Original Article

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A Comparative Study of ST Segment Resolution between Diabetic and Non-Diabetic ST Segment Elevation Myocardial Infarction Patients following Streptokinase Thrombolysis

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Ischaemic heart disease, Myocardial Infarction, Diabetes mellitus, Thrombolysis.

Abstract

Background: *One of the most effective and used (in our settings) methods of reperfusion of ST elevation myocardial infarction (STEMI) is administration of streptokinase (SK) infusion. This study was conducted with the aim to compare ST segment resolution between diabetic and non-diabetic patients with ST segment elevation myocardial infarction after thrombolysis by streptokinase.*

Methods: *A total of 100 patients with ST elevation myocardial infarction with or without diabetes mellitus were studied from December 2016 to November 2017. Among these half of patients were diabetic while rests were non-diabetic. Streptokinase was administered to all patients. Resolution (reduction) of elevated ST segment was evaluated after 90 min of streptokinase administration.*

Results: *Failed reperfusion (<30% ST resolution) was significantly higher in diabetic as compared to non-diabetic patients (42% vs. 12%, p <0.001). In hospital complications were more in diabetic patients who has failed reperfusion following streptokinase thrombolysis. Cardiogenic shock occurred in 44% and acute LVF in 30% patients and EF (46.54%) was significantly lower in diabetic patients and higher number of diabetic patients had prolong hospital stay than non-diabetic patients with STEMI.*

Conclusion: *The outcome of thrombolytic therapy is adversely affected by diabetes mellitus in patients with ST-elevation myocardial infarction.*

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Introduction:

Coronary artery disease (CAD) is the term used to describe coronary arteries that are affected by a pathological process which is the end result of the accumulation of atheromatous plaques within the walls of the coronary arteries that supply the myocardium.[1] CAD has become the a major health problem and is the most common cause of mortality & morbidity in all over the world.[2] Among the coronary artery disease, acute coronary syndrome (STEMI, Non-STEMI, UA) is the leading cause of death in developed countries & second leading cause of death in developing countries; and by the year 2020 IHD will hold first place in the WHOs list of leading cause of disability.[3] CADs are also becoming significant burden on healthcare service in Bangladesh. The prevalence of IHD according to 3 small scale population based studies in Bangladesh was 6.56/1000.[4,5] Acute myocardial infarction is the leading cause of death in Bangladesh in the fourth decade of life and even in the younger individuals pointing to the serious health hazard as well economic burden.[6,7]

Acute coronary syndrome is a multifactorial disease, involves well-known risk factors such as age, male, sex, smoking, hypertension, diabetes mellitus, dyslipidemia, obesity, family history of premature CAD & sedentary lifestyle. Atherosclerosis with superimposed thrombosis

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is by far the most frequent underlying cause.[8] Among the risk factors DM is a very strong risk factor for the development of CAD.[9] Diabetes, it probably directly influences atherosclerosis development, progression and instability.

CAD and diabetes has strong association and has lead to screening strategies in diabetic patients even before they are symptomatic. Diabetic patient often are unaware of myocardial ischemic pain, and thus, silent MI and ischemia are markedly increased. There is a heightened concern for the development of sudden cardiac death in those with diabetes.[10]

The patients with an acute myocardial infarction, 10-25% have DM and mortality after acute MI in patients with diabetes is about twice that of non-diabetic patients.[10] Early recanalization of the infarct related artery is the main therapeutic goal either by thrombolysis or PCI following acute ST elevation MI. After acute STEMI, treated with fibrinolytic therapy can be evaluated either by coronary angiographic measurement of TIMI blood flow or by measurement of ST segment resolution at 90 minute after Streptokinase infusion, in 12 lead ECG.[11] Although successful recanalization of the epicardial vessel is a necessary condition, it is the micro-vascular flow that most strongly correlated with outcome. ST segment changes reflect myocardial rather than epicardial flow and hence yield prognostic information beyond that provided by coronary angiogram alone.[12] The purpose of the study is to compare ST segment resolution between diabetic and non-diabetic patients with STEMI after thrombolysis by streptokinase.

Methods

This descriptive cross sectional study was conducted in the Department of Cardiology, Mymensingh medical college hospital Bangladesh, from December 2016 to November 2017 by using purposive consecutive sampling technique. Total 100 patients admitted with ST-Segment elevation MI within 12 hours of onset of chest pain, with or without diabetes mellitus were studied. STEMI was diagnosed by typical chest pain (symptoms of ischemia), elevated cardiac bio-marker troponin-I and electrocardiogram (ECG) changes. STEMI was confirmed using following ECG changes-

ST elevation MI in the absence of left bundle-branch block (LBBB) was diagnosed-

New ST elevation at the J point in at least 2 contiguous leads of >2 mm (0.2mV) men or ≥1.5 mm (0.15mV) in women in leads V2-V3 and/or of ≥1 mm (0.1 mV) in other contiguous chest leads or limb leads. Diabetes mellitus was diagnosed by the history of previous DM, patients taking oral or injectable hypoglycemic agents, or fasting plasma glucose ≥7.0 mmol/L (126 mg/dL) or 2-hours plasma glucose ≥11.1 mmol/L (200 mg/dL) during standardized 75-g oral glucose tolerance test or HbA1c ≥6.5% or symptoms of hyperglycemia plus nonfasting plasma glucose ≥11.1 mmol/L (200 mg/dL).[13]

Patients having LBBB on admission ECG, H/O PCI, CABG or receiving oral anticoagulant drugs and late presentation more than 12 hours of onset of chest pain were excluded from the study. Streptokinase was given to each patient at a dose of 1.5 million units, diluted in 100 ml of normal saline in 1 hour. 12 lead E.C.G was recorded immediately before the start of thrombolytic therapy and at 90 minutes there after. From admission ECG ST-segment elevation measurement was done manually by hand held calipers and magnifying glass, measuring voltage difference between the value at a point 60 ms after J point & iso-electric baseline (TP segment) in the single lead with maximal ST-segment elevation. The ST segment resolution was calculated as the initial sum of ST segment elevation (on pre-treatment ECG) minus the sum of ST segment elevation on the second ECG (90 minute after Streptokinase infusion) divided by the initial sum of ST segment elevation and expressed as percentages. The resolution of ST segment elevation into 3 categories - a) Complete ST resolution (≥70% reduction of ST elevation), b) Partial ST resolution (<70% to 30% reduction of ST elevation), c) Failed ST resolution (<30% reduction of ST elevation).

Fasting blood sugar was recorded from all patients in the morning of the day following hospital admission for differentiation of new cases of diabetes, stress hyperglycemia and non-diabetic. The hospital ethical committee approved the study protocol and informed consent was taken from all participants. All data

were recorded on a proforma. Confounding variables mentioned in the exclusion criteria were controlled. Bias in the study was controlled by following strict inclusion criteria for patient selection, use of same brand of Streptokinase for all patients, measurable operational definitions for assessing success or failure of thrombolytic therapy and LVEF and in-hospital complications between diabetic and non-diabetic STEMI patients who had failed or successful thrombolysis.

Data analysis was performed using SPSS version 20. Numerical variables were presented as mean +SD. Categorical variables were expressed as frequency and percentage. Comparison between two groups was performed by using student's t-test for numerical variables and chi-square test for categorical variables. p- value < 0.05 was considered statistically significant. Results were presented by tables.

Results:

Patient characteristics: Among 100 patients with STEMI, half of patients were diabetic group-A (n=50) while rest (n=100) were non-diabetic group-B. Hypertension and dyslipidemia, and family history of premature CAD was more in diabetic patients as compared to non-diabetic STEMI patients. Thrombolytic outcome: failed thrombolysis (<30% ST resolution) was significantly higher in diabetic as compared to non-diabetic STEMI patients, 42% vs. 12%, (p=0.001), on the other hand successful thrombolysis (>70% ST resolution) was significantly higher in non-diabetic than diabetic STEMI patients, 52% vs. 28% (p=0.001).

Partial thrombolysis was also higher in non-diabetics as compared to diabetic STEMI patients, however did not reach statistical significance 36% vs. 30% (p=0.163). These were presented in table-I. Among the in-hospital complications between diabetic and non-diabetic STEMI patients who received Streptokinase–carcinogenic shock and prolong hospital stay was significantly higher in diabetic STEMI patients and diabetic STEMI patients had significantly less LVEF as compared to non-diabetic STEMI patients (46.54% vs. 51.64%, p=0.008). Complications rates were more in diabetic STEMI patients who had failed ST-Segment resolution.

Table-I

Comparison of ST segment resolution between group-A (STEMI with DM) and group-B (STEMI without DM) patients after Streptokinase infusion (N=100).

ST segment resolution	STEMI with DM (n=50)		STEMI without DM (n=50)		p value
	No	%	No	%	
≥70% (Complete)	14	28.0	26	52.0	0.001
<70%- 30% (Partial)	15	30.0	18	36.0	0.163^{NS}
<30% (Failed)	21	42.0	6	12.0	0.001

NS means not-significant (p>0.05)

Table-II

Left ventricular ejection fraction in study subjects (N=100).

LVEF	STEMI with DM (n=50)		STEMI without DM (n=50)		p value
	Count	%	Count	%	
<25	1	2	0	0	0.008 **
26-40	11	22	5	10	
41-49	16	32	14	28	
≥50	22	44	31	62	
Mean±SD	46.54±10.17		51.64±8.48		

** means significant at 1% level (p<0.01)

Table-III

In-Hospital complications between Group-A (STEMI with DM) and Group-B (STEMI with out DM) patients who received streptokinase infusion.

	STEMI with DM (n=50)		STEMI without DM (n=50)		p value
	Count	%	Count	%	
ALVF	15	30	14	28	0.826 NS
Cardiogenic shock	22	44	12	24	0.005
Arrhythmia	7	14	6	12	0.766^{NS}
Prolong Hospital Stay	30	60	20	40	0.006

NS means not-significant (p>0.05)

Discussion:

The main goal of STEMI management is rapid reperfusion to establish coronary blood flow to ischemic myocardium. Currently there are three main reperfusion strategies: thrombolytic therapy, primary PCI and fibrinolytic- facilitated primary PCI.[13] Thrombolytic therapy recanalizes the thrombotic occlusion associated with STEMI, and restoration of coronary flow reduces infarct size and improves myocardial function and survival over both the short and long term.[14] Thrombolytic therapy is most effective when given within 3 hours from onset of chest pain.[15] Dramatic reduction in mortality can be achieved if treatment is obtained during the "golden" first hour.[16]

Even when promptly receiving thrombolytics, outcome in diabetics is still worse than non-diabetics, manifesting impaired post-thrombolysis, left ventricular function and prognosis. The outcome of acute myocardial infarction treated with fibrinolytic therapy can be evaluated by measurement of ST-Segment resolution at 90 minutes after Streptokinase infusion, in 12 lead ECG.[17] In this study the mean age of group-A was 59.44+9.95 years and group-B was 54.52+11.95 years. Shah et al. found that 57.19+9.95 years in diabetic and 56.42+10.30 in non-diabetic STEMI patients.[18] Most of the study subjects were male which was 58% and 88% in group-A and group-B respectively and female was 42% and 12% in group-A and group-B respectively.

Among the risk factors for CAD, diabetes is a major contributor, not only to the development of CAD but also to outcome following various manifestation of disease.[19] In our study we observed that, 52% of non-diabetic myocardial infarction patient showed complete resolution, 36% had partial resolution and 12% showed failed resolution. But in cases of diabetics STEMI, 28% of patients showed complete resolution, 30% partial resolution and 42% failed resolution.

This significant change in ST resolution between diabetic and non-diabetic group was similar with the study done by Shah et al. They showed significant difference between diabetic and non diabetic patient in relation to complete (19.0% vs. 50.4%; p<0.001) and failed (68.4% vs. 18.2%; p <0.001) resolution.[18] Several studies have reported similar angiographic or ECG success in both diabetic and non-diabetic STEMI subjects while others have revealed that diabetics have less complete resolution of ST elevation than non diabetics.[3,10,17,20] Our results were consistent with a published meta analysis in which it was shown that type-2 diabetes with STEMI subjects had less ST-Segment resolution after intravenous thrombolytics administration compared to non-diabetic STEMI subjects.

Among the in-hospital complications between two groups cardiogenic shock was significantly higher in diabetic patients with STEMI than those of non-diabetic patients with STEMI. Let ventricular ejection fraction (LVEF) was significantly lower in diabetic STEMI patients in comparison to non-diabetic STEMI patients (46.54 vs. 51.64; p=0.008). Most commonly noted arrhythmia was bradycardia with complete AV block, other noted arrhythmia was 2nd degree Mobitz type II AV block, 1st degree AV block and left and right bundle branch block and few

patients develop ventricular tachycardia. Hospital stay was significantly prolonged in diabetic patients with STEMI than non-diabetic patients with STEMI. Hospital stay was considered prolong >5 days in case of inferior MI and >7 days in anterior MI.

Conclusion:

In this study we found that diabetic patients had less ST segment resolution than non- diabetic patients with ST segment elevation myocardial infarction after thrombolysis by streptokinase.

Conflict of Interest - None.

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