

# Diabetes Mellitus and Acute ST Elevation Myocardial Infarction (STEMI)

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## ABSTRACT

**Aim:** To determine the prevalence of diabetes mellitus among patients suffering acute ST elevation myocardial infarction (STEMI) at tertiary care hospital, Gujranwala, Pakistan.

**Methods:** This was a cross-sectional study in which patients admitted with STEMI were categorized into two groups, one diabetics and other non-diabetics. Both groups were compared using Independent sample T test, Chi-square test, and binary logistic regression analysis. The p-values were taken statistically significant if < 0.05.

**Results:** Amongst 668 patients suffering acute STEMI, 29.5% were diabetic. Diabetic patients had significantly less age ( $p=0.047$ ), more BMI ( $p<0.01$ ), more baseline pulse rate ( $p=0.008$ ), and less serum sodium ( $p<0.01$ ) as compared to non-diabetic patients. Diabetic patients suffering acute STEMI had statistically significantly less history of smoking ( $p<0.01$ ), more death as outcome of hospitalization ( $p=0.045$ ), and less chance of resolution of elevated ST segment after streptokinase ( $p=0.004$ ) as compared to non-diabetic patients. The binary logistic regression explained 15.4% (Nagelkerke  $R^2$ ) of the variance in model and correctly classified 70.7% of cases. Younger age ( $p=0.01$ ), higher BMI ( $p=0.016$ ), more pulse rate ( $p=0.027$ ), lesser serum sodium level ( $p=0.005$ ), lack of smoking ( $p<0.01$ ), and less chance of resolution of elevated ST segment after streptokinase ( $p=0.003$ ) were significantly more among diabetic patients involved in acute STEMI as compared to non-diabetic patients.

**Conclusion:** A significant proportion of patients suffering acute STEMI were diabetics. Diabetic patients suffering acute STEMI were younger than non-diabetic patients. Those also had significantly higher BMI and pulse rate, and lower serum sodium level. History of smoking and resolution of elevated ST segment after streptokinase were significantly more among non-diabetic patients suffering acute STEMI.

**Keywords:** Acute STEMI, Diabetes mellitus, Statistical associations, SPSS

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## INTRODUCTION

Myocardial infarction (MI) is a major cause of mortality and morbidity among patients with diabetes mellitus<sup>1</sup>. Its annual incidence is 1.1-1.7% in USA<sup>2</sup>, while 6.44% in subcontinent<sup>3</sup>. It is categorized into ST segment elevation MI (STEMI) and non-STEMI (NSTEMI)<sup>4</sup>. STEMI occurs due to complete occlusion of major epicardial coronary vessel<sup>5</sup> and accounts for up to 40% of all acute coronary syndrome hospital admissions<sup>6</sup>. Diabetes mellitus increases the risk of coronary event, therefore it is seen in a large proportion of patients suffering acute STEMI. About 32-37% acute STEMI patients are diabetics<sup>7,8</sup>. Diabetes is associated with less resolution of elevated ST segment<sup>9</sup> and higher mortality following acute STEMI<sup>10</sup> as compared to non-diabetic patients. The differences in demographic features, risk factors, morbidity and mortality outcome of acute STEMI among diabetics and non-diabetic patients has been elaborated in detail in literature, however majority studies are from Western population. Local studies are scarce. Therefore, the objective of the present study was to determine the prevalence of diabetes mellitus among patients suffering acute ST elevation myocardial infarction (STEMI) at tertiary care hospital, Gujranwala, Pakistan. This study will also determine the significant associations of diabetes mellitus with different qualitative and quantitative factors in our population.

## MATERIAL AND METHODS

This was a cross-sectional analysis carried out at the Department of Cardiology, GMC Teaching hospital, Gujranwala from June 2017 to May 2018. The data of the patients admitted with STEMI was collected, and patients were categorized into two groups, one diabetics and other non-diabetics after inquiring about their history. Statistical analysis was performed using the Statistical Package for Social Science (SPSS), version 25. Age, BMI, door to needle time in minutes, time from onset of symptoms till arrival at hospital in minutes, systolic BP at presentation, diastolic BP at presentation, baseline pulse, serum sodium conc., serum potassium conc., and serum creatinine conc. were the quantitative variable, while gender, history of diabetes mellitus, history of smoking, hypertension, personal H/O IHD, History of IHD in female family member of age <45years, History of IHD in male family member of age <55years, cardiac wall involved by STEMI, obesity, outcome of hospitalization, ST segment settlement >50% at 1<sup>st</sup> post-admission day, and right ventricular involvement the qualitative variables. Independent sample T test<sup>11</sup> and Chi-square test for independence<sup>12</sup> were used for quantitative and qualitative variables respectively to determine their significant association with presence or absence of history of diabetes mellitus. Then, binary logistic regression analysis<sup>13</sup> was also performed. The p-values were taken statistically significant if < 0.05.

## RESULTS

Amongst 668 patients suffering acute STEMI, 29.5% were diabetic (Picture 1). Diabetic patients suffering acute STEMI had statistically significantly less age ( $52.34 \pm 11.51$  vs  $54.43 \pm$

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12.67, p=0.047), more BMI ( $27.97 \pm 4.49$  vs  $26.68 \pm 3.95$ , p<0.01), more baseline pulse rate ( $88.99 \pm 20.87$  vs  $84.72 \pm 18.07$ , p=0.008), and less serum sodium ( $135.72 \pm 6.79$  vs  $137.62 \pm 4.55$ , p<0.01) as compared to non-diabetic patients suffering acute STEMI (Table 1). Diabetic patients suffering acute STEMI had statistically significantly less history of smoking (p<0.01), more death as outcome of hospitalization (p=0.045), and less chance of resolution of elevated ST segment after streptokinase (p=0.004) as compared to non-diabetic patients suffering acute STEMI (Table 2).

A binary logistic regression analysis was performed to determine likelihood difference in various qualitative and quantitative factors in diabetic patients suffering acute STEMI

as compared to non-diabetic patients. The logistic regression model explained 15.4% (Nagelkerke  $R^2$ ) of the variance in diabetic patients suffering acute STEMI and correctly classified 70.7% of cases. Younger age (p=0.01), higher BMI (p=0.016), more pulse rate (p=0.027), lesser serum sodium level (p=0.005), lack of smoking (p<0.01), and less chance of resolution of elevated ST segment after streptokinase (p=0.003) were significantly more among diabetic patients involved in acute STEMI as compared to non-diabetic patients (Table 3).

Table 1: Associations of various quantitative variables with history of diabetes mellitus among patients suffering acute STEMI (n = 668) \*

Quantitative variables	ST elevation settled >50% at 1 <sup>st</sup> post-admission day		Mean difference	p-value
	Yes (mean + SD)	No (mean + SD)		
Age (years)	52.34 + 11.51	54.43 + 12.67	-2.09	0.047
BMI (Kg/m <sup>2</sup> )	27.97 + 4.49	26.68 + 3.95	1.29	0.000
Time till arrival (minutes) <sup>1</sup>	304.98 + 361.92	267.39 + 353.12	37.59	0.213
Door to needle time (minutes)	25.92 + 37.12	28.47 + 35.27	-2.54	0.403
Baseline pulse (per minute)	88.99 + 20.87	84.72 + 18.07	4.27	0.008
Baseline systolic BP (mmHg)	129.08 + 28.26	132.20 + 25.37	-3.11	0.163
Baseline diastolic BP (mmHg)	82.36 + 24.76	82.63 + 14.12	-0.28	0.855
Serum creatinine (mg/dl)	1.12 + 1.31	1.11 + 0.47	0.01	0.899
Serum Sodium (mEq/L)	135.72 + 6.79	137.62 + 4.55	-1.90	0.000
Serum Potassium (mEq/L)	3.72 + 0.75	3.82 + 0.60	-0.10	0.083

<sup>1</sup>Independent sample T-test was used; 1=Time from onset of symptoms till arrival at hospital (minutes)

Table 2: Associations of various qualitative variables with history of diabetes mellitus among patients suffering acute STEMI (n = 668) \*

Predictors / Factors	History of Diabetes mellitus		Total	P value
	Yes	No		
Male	156 (79.2%)	359 (76.2%)	515 (77.1%)	0.421
Female	41 (20.8%)	112 (23.8%)	153 (22.9%)	
<b>History of smoking:</b>				0.000
Yes	73 (37.1%)	289 (61.4%)	362 (54.2%)	
No	124 (62.9%)	182 (38.6%)	306 (45.8%)	
<b>History of hypertension:</b>				0.051
Yes	118 (59.9%)	243 (51.6%)	361 (54.0%)	
No	79 (40.1%)	228 (48.4%)	307 (46.0%)	
<b>Personal history of IHD:</b>				0.160
Yes	49 (24.9%)	144 (30.6%)	193 (28.9%)	
No	148 (75.1%)	327 (69.4%)	475 (71.1%)	
<b>History of IHD in male family member of age &lt;55years:</b>				0.195
Yes	29 (14.7%)	52 (11.0%)	81 (12.1%)	
No	168 (85.3%)	419 (89.0%)	587 (87.9%)	
<b>History of IHD in female family member of age &lt;45years:</b>				0.795
Yes	25 (12.7%)	56 (11.9%)	81 (12.1%)	
No	172 (87.3%)	415 (88.1%)	587 (87.9%)	
<b>Obesity:</b>				0.130
Yes	53 (26.9%)	100 (21.2%)	153 (22.9%)	
No	144 (73.1%)	371 (78.8%)	515 (77.1%)	
<b>Cardiac wall involved by STEMI:</b>				0.394
Inferior wall	81 (41.1%)	211 (44.8%)	292 (43.7%)	
Other walls	116 (58.9%)	260 (55.2%)	376 (56.3%)	
<b>Right ventricular involvement:</b>				0.208
Yes	20 (10.2%)	33 (7.0%)	53 (7.9%)	
No	177 (89.8%)	438 (93.0%)	615 (92.1%)	
<b>&gt;50% resolution of elevated ST segment after Streptokinase:</b>				0.004
Yes	141 (71.6%)	386 (82.0%)	527 (78.9%)	
No	56 (28.4%)	85 (18.0%)	141 (21.1%)	
<b>Outcome of hospitalization:</b>				0.045
Death	12 (6.1%)	13 (2.8%)	25 (3.7%)	
No death	185 (93.9%)	458 (97.2%)	643 (96.3%)	

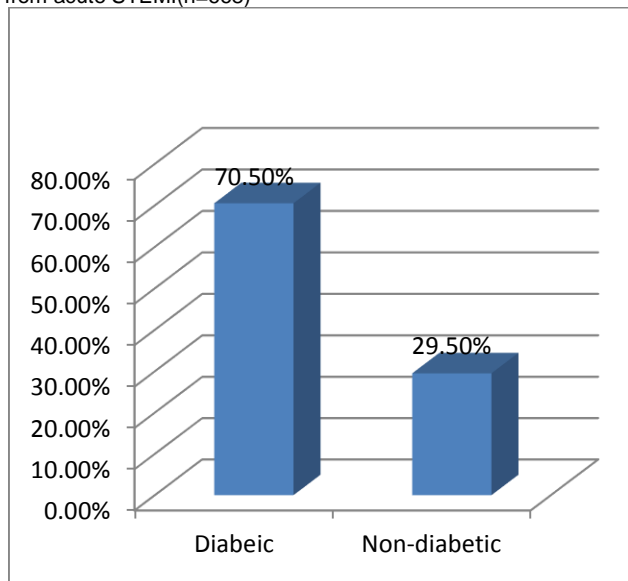
Chi-square test for independence was used

Table 3: Binary Logistic Regression Analysis to predict association of various factors with history of diabetes mellitus among patients suffering acute STEMI (n = 668)

Risk Factors	B	S.E.	Wald-Statistic	p-value	Odds Ratio	95% C.I. for EXP(B)	
						Lower	Upper
Age (years)	0.020	0.008	6.655	0.010	1.020	1.005	1.035
Gender (Male/Female)	0.209	0.220	0.900	0.343	1.232	0.800	1.897
BMI (Kg/m <sup>2</sup> )	-0.055	0.023	5.777	0.016	0.947	0.906	0.990
Pulse (per minute)	-0.011	0.005	4.912	0.027	0.989	0.980	0.999
Serum Sodium (mEq/L)	0.049	0.017	8.056	0.005	1.050	1.015	1.086
History of Smoking (Yes/No)	-0.977	0.186	27.460	0.000	0.377	0.261	0.543
Hypertension (Yes/No)	0.082	0.198	0.173	0.678	1.086	0.737	1.599
>50% resolution of elevated ST segment after Streptokinase (Yes/No)	-0.674	0.228	8.712	0.003	0.510	0.326	0.797
Outcome of hospitalization (Death/No death)	-0.217	0.484	0.201	0.654	0.805	0.312	2.079
Constant	-3.841	2.530	2.305	0.129	0.021		

Cox & Snell R Square = 10.8%, Nagelkerke R Square = 15.4%, Percentage correct =70.7%

Fig.1: Prevalence of diabetes mellitus among patients suffering from acute STEMI(n=668)



**DISCUSSION**

Diabetes mellitus is seen in a considerable proportion of patients suffering acute STEMI. In our study, 29.5% patients with acute STEMI have diabetes mellitus. In a study about acute coronary syndrome at 17 hospitals in different regions of Thailand<sup>8</sup>, 37.15% patients had diabetes mellitus. Similarly, Javed Iqbal et al<sup>7</sup> found 32% diabetics among acute STEMI suffering patients. In 2004, Kristen Franklin and colleagues<sup>14</sup> concluded that approximately 1 in 4 patients who presented to hospital with acute coronary event were diabetics. Patients with diabetes were older, and more often belong to female gender. Mir Milad Pourmousavi et al<sup>15</sup> also found in their study that mean age of diabetics suffering acute STEMI was significantly higher than non-diabetics suffering acute STEMI (61.68±12.2 vs 58.44±12.9, p=0.03). However, in our study both age and gender association with presence of diabetes among acute STEMI patients was reverse in comparison to that seen in above Western population studies. In our study, among acute STEMI patients, 20.8% were female among diabetics suffering acute STEMI while 23.8% were female among non-diabetics suffering acute STEMI, however gender association with diabetes mellitus was insignificant (p=0.421). In our data, diabetic patients suffering acute STEMI were younger than non-diabetic patients (52.34±11.51 vs

54.43±2.67, p=0.047). Larger studies are required to validate the importance of these findings. Marina Gradišer and colleagues<sup>16</sup> studied 266 patients and concluded that early arrivals had a lower chance of lethal outcome (p = 0.023). They also told that there was no significant difference in the arrival time after symptom onset between diabetic and non-diabetic patients (p = 0.105). Similarly, in our study, there was insignificant difference of time from onset of chest symptoms till arrival at hospital between diabetics and non-diabetic patients (304.98±361.92 minutes vs 267.39 ± 353.12 minutes, p=0.213). Early resolution of elevated ST-segment is associated with better outcome following acute STEMI<sup>17,18</sup> Michael N. Zairis et al<sup>9</sup> proved that time required for resolution of ≥50% elevated ST-segment was significantly more in diabetic patients than in nondiabetic patients (P < 0.001). Muhammad Ali Khan et al<sup>19</sup> studied diabetic and non-diabetic patients who were treated with thrombolytic therapy after acute MI. In diabetics group, ST segment resolution occurred in 13.8% (13 out of 94) patients and in non diabetic group, in 84% (74 out of 88) patients. Similarly in our study, ST resolution after thrombolysis was seen significantly in greater number of non-diabetic patients as compared to diabetic ones (82% vs 71.6%, p=0.004). Keun-Ho Park and colleagues<sup>20</sup> concluded that DM was an independent predictor of mortality after reperfusion treatment in patients suffering acute MI. Similarly, Kenneth J. Mukamal and colleagues<sup>21</sup> found that diabetes was associated with evidently increased mortality after acute MI. On the other hand, Saad M Ammar et al<sup>22</sup> found no significant difference in mortality (P=0.307) between diabetics and non-diabetics after MI. Tahir Soomro, Abdul Ghaffar Memon, and Shahid Memon from Hyderabad, Pakistan,<sup>23</sup> noted higher short-term mortality after acute MI in diabetic patients. Sean M. Donahoe et al<sup>10</sup> noted significantly higher mortality at 30 days among STEMI suffering patients with diabetes than without diabetes (8.5% vs 5.4%, P < .001). Similar findings were noted in our data (6.1% vs 2.8%, p=0.045). Hence, early resolution and relatively better outcome are the benefits to non-diabetic patients suffering acute STEMI as compared to diabetic patients. In addition, diabetes may be responsible of acute STEMI at younger age as suggested by multiple studies including our one. Adequate control of diabetes and prevention of other factors like high BMI, smoking etc may decrease the risk of acute STEMI among diabetics.

**CONCLUSION**

A significant proportion of patients suffering acute STEMI were diabetics. Diabetic patients suffering acute STEMI were younger than non-diabetic patients. Those also had

significantly higher BMI and pulse rate, and lower serum sodium level. History of smoking and resolution of elevated ST segment after streptokinase were significantly more among non-diabetic patients suffering acute STEMI. Diabetes mellitus may have a role in occurrence of acute STEMI at relatively younger age and lack of resolution of elevated ST segment after streptokinase.

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