



## **In Hospital Frequency of Heart Failure in STEMI after Thrombolysis in Patient with Diabetes**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors AM, NR and SK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors RK, Shahzad and JA managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Objective:** To determine the frequency of heart failure after thrombolysis in STEMI patients with diabetes mellitus.

**Methodology:** Through a prospective study we have enrolled all the diabetic patients who presented with acute ST-Segment Elevation Myocardial Infarction (STEMI) having age more than 35 years and less than 70 years who underwent pharmacological revascularization both males and females were included in this study. Patients with previous history of revascularization, end stage kidney, liver or heart disease, known advanced valvular heart disease, pregnant women, and those who develop serious complication related to streptokinase were excluded from our study. Echocardiography was done immediately after thrombolysis then after 3 days and then before

discharge of the patients to determine the frequency of heart failure. Baseline and clinical data were entered and analysed using SPSS and a chi square test and p-value  $\leq 0.05$  was considered as significant.

**Results:** A total of 175 patients were finally analysed and most of them were males as compared to females, 63.42% (N = 111) vs. 36.57% (N = 64), respectively. Mean age and SD of the patients was  $55.90 \pm 10.49$  years and mean duration of DM was  $12.95 \pm 8.40$  years. The overall frequency of heart failure in patients with post-STEMI was 56% (N = 98) and their mean ejection fraction was  $38.46 \pm 8.20\%$ . Frequency of heart failure in diabetic post-STEMI thrombolysed patients was significantly observed higher with increased age, increased duration of diabetes mellitus, hypertension, and smoking ( $p \leq 0.05$ ).

**Conclusion:** High prevalence of heart failure was observed in diabetic patients admitted with acute STEMI and underwent thrombolysis. The burden is even higher in males having age more than 55 years.

**Keywords:** Diabetes mellitus; heart failure; thrombolysis; STEMI.

## ABBREVIATIONS

STEMI	: ST-Segment Elevation Myocardial Infarction
SD	: Standard Deviation
DM	: Diabetes Mellitus
HF	: Heart Failure
IDF	: International Diabetes Federation
FAST-MI	: French registry of Acute ST elevation or non-ST-elevation Myocardial Infarction
WHO	: World Health Organization
mmHg	: Millimeter of Mercury
SPSS	: Statistical Package for the Social Sciences
EF	: Ejection Fraction
RBS	: Random Blood Sugar
CABG	: Coronary Artery Bypass Grafting

## 1. INTRODUCTION

ST-Segment Elevation Myocardial Infarction (STEMI) is one of the most common causes of hospitalization in cardiology emergency and is related to high rates of mortality even in the presence of advanced facilities. In Pakistan there is lack of epidemiological data in respect to acute myocardial infarction but data from USA has shown approximately 1.5 million people suffered from acute myocardial infarction in a year and the proportion STEMI is on constant rise [1]. Type 2 Diabetes mellitus (T2DM) is a metabolic disease affecting more than 34 million people in America means every 1 person is affected out of 10. Based on the recent statistics by the International Diabetes Federation (IDF) Pakistan was ranked 10<sup>th</sup> among the 221 countries of the world and the distributive prevalence of diabetes mellitus was 11.20% in males and 9.19% in females [2].

Association of T2DM and occurrence of myocardial infarction is well established. Patients with T2DM are more susceptible to developed acute STEMI and associated complications as compared to without T2DM [3]. In a study conducted by Boonsom W and colleagues has shown that incidence of adverse events in patients with STEMI and T2DM is higher as compared to STEMI in the absence of T2DM [4]. The findings from the French registry of Acute ST elevation or non-ST-elevation Myocardial Infarction (FAST-MI) have named it a deadly combination and have shown more than triple the rates of mortality among diabetics and compared to non-diabetics (25.5% vs. 10.4%) from heart failure following acute MI [5].

The burden of heart failure in diabetic patients admitted with STEMI in Pakistan has not been studied yet although few international studies have shown high rate of heart failure in diabetic patients admitted with STEMI. The present study is design to assess actual burden of heart failure in such cases so then policy could be design to increase the awareness for diabetes control and also prevent associated complications with proper management under multidisciplinary team based approach of diabetologist and cardiologist.

## 2. METHODOLOGY

This cross sectional prospective study was conducted at adult cardiology ward, National institute of cardiovascular diseases, Karachi from December 2013 to June 2014 using non probability consecutive sampling. Sample size was calculated using WHO software for sample size calculation. Total 175 patients of either gender with age 35 to 70 years who were diagnosed case of diabetes on insulin for

treatment for more than 6 month having uncontrolled and non-compliant to treatment were included in the study after getting informed consent from the patient and approval from the ethical committee of the hospital. Among study subjects if patient had blood pressure 140/90 mmHg, uncontrolled on medication, and non-compliant with treatment for more than 6 month then it will be labeled as hypertensive patient. If patient smokes 10 cigarettes per day since more than two years then the patients was labeled as smoker. Recruited patients had complaint of chest pain, consistent with acute myocardial infarction. STEMI was confirmed on ST elevation of 1mm or more in two or more contiguous lead. In lead V<sub>1</sub> V<sub>2</sub> 2mm of ST elevation in men and 1.5mm in women. Patients with STEMI were undergone Thrombolysis with streptokinase only. Just after the thrombolysis, 3 days post thrombolysis and before patient getting discharge an echocardiogram was performed to assess the ejection fraction, if found ≤40% then it will be labeled as heart failure.

The data was compiled and analyzed using statistical package of social sciences (SPSS). Frequency and percentage were calculated for qualitative variable i.e. gender, diabetes, smoking, hypertension, echocardiography finding, type of infarction, frequency of heart failure (EF<40%) after thrombolysis. Means ± SD were calculated for quantitative variables i.e. age, duration of DM, RBS at presentation, and ejection fraction. Stratification was done to see the association of modifiers with heart failure by

applying chi square test. P-value≤0.05 was considered as significant.

### 3. RESULTS

Among total study subjects of 175, 111(63.4%) were males and 64 (36.6%) were females. The mean age of the study subjects was 55.90±10.49 years, with range of 35 (35-70) years, majority of the patients had age ≤55 years (N = 90, 51.42%) while 48.57% (N = 85) belongs to age group of >55 years. It was found that 57.7% patients were hypertensive and 49.1% patients were smokers (Table 1). The mean random blood sugar (RBS) at presentation was 281.19±59.37 mg/dl ranging from 140 - 450 mg/dL.

The echocardiographic findings showed that anterior MI was observed in 41(23.42%) patients, inferior MI was observed in 45 (25.71%) patients, lateral MI was observed in 24 (13.74%) patients, posterior MI was observed in 32 (18.28%) patients, and left bundle branch block was observed in 33 (18.85%) patients (Graph 1).

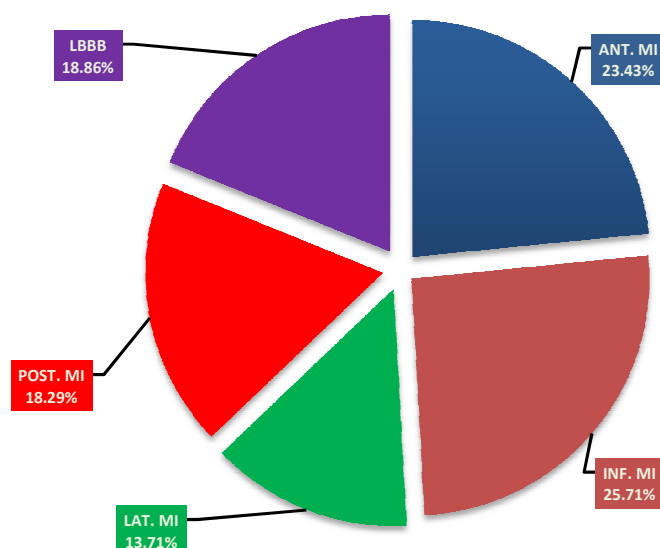
The mean ejection fraction was 38.46±8.20%, with range 30 (20%-50%). The EF between 20%-30% was observed in 20.6% patients, EF between 31%-40% was observed in 36.0% patients, and EF between 41%-50% was observed in 43.4% patients. The descriptive statistics of ejection fraction according to heart failure status was also calculated. The frequency of heart failure was observed according to cutoff value of ejection fraction i.e. EF≤40% (Table 2).

**Table 1. Frequency distribution of gender and comorbids (N = 175)**

		n	%
<b>Gender</b>	<b>Male</b>	111	63.4%
	<b>Female</b>	64	36.6%
<b>Hypertension</b>	<b>Yes</b>	101	57.7%
	<b>No</b>	74	42.3%
<b>Smoking</b>	<b>Yes</b>	86	49.1%
	<b>No</b>	89	50.9%
<b>Positive Family History</b>	<b>Yes</b>	38	21.71%
	<b>No</b>	137	78.28%

**Table 2. Descriptive statistics of ejection fraction (N = 175)**

	n(%)	EF (Mean±SD)	EF (Range)
<b>Heart failure</b>			
Yes	98 (56.0%)	32.12±4.78	20
No	77 (44.0%)	46.52±2.69	15
EF (overall)		38.46±8.20	30
EF (20% - 30%)	36 (20.6%)	26.61±3.37	10
EF (31% - 40%)	63 (36.0%)	35.32±1.22	5
EF (41% - 50%)	76 (43.4%)	46.67±2.35	5



Graph 1. Percentages of echocardiographic findings (N = 175)

Table 3. Frequency distribution of clinical presentations according to gestational and postpartum period (N = 175)

		Heart failure		P value
		Yes (n=98)	No (n=77)	
Gender	Male (n=111)	61	50	0.714**
	Female (n=64)	37	27	
Side Involved In MI	Anterior MI (n=41)	30	11	0.061**
	Inferior MI (n=45)	27	18	
	Lateral MI (n=24)	11	13	
	Posterior MI (n=32)	14	18	
	LBBB (n=33)	16	17	
Age (years)	≤ 55 (n=90)	21	69	0.000*
	> 55 (n=85)	77	8	
Duration of Diabetes Mellitus (years)	≤ 12 (n=106)	35	71	0.000*
	> 12 (n=54)	63	6	
Duration of Hypertension (years)	≤ 15 (n=47)	31	23	0.000*
	> 15 (n=64)	45	2	
Duration of Smoking (years)	≤ 19 (n=111)	11	26	0.000*
	> 19 (n=64)	45	4	

\* Significant at 0.01 level; \*\*Significant at 0.05 level

The stratification was done on gender, age, duration of diabetes mellitus, duration of hypertension, duration of smoking, and sides involved to see the association of these with functional outcome i.e. heart failure. The results

showed among 98 patients who were observed heart failure, 61 were male and 37 were female. Anterior wall was mostly affected followed by inferior wall. Most of the patients were aged more than 55 years. Most of the patients had duration

of comorbidities >12 years, >15 years and >19 years for diabetes, hypertension, and smoking respectively. No significant association of heart failure was observed with gender and myocardial walls involved ( $p > 0.05$ ). A significant association of heart failure was observed with age and duration of comorbidities ( $p \leq 0.05$ ) (Table 3).

#### 4. DISCUSSION

Acute ST-Segment Elevation Myocardial Infarction (STEMI) is one of the most common cardiovascular emergencies should be dealt in time to prevent from associated complications and also increased chances of death, if left untreated. The burden of this disease is increased the double when patient is having underlying diabetes mellitus along with its complications such as heart failure. The definite treatment of acute STEMI is to reperfuse the culprit vessel and save the myocardial ischemia to expand and leads the patients to complication including heart failure and even death and this is even the worse when patient do not receive thrombolytic therapy. In a previously conducted prospective clinical study authors have observed that rate of heart failure reduced from 40% to 17% post-thrombolytic STEMI patients [6]. While in our study, the rate of heart failure is quite high and reaches up to 56% even after they have received the thrombolytic therapy. Multiple reasons can define this diversity in the prevalence such as time taken by the patients presenting to hospital and get thrombolysed because early the thrombolysis performed reduce the chances of having heart failure, increased age is also associated with high prevalence of having heart failure, uncontrolled diabetes mellitus/hypertension, chronic/acute kidney disease, and territory of ischemia leading to STEMI also a predictor of heart failure in patients with STEMI and type 2 diabetes mellitus. Patients with anterior wall myocardial infarction are more likely to experience heart failure as compared to other territory involved [7,8].

In our study the mean age of heart failure in diabetic STEMI patients was 55.90 years which is consistent with the study conducted by Iqbal MJ and colleagues in Pakistan [9]. but there is a difference in other regions of the world like in developed countries the mean age is comparatively higher than 75 years but the overall incidence of heart failure is declined in these countries over the past 2 decades [10]. this is possibly due to advance facilities available in those countries with proper healthcare

management while in our region including other developing countries lack of proper healthcare facilities and along with awareness regarding the disease is reducing the overall life expectancy [11].

Findings from our study have shown that patients with diabetes mellitus are more likely to have recurrent episodes of ischemia and also heart failure. A study conducted by Nesto and colleagues [12] have also observed that patients with DM and admitted with STEMI are more likely to have recurrent ischemia and admissions due to heart failure along with also higher mortality rates and are more likely to have multivessel disease and candidates of coronary artery bypass grafting (CABG). These findings are also consistent with the studies conducted by Kapur A [13] and Park KH [14]. A multicenter trial has been conducted in patients with STEMI in which a total of 1335 patients were included among them the ratio of diabetics and non-diabetics were almost the same, 142 and 136, respectively. The overall rates of mortality and heart failure were most commonly seen in patients with diabetes mellitus as compared to non-diabetics 19.5% vs 14.3% [15].

#### 5. CONCLUSION

In our study a quite high prevalence of heart failure observed in diabetic patients admitted with acute STEMI and underwent thrombolysis. The burden is even higher in males having age more than 55 years of age.

#### CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

#### ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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