RESEARCH ARTICLE

Impact of diabetes mellitus on clinico-laboratory characteristics and in-hospital clinical outcomes among patients with myocardial infarction

Syed Haroon Khalid[1], Iqra Liaqat[2], Tauqeer Hussain Mallhi[3], Amer Hayat Khan[4], Junaid Ahmad[5], Yusra Habib Khan[6]

Abstract

Objective: Diabetes mellitus (DM) along with myocardial infarction (MI) carries increased burden on patients in terms of morbidity, mortality and cost. Current study was aimed to investigate the impact of DM on clinico-laboratory characteristics on in-hospital treatment outcomes among MI patients.

Method: All MI patients admitted to the emergency department of Faisalabad Institute of Cardiology from April, 2016 to March, 2017 were recruited into the study. The clinico-laboratory profile and in-hospital outcomes of patients with and without DM were compared using chi-squared test or student t-test, where appropriate.

Results: A total 4063 patients (Mean age: 55.86 ± 12.37years) with male preponderance were included into the study. STEMI was most prevalent (n = 2723, 67%) type of MI among study participants. DM was present in substantial number of cases (n = 3688, 90.8%). Patients with DM presented with increased BMI, higher blood pressure, elevated levels of cholesterol, serum creatinine, and blood urea nitrogen, when compared to the patients without DM ($p<0.05$). Out of 560 patients who were followed up, cardiogenic shock was frequent (n = 293, 52.3%) adverse outcome followed by heart failure (n = 114, 20.4%), atrial fibrillation (n = 78, 13.9%) and stroke (n = 75, 13.4 %). Moreover, in-hospital adverse outcomes were more prevalent among MI patients with DM than those without DM.

Conclusion: MI patients with DM present with varying clinico-laboratory characteristics as well as experience higher prevalence of adverse cardiovascular events as compared to patients without DM. These patients require individual management strategy on very first day of admission.

Keywords: Myocardial Infarction; Diabetes Mellitus; Acute Coronary Syndrome; Coronary Heart Disease; ST-Elevation Myocardial Infarction; Non-ST-elevation myocardial infarction; Cardiovascular Events.

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Introduction

Myocardial infarction (MI) is one of the major complications of coronary heart disease (CHD).[1] Existing data suggested that the Asian population is more susceptible to MI.[2] Recent estimates described higher prevalence (50 %) of acute MI in South Asians than in white people from United Kingdom.[2] Pakistan is a developing South Asian country with approximate population around 200 million, where majority of individuals (67.5%) live in rural areas and bear enormous burden of heart diseases.[3] It has been reported that obesity, hypertension, smoking, diabetes mellitus (DM), and hypercholesterolaemia are major risk factors for the onset of CHD.[4] However, it has been estimated that prevalence of MI risk factors is high in Pakistan where >30% of population over 45 years of age has MI.[5]

[1,5]Department of Pharmaceutics, Government College University, Faisalabad, Pakistan; [2]Faisalabad Institute of Cardiology FIC, Civil Lines, Faisalabad, Pakistan; [3,6]Department of Clinical Pharmacy, College of Pharmacy, Jouf University, Sakaka, Kingdom of Saudi Arabia; [4]Department of Clinical Pharmacy, School of Pharmaceutical Sciences, University Sains Malaysia, Penang, Malaysia

Correspondence: Tauqeer Hussain Mallhi
e-mail: tauqeer.hussain.mallhi@hotmail.com

Diabetic patients having cardiovascular events experience worst outcomes as compared to patients without DM.[6] Previous investigations have suggested that DM is strongly associated with the higher risks of heart failure.[7] Despite the high prevalence and explicit association of DM with adverse events, there are few contemporary data on the clinical outcomes of MI diabetic patients. Earlier studies have suggested that DM carries increased risk equivalent to the magnitude similar to that of the presence of known atherothrombosis.[8] Moreover, higher mortality after MI in diabetic versus non-diabetic patients is a well-established problem.[9] Type 2 DM counts 10% to 30% among patients presenting with MI and represents a serious public health concern.[10] The risk profile of diabetic patients were worse than non-diabetic patients, and several studies have shown DM as an independent predictor of mortality after MI.[11,12] To the best of our knowledge, the impact of DM among MI patients has not been investigated in Pakistani population. There are few small case series evaluating the clinical profile of MI and characteristics of MI patients with respect to DM.[13-16] In this context, current study was aimed to evaluate the clinico-laboratory characteristics of MI patients with respect to presence of DM, and to investigate the impact of DM on clinical outcomes of MI patients.

Patients and Methods

Permission to conduct the current study was acquired from Ethical Review Committee of Faisalabad Institute of Cardiology (FIC), prior to data collection. All the identities of patient's were anonymous before subjecting the data for analysis. Present study was carried out in accordance to the principals laid by the 18th World Medical Assembly. Informed consents were obtained from all the study participants.

The current cross-sectional study was conducted at Emergency department of FIC, Faisalabad, Pakistan. FIC is a tertiary care specialized autonomous institution for cardiac diseases in the Punjab Province of Pakistan. The estimated population of Faisalabad city is about 2.5 million. The hospital is comprised of 202 beds, 6 inpatient units and emergency department. This institution is working under the provision of Punjab Medical and Health Institute ACT (2003). FIC plays vital role in provision of evidence based healthcare services to cardiac patients not only from Faisalabad city but also from other adjacent districts including Sargodha, Toba Tek Singh, Jhang, Chiniot and beyond areas of Punjab Province.

MI patients admitted to the Emergency department of FIC, between April 1, 2016 and March 31, 2017 were recruited for the purpose of study. Inclusion criteria were extended to adult population presenting in emergency department with MI (chest pain >30minutes), abnormal electrocardiogram (ECG) or patients presented within 12 hours of symptoms of MI. Children, patients with repeated MI, on thrombolytic agents and had previous history of coronary artery bypass grafting or percutaneous coronary intervention (PCI) were excluded from the analysis. A pre-structured data collection form was used to extract demographics, patient`s history, medication record and clinical outcomes. Independent variables included demographic characteristics such as age, sex, anthropometric parameters and smoking status. ECG findings were recorded to stratify the MI cases into ST-elevation myocardial infarction (STEMI) and Non-ST-elevation myocardial infarction (NSTEMI). Comorbidities such as diabetes mellitus (DM), heart failure (HF), hyperlipidaemia, hypertension were noted from the patient`s record. All available vitals including systolic blood pressure (SBP) and diastolic blood pressure (DBP) were extracted from the file. Laboratory data including blood urea nitrogen (mg/dl), Serum creatinine (mg/dl), glucose (mg/dl), total cholesterol (mg/dl), potassium (mEq/L) and Sodium (mEq/L) were noted at hospital admission. All medications taken by the patients during hospital stay either in emergency or ward were recorded. All the patients were followed-up for 3 days and occurrence adverse in-hospital clinical outcomes including cardiogenic shock, heart failure, atrial fibrillation and stroke were noted.

The sample size for the current study was estimated by Daniel Equation ($n= Z^2 P (1- P)/ d^2$).[17] Where n= required number of patients (sample size), Z represents the statistics for a level of confidence, P is expected prevalence or proportion of the disease of interest and d refers to precision (margin of error). By using confidence of interval as 95 % and margin of error of 5 %, the minimum sample size estimated was n = 560.

Statistical Package for Social Sciences software version 21 (SPSS Inc., Chicago, IL) was used for the data analysis. All the collected data was coded into variables. Quantitative variables including age, BMI, SBP, DBP, glucose, cholesterol, BUN, creatinine, sodium and potassium were presented with mean and standard deviation. Categorical variables were presented as frequencies along with proportions. The quantitative data was compared by chi-square test, while student t-test was used to compare the continuous data. P-value ≤ 0.05 was considered significant for the purpose of this study. The major comparative groups in the current study were STEMI versus NSTEMI and DM versus no-DM.

Results

A total 4063 patients with male preponderance (n = 3083, 75.9%) were enrolled in the current study. Electrocardiogram (ECG) assessment revealed STEMI as a most prevalent type of MI (n=2723, 67%) followed by NSTEMI (n =1340, 33%). Most of the STEMI (n=1097/2723, 40.3%) cases were of anterior wall MI (AWMI). The baseline characteristics of the patients and their comparison between STEMI and NSTEMI are shown in Table 1.

Patient with STEMI were younger (55.4 ± 12.5 vs 56.7 ± 11.9, $p = 0.002$) than those with NSTEMI. The proportion of male gender and smokers were significantly higher in STEMI than NSTEMI ($p < 0.001$). Higher levels of BMI (24.9±2.7) Kg/m^2) and DBP (85.9±7.5 mmHg) were associated with STEMI, while the patients with NSTEMI had significantly higher SBP at baseline as compared to patients with STEMI. DM was most common (n=3688, 90.8%) co-morbid condition among patients followed by hypertension (n=2979, 73.3%) and hyperlipidaemia (n=2404, 59.2%). Hypertension was more prevalent among patients with NSTEMI while DM was associated with STEMI. The proportion of patients with hyperlipidaemia was equally distributed between two groups. Blood thinning agents were frequently prescribed medications among patients during hospitalization (Table 1). Aspirin, Clopidogrel and atorvastatin were frequently prescribed in patients with STEMI, while use of lisinopril and bisoprolol was higher in patients with STEMI.

Table-1: Baseline Data of MI patients admitted in Emergency Department and Comparison of Clinico-laboratory Characteristics between STEMI & NSTEMI.

Variables	Total Patients (n = 4063)	STEMI (n=2723)	NSTEMI (n=1340)	*p*-value*
Age (years) (Mean ± SD)	55.9 ±12.4	55.4 ± 12.5	56.7 ± 11.9	0.002
Male Gender	3083 (75.9%)	2183 (80.2%)	900 (67.2%)	<0.001
Smokers	2180 (53.7%)	1666 (61.2%)	514 (38.4%)	<0.001
BMI (Kg/m^2)	24.86 ± 2.6	24.9 ± 2.7	24.6 ± 2.6	<0.001
SBP (mmHg)	141.7 ± 9.4	141.1 ± 10.1	143.2 ± 7.6	<0.001
DBP (mmHg)	94.8 ± 7.6	85.9 ± 7.5	82.3 ± 7.42	<0.001
Comorbidities (%)				
Hyperlipidaemia	2404 (59.2%)	1631 (59.9%)	773 (57.7%)	0.178
Hypertension	2979 (73.3%)	1808 (66.4%)	1171 (87.4%)	<0.001
Diabetes Mellitus	3688 (90.8%)	2503 (91.9%)	1185 (88.4%)	<0.001
In-hospital medication (%)				
Aspirin 75mg	3228 (79.4%)	2417 (88.8%)	811 (60.5%)	<0.001
Clopidogrel 75mg	2831 (69.7%)	2301 (84.5%)	530 (39.6%)	<0.001
Atorvastatin 20mg	2202 (54.2%)	1508 (55.4%)	694 (51.8%)	0.031
Lisinopril 10mg	2514 (61.9%)	1628 (59.8%)	886 (66.1%)	<0.001
Bisoprolol 5mg	1888 (46.5%)	1002 (36.8%)	886 (66.1%)	<0.001
Cathetrization	525 (12.9%)	240 (8.8%)	285 (21.3%)	<0.001
Laboratory Data				
Glucose (mg/dL)	232.4 ± 62.6	228.92 ± 62.5	239.32 ± 62.2	<0.001
Total Cholesterol (mg/dL)	210.5±48.9	209.86±48.9	211.69±49.9	0.262
Creatinine (mg/dL)	1.3 ± 0.6	1.26 ± 0.6	1.23 ± 0.4	0.006
BUN (mg/dL)	28.5 ± 10.6	28.81 ± 10.7	27.84 ± 10.5	0.115
Haemoglobin (g/dL)	10.2 ± 2.1	10.21 ± 2.1	10.03 ± 2.1	0.010
Sodium (mEq/L)	139.9 ± 1.9	139.84 ± 1.8	140.25 ± 1.9	<0.001
Potassium (mEq/L)	4.4 ± 0.5	4.34 ± 0.5	4.37 ± 0.4	0.043

Data presentation: Categorical data is presented in frequency (proportion), continuous data is presented in Means (standard deviation)

Abbreviations: STEMI: ST elevation myocardial infarction, NSTEMI: non-ST elevation myocardial infarction, BMI: Body mass index, SBP: systolic blood pressure, DBP: Diastolic blood pressure, BUN: blood urea nitrogen,

*p-values is calculated between STEMI and NSTEMI using Chi-squared and student-t tests, where appropriate, p values < 0.05 are considered statistically significant

Table-2: Baseline Data of MI patients admitted in Emergency Department and Comparison of Clinico-laboratory Characteristics between STEMI & NSTEMI.

Variables	Total Patients (n = 4063)	MI + DM (n=3688)	MI - DM (n=375)	P-value*
Age (years) (Mean± SD)	55.9 ±12.3	55.9 ± 12.4	55.1 ± 12.1	0.173
Male Gender	3083 (75.9%)	2793 (75.7%)	290 (77.3%)	0.490
Smokers	2180 (53.7%)	1987 (53.9%)	193 (51.5%)	0.372
BMI (Kg/m^2)	24.9 ± 2.6	25.26 ± 2.4	20.92 ± 1.8	<0.001
SBP (mmHg)	141.7 ± 9.4	144.6 ± 9.8	143.6 ± 7.8	<0.001
DBP (mmHg)	94.8 ± 7.6	85.4 ± 7.61	78.5 ± 4.2	<0.001
Comorbidities (%)				
Hyperlipidaemia	2404 (59.2%)	2167 (58.8%)	237 (63.2%)	0.095
Hypertension	2979 (73.3%)	2791 (75.7%)	188 (50.1%)	<0.001
In-hospital medication (%)				
Aspirin 75mg	3228 (79.4%)	3043 (82.5%)	185 (49.3%)	<0.001
Clopidogrel 75mg	2831 (69.7%)	2585 (70.1%)	246 (65.6%)	0.071
Atorvastatin 20mg	2208 (54.2%)	2017 (54.7%)	185 (49.3%)	0.047
Lisinopril 10mg	2514 (61.9%)	2395 (64.9%)	119 (31.7%)	<0.001
Bisoprolol 5mg	1888 (46.5%)	1769 (48.0%)	119 (31.7%)	<0.001
Cathetrization	525 (12.9%)	427 (11.6%)	98 (26.1%)	<0.001
Laboratory Data				
Glucose (mg/dL)	232.4 ± 62.6	280.5 ± 38.3	227.5 ± 62.5	<0.001
Total Cholesterol (mg/dL)	210.5 ± 48.9	213.4 ± 49.7	181.9 ± 28.1	<0.001
Creatinine (mg/dL)	1.2 ± 0.6	1.3 ± 0.4	1.1 ± 1.3	<0.001
BUN (mg/dL)	28.5 ± 10.6	28.8 ± 10.7	25.8 ± 9.4	0.019
Haemoglobin (g/dL)	10.2 ± 2.1	10.2 ± 2.1	10.1 ± 2.1	0.360
Sodium (mEq/L)	139.9 ± 1.9	139.7 ± 1.7	142.2 ± 2.3	<0.001
Potassium (mEq/L)	4.4 ± 0.5	4.4 ± 0.5	4.3 ± 0.4	<0.001

Data presentation: Categorical data is presented in frequency (proportion), continuous data is presented in Means (standard deviation)

Abbreviations: STEMI: ST elevation myocardial infarction, NSTEMI: non-ST elevation myocardial infarction, BMI: Body mass index, SBP: systolic blood pressure, DBP: Diastolic blood pressure, BUN: blood urea nitrogen

*p values is calculated between MI patients with and without, p values < 0.05 are considered statistically significant

Comparison of laboratory data indicated that levels of cholesterol and BUN at admission were equally distributed between two groups. Increased levels of SCr and Haemoglobin were associated with STEMI in the present study. Furthermore, the levels of glucose, sodium and potassium were significantly higher among patients with NSTEMI as compared to those with STEMI (Table 1).

It is interesting to note that 3688(90.8%) of study participants had DM. Subgroup analysis revealed that MI patients with DM presented with variable clinico-laboratory characteristics during admission as compared to those without DM (Table 2). Age, gender and smoking status were equally distributed between MI patients with and without DM. Patients with DM when compared to those without DM, presented with significantly higher BMI, SBP, DBP and prevalence of hypertension. On-admission, laboratory indices showed significantly higher thresholds of glucose, total cholesterol, serum creatinine, BUN and potassium among diabetic MI patients as compared to non-diabetic MI patients. Moreover, the use of in-hospital medications was significantly higher among patients with MI coexisted with DM than patients without DM. These findings indicated that compared to patients without DM, presence of DM with MI caused variations in clinical and laboratory profile of patients.

Following stratification of MI into STEMI and NSTEMI, it was observed that patients with either subtype presented with varying clinical and laboratory characteristics on emergency admission. We also observed that these characteristics were affected by the presence of DM (Table 3). In DM group, patients with STEMI were of young age, male gender, and had increased BMI and DBP, and decreased SBP as compared to patients with NSTEMI. However, these characteristics were equally distributed between STEMI and NSTEMI for patients without DM. In addition, STEMI was associated with smoking when compared to NSTEMI, regardless of the presence of DM. Similarly, co-morbidities and serum potassium significantly differed between STEMI and NSTEMI in both diabetic and

Table-3: Comparison of STEMI and NSTEMI among patients with and without diabetes mellitus.

Variables *	MI patients with DM (n = 3688)				MI Patients without DM (n = 375)			
	MI + DM (n=3688)	STEMI (n=2503)	NSTEMI (n=1185)	*p*-value*	MI - DM (n=375)	STEMI (n=220)	NSTEMI (n=155)	*p*-value*
Age (years)	55.9 ± 12.3	55.4 ± 12.5	57.12 ± 11.9	<0.001	55.03 ± 12.1	56.0 ± 12.5	53.7 ± 11.4	0.063
Male	2793 (75.7%)	2010 (80.3%)	783 (66.1%)	<0.001	290 (77.3%)	173 (78.6%)	117 (75.5%)	0.473
Smokers	1987 (53.9%)	1535 (61.3%)	452 (38.1%)	<0.001	193 (51.5%)	131 (59.5%)	62 (40.0%)	<0.001
BMI (Kg/m^2)	25.3 ± 2.4	25.3 ± 2.4	25.1 ± 2.3	0.005	20.9 ± 1.8	20.91 ± 1.79	20.93 ± 1.75	0.885
SBP (mmHg)	144.55 ± 9.6	140.78 ± 10.4	143.2 ± 7.6	<0.001	143.6 ± 7.8	143.6 ± 7.6	143.4 ± 8.1	0.786
DBP (mmHg)	85.4 ± 7.6	96.6 ± 7.3	92.9 ± 7.6	<0.001	78.5 ± 4.2	78.8 ± 4.2	78.0 ± 4.2	0.090
Comorbidities								
Hyperlipidaemia	2167 (58.8%)	1434 (57.3%)	733 (61.9%)	0.009	237 (63.2%)	197 (89.6%)	40 (25.8%)	<0.001
Hypertension	2791 (75.7%)	1758 (70.2%)	1033 (87.2%)	<0.001	188 (50.1%)	50 (22.7%)	138 (89.0%)	<0.001
In-hospital medications								
Aspirin 75mg	3034 (82.5%)	2249 (89.9%)	794 (67.0%)	<0.001	185 (49.3%)	168 (76.4%)	17 (11%)	<0.001
Clopidogrel 75mg	2585 (70.1%)	2164 (86.5%)	421 (35.5%)	<0.001	246 (65.6%)	137 (62.3%)	109 (70.3%)	0.106
Lisinopril 10mg	2017 (54.7%)	1601 (64 %)	794 (67.0%)	0.071	185 (49.3%)	27 (12.3%)	92 (59.4%)	<0.001
Atorvastatin 20mg	2395 (64.9%)	1340 (53.5%)	677 (57.1%)	0.041	119 (31.7%)	168 (76.4%)	17 (11 %)	<0.001
Bisoprolol 5mg	1769 (48.0%)	975 (39 %)	794 (67.0%)	<0.001	119 (31.7%)	27 (12.3%)	92 (59.4%)	<0.001
Catheterization	427 (11.6%)	188 (7.5%)	239 (20.2%)	<0.001	98 (26.1%)	52 (23.6%)	46 (29.7%)	0.190

Data presentation: Categorical data is presented in frequency (proportion), continuous data is presented in Means (standard deviation)
Abbreviations: BMI: Body mass index, SBP: systolic blood pressure, DBP: Diastolic blood pressure, BUN: blood urea nitrogen
*p values is calculated between STEMI and NASTEMI.

Table-4: Comparison of Laboratory data STEMI and NSTEMI among patients with and without diabetes mellitus.

Variables *	MI patients with DM (n = 3688)				MI Patients without DM (n = 375)			
	MI + DM (n=3688)	STEMI (n=2503)	NSTEMI (n=1185)	*p*-value*	MI - DM (n=375)	STEMI (n=220)	NSTEMI (n=155)	*p*-value*
Glucose	280.5 ± 38.3	224.4 ± 62.2	233.9 ± 62.8	<0.001	227.5 ± 62.5	180.3 ± 39.3	180.7 ± 36.9	0.925
Cholesterol	213.4 ± 49.7	212.2 ± 49.5	215.7 ± 49.9	0.046	181.9 ± 28.1	182.7 ± 31.3	180.7 ± 22.8	0.504
Creatinine	1.3 ± 0.4	1.3 ± 0.5	1.3 ± 0.3	0.773	1.1 ± 1.3	1.2 ± 1.6	1.0 ± 0.6	0.130
BUN	28.8 ± 10.7	29.1 ± 10.8	28.1 ± 10.6	0.007	25.8 ± 9.4	25.6 ± 9.2	26.1 ± 9.6	0.613
Haemoglobin	10.2 ± 2.1	10.2 ± 2.1	10.2 ± 2.2	0.959	10.1 ± 2.1	10.8 ± 1.9	9.1 ± 1.9	<0.001
Sodium	139.8 ± 1.7	139.6 ± 1.6	140.0 ± 1.8	<0.001	142.2 ± 2.3	142.3 ± 2.3	142.0 ± 2.3	0.267
Potassium	4.4 ± 0.5	4.3 ± 0.6	4.4 ± 0.4	<0.001	4.3 ± 0.4	4.4 ± 0.4	4.13 ± 0.3	<0.001

Data presentation: continuous data is presented in Means (standard deviation); Abbreviations: BUN: blood urea nitrogen; *p values is calculated between STEMI and NASTEMI

non-diabetic groups. MI patients with DM were more likely to receive in-hospital medications than patients without DM. Likewise, DM patients with STEMI and NSTEMI were more likely to be on aspirin, lisinopril, bisoprolol than patients without DM. Table 3 and Table 4 illustrated the comparison between patients with STEMI or NSTEMI according to the presence and absence of DM.

Out of total cases, 560 patients experienced adverse in-hospital clinical outcomes during follow-up. Cardiogenic shock was most prevalent adverse outcome 293(52.3%) followed by heart failure 114(20.4%), atrial fibrillation 78(13.9%) and stroke 75(13.4%). Figure indicated comparative differences between two types of MI with respect to presence of DM. Patients with STEMI experienced more frequent in-hospital adverse outcomes as compared to those with NSTEMI. Likewise, MI patients with DM were frequently associated with adverse outcomes than MI patients without DM. STEMI with DM was more frequently associated with adverse outcomes among patients than NSTEMI with DM. Of patients without DM, STEMI was associated with heart failure.

Discussion

Current study demonstrated the high prevalence of diabetes mellitus among patients with MI. The patients with concurrent MI and DM were associated with varying clinico-laboratory characteristics on emergency admission as well as in-hospital adverse clinical outcomes, when compared to patients without DM.

Most of the patients in our study had STEMI, male preponderance and anterior wall myocardial infarction. These findings are in concordance with the previous report evaluating the clinical profile of STEMI patients in Pakistan[18] and other studies conducted elsewhere.[19] It has been

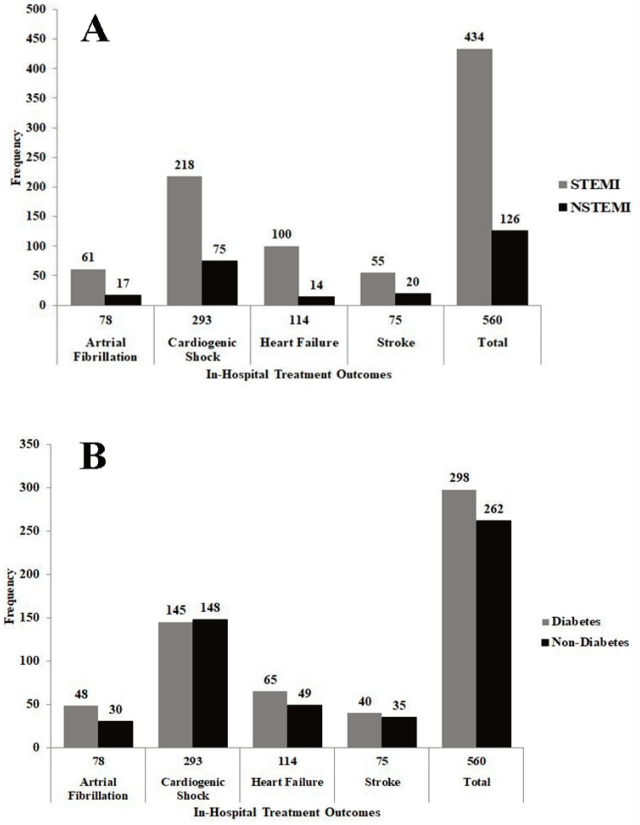

Figure: In-Hospital Clinical Outcomes among MI patients (A) between STEMI and NSTEMI (B) between diabetes and non-diabetes.

documented that women are protected with the risks of CHD in premenopausal phase through estrogen levels and in postmenopausal phase by hormone replacement therapy (HRT).[20] Estrogen plays pivotal role in women and is thought to be a major contributor to premenopausal women's tendency to have normal blood pressure, higher levels of HDL-C, and lower triglyceride levels compared to men.[21] It might be a possible reason of high prevalence of MI among males in our study. More than half of our study population was smoker. Smoking is an established risk factor of MI and has positive association with the occurrence of MI as well as with poor prognosis.[22] In contrary, COURAGE trial concluded that smoking is not a significant risk factor of MI.[23] Besides disparity in the existing literature, it is well established that smoking is associated with deterioration of HDL-C, high blood pressure and free radical formation which are injurious to heart's health.[24] Wu et al,, have also demonstrated that smoking cessation reduces the risks of heart disease by 65%.[25] Since smoking might deteriorate the conditions and prognosis of MI patients, we suggest continuous smoking cessation programs in cardiology centers of Pakistan.

Substantial number of patients in our study had co-morbid conditions including hyperlipidaemia (n=2404, 60%), hypertension (n = 2979, 73%) and diabetes mellitus (n = 3688, 91%) (Table 1). These findings are in contrast with the results of Iqbal et al, where authors reported these co-morbidities in MI patients as of 26%, 37%, and 19.4% respectively.[26] These differences in the findings might be attributed to the study population, as Iqbal et al, included varying population from rural and urban health centers of Punjab or to the criteria used to define these co-morbidities in their study. Other findings have demonstrated the enormous burden of co-morbid conditions among patients with MI.[27]

It is important to note that most of the study participants were overweighed with mean BMI greater than 24 Kg/m^2. Gupta et al, reported that a higher BMI had a positive relationship with MI and our findings corroborate their results.[28] The high values of BMI in our study might be attributed to the unhealthy life style and eating habits of patients living in urban areas. Moreover, STEMI patients in our study had different demographics, anthropometric, clinical and laboratory profile as compared to NSTEMI cases, which necessitate the need individualized approach of treating these two types of MI.

The presence of DM among patients with acute MI carries adverse influence on the prognosis.[29] There are also many reports indicating the frequent occurrence of other CHD risk factors among diabetic patients.[30] The findings of our study comparing DM versus no-DM populations are consistent with previously published reports.[10,31,32]Rousan et al, reported that MI patients with DM were significantly associated with old age; however, this finding is in contrast with our result where age was equally distributed between two groups. Patients with DM were overweight in our study and similar result has been described by Rousan et al.[31] Klamann et al, reported equal distribution of BMI between MI patients with and without DM and it might be attributed to the reason that study population had substantial number of young MI patients with newly diagnosed DM, as young age is less likely to be overweighed.[33] In our study, MI patients with DM had significantly higher levels of total cholesterol, creatinine, BUN and potassium on admission as compared to MI patients without DM. It is interesting to note that clinico-laboratory profile of STEMI patients with DM significantly differed from NSTEMI patients with DM in our study (Table 3 and 4). However, we observed few differences between STEMI and NSTEMI patients without DM. Our study explicitly explained that MI patient with DM present with varying clinico-laboratory characteristics and must be considered for targeted management.

Existing data indicated that diabetic patients with CHD experience worse outcome and poorer long-term survival

as compared to non-diabetic patients with CHD.[34] Since the presence of DM significantly increases the risk of adverse outcomes among MI patients,[6] our findings agreed with the prior studies demonstrating the association between DM and adverse in-hospital clinical outcomes among MI patients, including atrial fibrillation, cardiogenic shock, heart failure and stroke. These outcomes were more prevalent among patients with DM than those without DM. The association of DM with clinical prognosis among MI patients is least appreciated in cardiology research. McMurray et al, reported that the association between DM and heart failure remains under-recognized by the clinicians.[35] Nevertheless, in an era of increasing emphasis on chronic disease management as a strategy to control healthcare costs, our findings underscore the significance of DM and emphasize the need for therapies for such population to improve outcomes and overall prognosis. The mechanism behind the association of DM and adverse clinical outcomes has been hypothesized in several ways. These include a high burden of ischaemic heart disease, other comorbid conditions associated with DM, drugs used in the management of DM, and a direct metabolic effect of altered glucose regulation.

Conclusion

Current study underscores that patients with MI and DM significantly varied in clinico-laboratory characteristics as compared to those without DM. Our analysis indicated that MI patients with DM have higher risks of adverse outcomes than patients without DM. These findings necessitate the need for therapies which could improve prognosis in this high-risk population. Moreover, MI with DM requires intensive diagnostic procedures and aggressive treatment maneuvers including percutaneous and surgical revascularization. Clinicians must focus on preventive strategies, particularly the elimination of modifiable risk factors among patients with concurrent MI and DM.

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