

Original Article

Association of Risk Factors and Glycemic Status in Hospital Patients of Different Types of Myocardial Infarction in a Tertiary Care Hospital

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Abstract

Background: Glycometabolic state at hospital admission is an important risk marker for long-term mortality in patients with acute myocardial infarction. Our aim was to ascertain the associated risk factors and glycemic status in patients with different types of myocardial infarction, and to assess whether such abnormalities can be identified in the early course of myocardial infarction.

Methodology: This cross sectional observational study was carried out enrolling 100 subjects with ST elevation (42 subjects) and non ST elevation (58 subjects) myocardial infarction, in the Department of Cardiology, BIRDEM General Hospital, Shahbagh, Dhaka, over a period of six months from January 2012 to June 2012. We did fasting blood glucose and glycated haemoglobin A1C (HbA1C) level next day following admission with or without history of diabetes mellitus and observed the difference between two types of myocardial infarction (ST elevation and non ST elevation).

Results: Mean age and gender difference was significant between ST elevation and non ST elevation myocardial infarction. Significant differences in pre-existing risk factors such as Diabetes (95.2%, vs 86.2%), Dyslipidemia (72.91%, vs 44.82%), Hypertension (79.16%, vs 36.2%) and family history of Ischemic Heart Disease (75%, vs 29.31%) were observed between ST elevation and non ST elevation groups. It was revealed that mean fasting blood glucose (FBG) in ST elevation and non ST elevation was 10.23 mmol/l and 8.42 mmol/l respectively. Mean HbA_{1C} level was 9.2% and 8.9% in ST elevation and non ST elevation. Significant difference in fasting blood glucose and HbA_{1C} was observed between ST elevation and non ST elevation group.

Conclusion: Glycemic status is relatively more uncontrolled in ST elevated MI and must be managed with all possible therapeutic modules to minimize further complications.

Key Words: ST elevation myocardial infarction (STEMI), Non ST elevation myocardial infarction (NSTEMI), Acute coronary syndrome (ACS), Glycated haemoglobin A1C (HbA1C), Fasting blood sugar (FBS).

Introduction:

Diabetes mellitus (DM) is a major public health problem and is associated with poor outcomes in patients with coronary

artery disease.¹ A strong correlation between glycaemic status and shock or development of heart failure has also been reported.² Elevated blood glucose levels per se adversely affect outcome through the cumulative effects of several mechanisms, including induction of endothelial dysfunction, oxidative stress, hyper coagulability and impaired fibrinolysis.^{2,3}

Patients with diabetes have increased in-hospital mortality following acute myocardial infarction (AMI), with studies suggesting higher risk with both hypoglycemia and hyperglycemia.⁵ So, optimal control is needed for better outcome. In this study, we assessed whether there is any relation of glycemic status in ST elevation myocardial infarction (STEMI) and non ST elevation myocardial infarction (NSTEMI).

Methodology:

This prospective observational study was done in the Department of Cardiology, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) General Hospital, Shahbagh, Dhaka between January 2012 to June 2012. The primary objective was to compare risk factors and glycaemic status in hospital patient with ST Elevation versus Non ST Elevation Myocardial Infarction. Patients aged between 25-75 years,

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suffering from STEMI and non-STEMI who presented with chest discomfort, palpitation or shortness of breath with either ECG change (ST elevation/depression, T wave changes) or raised Troponin I were included. Patient with chronic stable angina, unstable angina, non-cardiac chest pain, congenital or valvular cases and shortness of breath other than ischemic heart disease were excluded from our study. Consecutive patients admitted patient to Coronary Care Unit (CCU) referred from emergency department or from in-patient department of the respective discipline with acute coronary syndrome who met the inclusion criteria, were enrolled in the study.

Clinical examination, Glycated haemoglobin A1C (HbA1C) and Fasting blood sugar (FBS) were done next day of admission and data collected. Demographic information was prospectively recorded including the subject's age, gender, medical and clinical history, clinical examination and follow up of clinical conditions during hospital stay were assessed and study was conducted. Convenience sample of 100 consecutive patient were taken due to time constrain.

Data were analyzed by using SPSS version 13. Comparison of mean between two groups were done by Student's t test. The level of significance was set at 0.5.

Results:

100 consecutive patients were included in the study, of which 42 had STEMI and 58 had NSTEMI. The mean age and age distribution of the STEMI and NSTEMI groups are given in Table I.

Table I: Age distribution of the study (n=100)

Age group (Years)	STEMI (n=42) n (%)	Non-STEMI (n=58) n (%)	p value
25-39	06 (6)	11 (11)	
40-49	08 (8)	14 (14)	
50-59	16 (16)	19 (19)	
60 and above	12 (12)	14 (14)	
Mean± SD	48.36±10.18	51.29±11.55	0.024
Age range	33-68		

In STEMI group, 14 patients (33%) were male and 28 (67%) were female. In non-STEMI group, 25 patients (43%) were male and 33(57%) were female (Fig-I).The male female ratio was 1:2 in the STEMI group and 1:1.3 in the NSTEMI group.

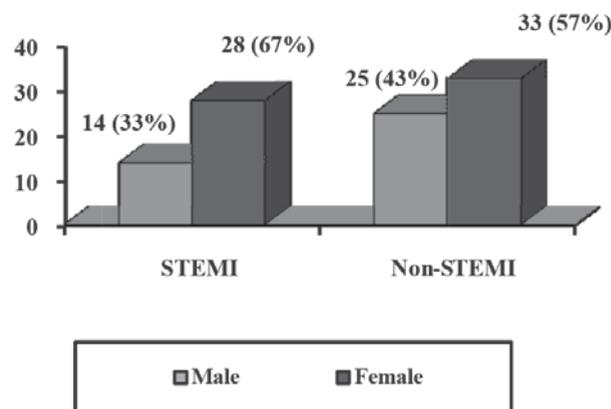


Figure 1: Bar diagram showing gender distribution of the study subjects

Significant differences in pre-existing risk factors were observed between STEMI and non-STEMI groups (Table-II). Glycemic status of the study patients is shown in Table-III.

Table II: Pre-existing risk factors of the study subjects (n=100)

Co-morbid conditions	STEMI (n=42) n (%)	Non-STEMI (n=58) n (%)	p value
Diabetes mellitus	40 (95.2)	50 (86.2)	0.001
Dyslipidemia	35 (72.91)	26 (44.82)	0.001
Hypertension	38 (79.16)	21 (36.2)	0.001
Family history of IHD	36 (75)	17 (29.31)	0.037
Smoking	24 (50)	13 (22.41)	0.042

The mean fasting blood glucose (FBG) in STEMI and non-STEMI groups were 10.23 mmol/l and 8.42 mmol/l respectively. Mean glycated haemoglobin A1C (HbA_{1c}) level were 9.2% and 8.9% in STEMI and non-STEMI groups. Significant difference in FBG and HbA_{1c}% was observed between STEMI and non-STEMI groups (Table 4).

Table III: Glycaemia status of the study subjects (n=100)

Glycaemic status	STEMI (n=42)	Non-STEMI (n=58)	p value
Mean FBG (mmol/l)	10.23	8.42	0.015
Mean Hb A _{1c} %	9.2	8.9	0.042

Discussion:

Myocardial infarction usually consists of ST elevation myocardial infarction and non ST elevation myocardial infarction.⁶ These types are named according to the appearance of the electrocardiogram (ECG) features, that is ST segment elevation myocardial infarction (STEMI). In non-

ST elevation myocardial infarction (NSTEMI) there are ST segment depression or T wave abnormalities.⁷

Diabetes and asymptomatic hyperglycemia increase the risk of future cardiovascular morbidity and mortality.^{8-10,12} Microvascular complications can be reduced by stabilizing glucose concentrations in patients with diabetes, but whether such action can also prevent macro vascular complications is unclear. Treatment with insulin reduced the frequency of cardiovascular events by 40% in the Diabetes Control and Complications Trial.¹⁴

It was observed that mean age of ST elevation and non ST elevation myocardial infarction groups were 48.36±10.18 and 51.29±11.55 years respectively with age range from 33 to 68 years. Majority of the respondents (STEMI vs Non-STEMI, 16% vs 19%) were found in the age group of 50-59. STEMI vs Non-STEMI subjects were found in 12% and 14% cases respectively above 60 years age group. Mean age difference was significant between STEMI and non-STEMI. Burazeri et al¹¹ found that mean age of the study subjects with STEMI was 59.1±8.7 years in their study. In STEMI group, male were 33% and 67% were female. In non-STEMI group, 43% subjects were male and 57% were female. There were significant differences in gender between two groups.

In present study, diabetes was present in 95.2% ST elevation and 86.2% non ST elevation myocardial infarction subjects. They (STEMI vs non-STEMI) also had dyslipidemia (72.91%, 44.82%), hypertension (79.16%, 36.2%) and family history of IHD (75%, 29.31%). Significant differences in pre-existing risk factors were observed between STEMI and non-STEMI groups. Burazeri et al¹¹ observed that family history of coronary heart disease, hypertension and current smoking were found to be a strong predictor of STEMI and non-STEMI and differences in diabetes, dyslipidemia, IHD and hypertension were observed between STEMI and non-STEMI groups.

The mean Fasting Blood Glucose in ST elevation and non ST elevation was 10.23 mmol/l and 8.42 mmol/l respectively. Mean HbA_{1c}% level was 9.2% and 8.9% in STEMI and non-STEMI. Significant difference in FBG and HbA_{1c}% were observed between STEMI and non-STEMI groups. Our findings indicate a high prevalence of impaired fasting glucose in patients with acute ST elevation myocardial infarction. Furthermore, elevated fasting glucose level is associated with worse outcome after a myocardial infarction.^{8,10} In previous studies,^{15,16} a high concentration of glucose at admission to hospital predicted long-term outlook in myocardial infarction, and that metabolic intervention improved outcome, at least in patients with overt diabetes. Patients with poorly controlled diabetes mellitus have the risk of developing macro vascular and micro vascular complications, but also have an increased risk of cardiovascular morbidity and mortality compared with patients with normal glucose tolerance. Early detection therefore, permit initiation of secondary preventive treatment measures in such patients. Patients admitted for myocardial infarction should be tested for glycemic status and other

conventional risk factors. Furthermore, trials should be done to identify whether or not the outlook of patients with uncontrolled blood sugar could be improved by implementation of dietary and exercise oriented programs along with long term use of drugs. According to the DIGAMI study, there was a substantial mortality reduction among patients with diabetes and myocardial infarction who were randomized treated by insulin and improved metabolic care.^{17,18} The relationship between elevated fasting glucose level and cardiogenic shock after STEMI has been reported before¹⁰ and our results showed that STEMI has significantly poor glycemic control than NSTEMI.

To the best of our knowledge there is no such study which compares the glycemic status in different types of myocardial infarction. Our results indicate that high-risk individuals can be identified during their hospital stay. Risk can, therefore, be identified by an HbA_{1c} value at admission, a single fasting blood glucose concentration. These are all quick, inexpensive tests, which are seldom done in coronary care units.

Conclusion:

Diabetes mellitus, Dyslipidemia, Hypertension, family history of IHD and smoking were most common risk factors of the study subjects with pre-existence risk factor being significantly different between STEMI and non-STEMI groups. There was a significant difference in FBG and HbA_{1c}% between the STEMI or NSTEMI groups. Since complications of STEMI are grave, tight control of glycemic status may improve long term outcome. Our study is limited by the absence of correlation of in hospital outcome with glycemic status and risk factors. Although sample size was calculated statistically, the original sample size was small in relation to huge number of population; as well as the study period was only six months. So large sample could not be included. Further studies are required to assess the relation between glycemic status and long term outcome in different type of MI.

References:

1. Wei C, Shyu K, Cheng J, Lo H, and Chiu C. Diabetes and Adverse Cardiovascular Outcomes in Patients with Acute Coronary Syndrome Data from Taiwan's Acute Coronary Syndrome Full Spectrum Data Registry. *Acta Cardiol Sin* 2016;32:3138.
2. Zeller M, Cottin Y, Brindisi MC, et al. Impaired glucose and cardiogenic shock in patients with acute myocardial infarction. *Eur Heart J* 2004; 355: 308-12.
3. Antman EM, Selwyn AP, Braunwald E, Loscalzo J. Ischemic Heart Disease. In Harrison's Principles of Internal Medicine. Editors: Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J. 18th edition. McGraw Hill. Vol 2. 1998-2035.
4. Dąbek J, Bałys M, Majewski M, Gąsior ZT. Diabetic Patients with an Acute Myocardial Infarction in Terms of Risk Factors and Comorbidities Management: Characteristics of the Highest-Risk Individuals. *Adv Clin Exp Med* 2016;25(4):655-663.

5. Britton KA, Aggarwal V, Chen AY, et al. No Association between Hemoglobin A1c and In Hospital Mortality in Patients with Diabetes and Acute Myocardial Infarction. *Am Heart J* 2011 April ; 161(4): 657–6636.
6. Braunwald E, Antman EM, Beasley JW, et al. ACC/AHA 2002 guideline update for the management of patients with unstable angina and non-ST-segment elevation myocardial infarction--summary article: a report of the American College of Cardiology/American Heart Association task force on practice guidelines(Committee on the Management of Patients with Unstable Angina). *J Am CollCardiol* 2002; 40:1366-74.
7. Bertrand ME, Simoons ML, Fox KA, et al. Management of acute coronary syndromes: acute coronary syndromes without persistent ST segment elevation; recommendations of the task force of the European society of Cardiology. *Eur Heart J* 2000;21:1406-32.
8. Bartnik M, Malmberg K, Norhammar A, Tenerz A, Ohrvik J, Rydén L. Newly detected abnormal glucose tolerance: an important predictor of long-term outcome after myocardial infarction. *Eur Heart J* 2004;25(22):1990-1997.
9. Norhammar A, Tenerz A, Nilsson G, et al. Glucose metabolism in patients with acute myocardial infarction and no previous diagnosis of diabetes mellitus: a prospective study. *Lancet* 2002;359(9324):2140-2144.
10. Zeller M, Cottin Y, Brindisi MC, et al. RICO Survey Working Group. Impaired fasting glucose and cardiogenic shock in patients with acute myocardial infarction. *Eur Heart J* 2004;25(4):308-312.
11. Burazeri G, Goda A, Sulo G, Stefa J, Roshi E, Kark JD. Conventional Risk Factors and Acute Coronary Syndrome during a Period of Socioeconomic Transition: Population-based Case-control Study in Tirana, Albania. *Croat Med J* 2007; 48(2): 225–233.
12. Otten R, Kline-Rogers E, Meier DJ, et al. Impact of pre-diabetic state on clinical outcomes in patients with acute coronary syndrome. *Heart* 2005;91(11):1466-1468.
13. Suleiman M, Hammerman H, Boulos M, et al. Fasting glucose is an important independent risk factor for 30-day mortality in patients with acute myocardial infarction: a prospective study. *Circulation* 2005;111(6):754-760.
14. Moscucci M, Fox KA, Cannon CP, et al. Predictors of major bleeding in acute coronary syndromes: the Global Registry of Acute Coronary Events (GRACE). *Eur Heart J* 2003;24(20):1815-1823.
15. Malmberg K, Norhammar A, Wedel H, Rydén L. Glycometabolic state at admission: important risk marker of mortality in conventionally treated patients with diabetes mellitus and acute myocardial infarction: long-term results from the diabetes and insulin-glucose infusion in acute myocardial infarction (DIGAMI) study. *Circulation* 1999;99:2626–32.
16. Norhammar AM, Rydén L, Malmberg K. Admission plasma glucose: independent risk factor for long-term prognosis after myocardial infarction even in nondiabetic patients. *Diabetes Care* 1999;22:1827–31.
17. Malmberg K, Ryden L, Efendic S, et al. Randomized trial of insulin-glucose infusion followed by subcutaneous insulin treatment in diabetic patients with acute myocardial infarction (DIGAMI study): effects on mortality at 1 year. *J Am CollCardiol* 1995;26:57–65.
18. Malmberg K. Prospective randomised study of intensive insulin treatment on long term survival of diabetes mellitus. *BMJ* 1997;314:1512-1.