individuals, diabetic patients develop CVD symptoms much earlier in life and manifest severe atherosclerosis and complex and diffused lesions leading to a poorer prognosis.[6] Currently, the recommended management strategy for diabetic patients with complex coronary artery diseases (CAD) is coronary artery bypass grafting (CABG), however, in the recent years, percutaneous intervention showed promising results in these patients owing to the advancements in the intervention technology and introduction of drug-

eluting stents (DES).[7, 8] Regardless of advancements, diabetes is well established prognostic factor among CVD patients. More specifically, DM has been observed to be associated with an increased risk of in-hospital, short- or long-term adverse outcomes following percutaneous coronary intervention (PCI) for acute myocardial infarction (AMI).[9, 10]

Ample literature is available on the prognostic role of DM in AMI patients, but data regarding the impact of DM on the angiographic profile of patients with ST-segment elevation myocardial infarction (STEMI) is lacking, especially for the Pakistani population. Therefore, in this study, we have evaluated the differences in clinical and angiographic profiles between diabetic and non-diabetic patients with STEMI at a tertiary care cardiac hospital in Karachi, Pakistan.

METHODOLOGY

This descriptive cross-sectional study was conducted at a tertiary care cardiac hospital namely the National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan during the study period of June to December 2021. The study included consecutive patients diagnosed with STEMI undergoing primary PCI fulfilling the inclusion criteria of both male and female and age ≥ 18 years. Patients refused to give consent for primary PCI or participation in the study were not included in this study. Verbal consent was obtained from all the patients and this study was approved by the ethical review board of the institution.

Demographic and clinical data were obtained which included age, gender, presenting vitals, time laps between symptoms and hospital arrival, type of myocardial infarction, hemodynamic status Killip class), and co-morbid conditions such as diabetes, obesity, hypertension, and positive family history of CAD. Diabetes was labeled positive if the patient was on any anti-hyperglycemic treatment and similarly hypertension was labeled positive if the patient was taking any anti-hypertensive treatment for at least the last six months. As per the institutional routine policy, all the primary PCI procedures were performed free of charge by the on-call team of interventional cardiologists. The angiographic variables consisted of status regarding the significant left main disease, number of vessels diseased, type of culprit vessel, the severity of culprit vessel, TIMI (Thrombolysis in Myocardial Infarction) flow in culprit vessel, left ventricular ejection fraction (LVEF %), length of the lesion, vessel diameter, and Left ventricular end-diastolic pressure (LVEDP mmHg).

Collected data were analyzed using IBM SPSS version 19 and summarized as either mean ± standard deviation (SD) or frequency (%). Angiographic and clinical variables were compared between patients with and without DM with the help of Chi-square test or independent sample t-test, appropriately. P-value of ≤ 0.05 was considered statistically significant.

RESULTS

The study sample consisted of 43.8% (218) diabetic patients and 280 (56.2%) non-diabetic patients. The proportion of females was 35.3% (77) vs. 14.6% (41); p<0.001 and the mean age was 59.03 ± 9.69 years vs. 49.54 ± 11.53 years; p<0.001 among the diabetic and non-diabetic group, respectively. The frequency of Killip class III or IV was observed to be 7.8% (17) vs. 2.5% (7), hypertension was 83% (181) vs. 56.8% (159); p<0.001, and positive family history of CAD was 6.9% (15) vs. 24.3% (68); p<0.001 among the diabetic and non-diabetic group, respectively (Table 1).

Table 1: Comparison of clinical characteristics for ST-segment elevation myocardial infarction patients with and without diabetes mellitus

Characteristics	Diabetes Mellitus Status		P-value
	Non-diabetics	Diabetics	
Total (N)	**280 (56.2%)**	**218 (43.8%)**	**-**
Gender			
Male	85.4% (239)	64.7% (141)	<0.001
Female	14.6% (41)	35.3% (77)	
Age (years)	49.54 ± 11.53	59.03 ± 9.69	<0.001
Door to balloon time (minutes)	56.83 ± 25.4	60.75 ± 25.98	0.091
Total ischemic time (hours)	6.58 ± 2.09	6.74 ± 2.21	0.388
Heart Rate (bpm)	82.9 ± 17.6	88.2 ± 19.8	0.002
Systolic blood pressure (mmHg)	120.9 ± 17.8	117.3 ± 20.1	0.035
Diastolic blood pressure (mmHg)	76.1 ± 10.1	73.9 ± 11	0.019
Killip Class			
I	83.2% (233)	72.5% (158)	0.003
II	14.3% (40)	19.7% (43)	
III	0.4% (1)	4.1% (9)	
IV	2.1% (6)	3.7% (8)	
Type of myocardial infarction			
Anterior	55% (154)	53.2% (116)	0.803
Inferio-posterior	4.3% (12)	6.9% (15)	
Inferior	22.5% (63)	23.4% (51)	
Inferior plus RV infarction	9.3% (26)	9.6% (21)	
Isolated posterior	5.7% (16)	4.6% (10)	
Lateral	3.2% (9)	2.3% (5)	
Mechanical ventilation	2.1% (6)	5.5% (12)	0.046
Co-morbid conditions			
Hypertension	56.8% (159)	83% (181)	<0.001
Current smoker	33.2% (93)	27.1% (59)	0.139

Family history of CAD	24.3% (68)	6.9% (15)	<0.001
Obesity	6.8% (19)	3.7% (8)	0.128

RV = right ventricular, CAD = coronary artery disease

Frequency of multi-vessel disease was 50.9% (111) vs. 39.6% (111), significant left main was 5% (11) vs. 2.5% (7) among diabetic and non-diabetic group, respectively. The left anterior descending artery (LAD) was the commonly observed culprit artery in both diabetic and non-diabetic patients (54.1% vs. 56.8%) followed by the right coronary artery (31.7% vs. 29.6%), respectively. Initial TIMI III flow was 19.3% vs. 25.4% in diabetic and non-diabetic patients, respectively (Table 2).

Table 2: Comparison of angiographic characteristics for ST-segment elevation myocardial infarction patients with and without diabetes mellitus

Characteristics	Diabetes Mellitus Status		P-value
	Non-diabetics	Diabetics	
Total (N)	**280 (56.2%)**	**218 (43.8%)**	**-**
Significant left main disease	2.5% (7)	5% (11)	0.131
Number of vessels diseased			
Single vessel disease	60.4% (169)	49.1% (107)	0.041
Two vessel disease	21.1% (59)	28% (61)	
Three vessel disease	18.6% (52)	22.9% (50)	
Culprit vessel			
LAD	56.8% (159)	54.1% (118)	0.756
Left circumflex	13.2% (37)	14.2% (31)	
Left main	0.4% (1)	0% (0)	
Right coronary artery	29.6% (83)	31.7% (69)	
Severity of culprit vessel			
80 to 90%	28.6% (80)	28.9% (63)	0.704
91 to 99%	6.8% (19)	8.7% (19)	
100%	64.6% (181)	62.4% (136)	
Baseline TIMI flow in culprit vessel			
0	64.6% (181)	63.8% (139)	0.079
I	3.2% (9)	4.6% (10)	
II	6.8% (19)	12.4% (27)	
III	25.4% (71)	19.3% (42)	
Total length lesion (mm)	26.9 ± 10.9	26.3 ± 10	0.537
Vessel diameter (mm)	3.3 ± 0.3	3.2 ± 0.3	0.328
LV end-diastolic pressure (mmHg)	19 ± 5.5	19.9 ± 6.9	0.106
LV ejection fraction (%)	42.2 ± 8.4	40.9 ± 10	0.126

LAD = left anterior descending artery, LV = left ventricular

DISCUSSION

Considering the lack of local data regarding differences in the angiographic profile of diabetic and non-diabetic STEMI patients, this study was conducted at a tertiary care cardiac hospital in Karachi Pakistan. This study revealed significant differences in clinical characteristics of patients with and without diabetes. Such as, although patients in both the groups were predominantly male, the proportion of females was significantly higher among diabetic patients as compared to non-diabetic patients. Similarly, diabetic patients were significantly older than their non-diabetic counterparts. Diabetic patients were observed to have compromised hemodynamic stat at presentation with a comparatively higher proportion of Killip class III/IV patients, significantly increased heart rate, and more hypotensive as compared to the non-diabetic patients, eventually, a significantly higher number of diabetic patients needed mechanical ventilation support than non-diabetic patients. Prevalence of hypertension was significantly higher among diabetic patients, while, positive family history of CAD was significantly higher among non-diabetic patients along with a higher tendency of smoking. The angiographic outlook of diabetic patients was also different with a higher tendency of multi-vessel disease, significant left main disease, and lower initial TIMI III flow as compared to the non-diabetic patients.

Most of the differences identified in our study are consistent with the existing knowledge based on available data for our population. Such as a small study by Ahmed S et al.[11] included both STEMI and non-STEMI patients from three tertiary care hospitals in Pakistan and demonstrated several significant differences in emergency room presentation of diabetic patients. The diabetic patients were reported to have more atypical symptoms with a higher incidence rate of epigastric pain, cold sweats, and anxiety. Diabetic patients were also found to have longer durations between onsets of symptoms to hospital arrival.[11] Another study by Ali F et al.[12] compared biochemical parameters among individuals with normal ECG, AMI with diabetes, and AMI without diabetes. The study associated significantly elevated non-traditional (C-reactive protein) and traditional (creatine kinase-MB, creatine phosphokinase, aspartate aminotransferase, and lactate dehydrogenase) cardiac biomarkers with diabetes.[12]

In our study diabetics were 43.8% of the total study sample, which is in range of what i000s reported from various parts of the world, the range of distribution of diabetes in various studies is from 20.3% to 50.3%.[10, 13-17] The prognostic role of DM is well established, such as Piccolo R et al.[13] evaluated the impact of DM on the rate of adverse outcomes after PCI for acute coronary syndrome. One year all-cause mortality was

highest among STEMI patients with DM (13.4%) followed by NSTE-ACS with DM (10.3%). STEMI patients with DM were also found to have an increased risk of early stent thrombosis with a hazard ratio (HR) of 2.26 [1.48 - 3.44].[13] Chichareon P et al.[10] reported HR of 1.38 [1.17 - 1.63] for the incidence of new Q-wave MI or all-cause death after two years of PCI for ACS in diabetic patients. Tailakh MA et al.[14] reported newly diagnosed DM in 19% of the patients and comparative findings on clinical and angiographic characteristics of non-DM and previously known DM cohorts were the same as our study. Similar to what we observed, the previously known DM cohort had greater mean age (67.9 ± 10.4 vs. 62.0 ± 11.3), higher female proportion (37.3% vs. 25.3%), higher prevalence of hypertension (71.4% vs. 59.3%), and higher multi-vessel disease (78.4% vs. 65.8%). DM was also found to be associated with an increased risk of major adverse cardiovascular events (MACE) at 1-year follow-up with an adjusted HR of 1.75.[14] Another study by Faggioni M et al.[15] demonstrated similar differences in clinical and angiographic characteristics among diabetic and non-diabetic ACS patients. The study also reported a significant reduction in 90-day death rate with the use of prasugrel in PCI-treated ACS as compared to clopidogrel.[15] Differences in clinical and angiographic variables between the DM and non-DM cohort in a study by Konigstein M et al.[16] were the same as we observed in our study, additionally, it has been reported that modern DES failed more often among DM patients with a higher incidence of target lesion failure, target vessel revascularization, and MACE. Increased incidence of adverse outcomes among diabetic patients after PCI is well reported by various other studies as well.[9, 17-19]

Further multi-center large-scale studies are required in our population to highlight the clinical importance and impact of diabetes mellitus on the clinical course and prognosis of STEMI patients. Even though this study was performed at the largest cardiac care center of the country, single-center coverage and a limited number of study subjects remained the main limitation of this study. Secondly, outcomes of DM and non-DM patients after primary PCI were not compared in this study, therefore, no conclusion could be made regarding the gravity of the impact of DM on short- or long-term outcomes after primary PCI in our population.

CONCLUSION

In conclusion, diabetes in STEMI setting is associated with complex coronary artery diseases, more hemodynamic instability at presentation, and the presence of multiple co-morbid conditions. The prognostic role of DM after primary PCI could stem from these differences, hence, management and prevention of DM should be given due importance in the management of patients with CAD, in particularly STEMI.

AUTHORS' CONTRIBUTION

BAS, JAS, RK, MHB, KAS, AA, AN, GA and TS: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. TS, and NQ: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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