



An Observational Study on Prognostic Significance of Admission Blood Glucose Level in ST Elevation Myocardial Infarction

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Abstract

Aims and Objectives: *To determine the prognostic significance of admission blood glucose level among nondiabetic patients presenting with ST elevation myocardial infarction (STEMI).*

Method: *This is a prospective observational study conducted from November 2017 to October 2019. A total of 100 consecutive patients admitted with ST elevation myocardial infarction in CCU, RMMCH were included after satisfying the inclusion and exclusion criteria. All the patients were subjected to complete history taking and clinical examination. Investigations like ECG, cardiac enzyme, admission blood glucose, HbA1c, Echocardiogram were done in all patients. Patients in the study were divided into three groups i.e. Group A (patients with blood glucose level <140 mg/dl), Group B (patients with blood glucose level between 140 and 200 mg/dl), Group C (patients with blood glucose level >200 mg/dl). Group A had 21 participants group B had 42 and Group C 37.*

Results

- In this study among those who developed cardiogenic shock 66.7 % were in the group C, and 33.3 % were in group B and no patient in Group A.*
- Among those who developed pulmonary edema 66.7% were in the Group C, and 26.7 % were in group B and in Group A 6.7%.*
- Among those who developed arrhythmias 54.5% were in the Group C, and 27.3% were in group B and in Group A 18.2%.*
- Among those patients who had ejection fraction of <40%, 69.6% were in Group C*
- In total 4 patients died before hospital discharge, of them 3 belong to Group C and one belong to Group B.*

Conclusion: *From the above observations it has been concluded that hyperglycemia at the time of admission is very common in patients presenting with ST elevation myocardial infarction. It is associated with greater myocardial injury and an increased risk of major adverse cardiovascular events. Therefore in all patients with STEMI random blood sugar level should be estimated at the time of admission which will predict cardiovascular complications and could be used in the risk stratification of these patients.*

Keywords: *Admission blood glucose, ST elevation myocardial infarction, adverse cardiovascular events.*

Introduction

Cardiovascular disease is the most common cause of death in the developing countries. The commonest cause of ischemic heart disease is atherosclerotic coronary artery disease. Diabetes is associated with poor prognosis in patients with acute coronary syndrome. However, more acute glycometabolic disturbances may also have a negative impact on outcome.

Many studies have shown that an elevated plasma glucose level on admission is a major independent predictor of in-hospital and long-term outcome in patients with acute myocardial infarction (AMI), regardless of diabetes status.¹ Hyperglycemia during ACS is caused by an inflammatory and adrenergic response to ischemic stress, when catecholamine are released and glycogenolysis induced. It has been also shown that patients with stress hyperglycemia, but without previous diagnosis of diabetes, were at increased risk of congestive heart failure and cardiogenic shock when compared to patients with Diabetes Mellitus. Some studies show that hyperglycemia, more than diabetes, is associated with poor prognosis of AMI and diabetic patients have better prognosis than patients with stress hyperglycemia.⁴

In a retrospective study, Stranders et al observed that for each 18 mg/dL of glucose increase, there was a 4% increase in mortality in non-diabetic subjects. The Cooperative Cardiovascular Project, the largest retrospective study in elderly patients hospitalized with AMI to date, demonstrated a significant 13%–77% relative increase in 30-day mortality and a 7%–46% relative increase in 1-year mortality, depending on the degree of hyperglycemia.² In the randomized CREATE-ECLA trial, which evaluated patients with ST-segment elevation myocardial infarction, the 30-day mortality rate was 6.6% among patients with baseline glucose in the lowest tertile, whereas those in the highest glucose tertile experienced a mortality rate of 14%.³

Aims and Objectives

- To determine the prevalence of hyperglycemia in ST elevation myocardial infarction.
- To determine the prognostic significance of admission blood glucose level among nondiabetic patients presenting with ST elevation myocardial infarction.

Inclusion Criteria

- Patients diagnosed with ST elevation myocardial infarction

Exclusion Criteria

- Known Diabetes Patients
- HbA1c >6.5%
- Patients on steroid therapy
- Recent major surgery
- Trauma

Methods

This is a prospective observational study conducted from November 2017 to October 2019. A total of 100 consecutive patients admitted with ST elevation myocardial infarction in CCU, RMMCH were included after satisfying the inclusion and exclusion criteria. All the patients were subjected to complete history taking and clinical examination. Investigations like ECG, cardiac enzyme, admission blood glucose, HbA1c Echocardiogram were done in all patients. Patients in the study were divided into three groups i.e. Group A (patients with blood glucose level <140 mg/dl), Group B (patients with blood glucose level between 140 and 200 mg/dl), Group C (patients with blood glucose level >200 mg/dl). Group A had 21 participants Group B had 42 and Group C 37.

Results

Table – 1 Patients Characteristic

Variable	Frequency	Percentage	
Age (in years)	41-50	26	26.0
	51-60	37	37.0
	61-70	28	28.0
	71-80	4	4.0
	>80	5	5.0
Sex	Male	64	64.0
	Female	36	36.0
Total	100	100.0	

Table- 2 Killip class and ejection fraction

Variable		Frequency	Percentage
Blood glucose values (mg/dl)	<140	21	21.0
	140-200	42	42.0
	>200	37	37.0
Killip class	1	46	46.0
	2	29	29.0
	3	16	16.0
	4	9	9.0
Ejection fraction	<40%	33	33.0
	41-49%	32	32.0
	≥50%	35	35.0
Total		100	100.0

Graph – 1: Adverse cardiovascular events

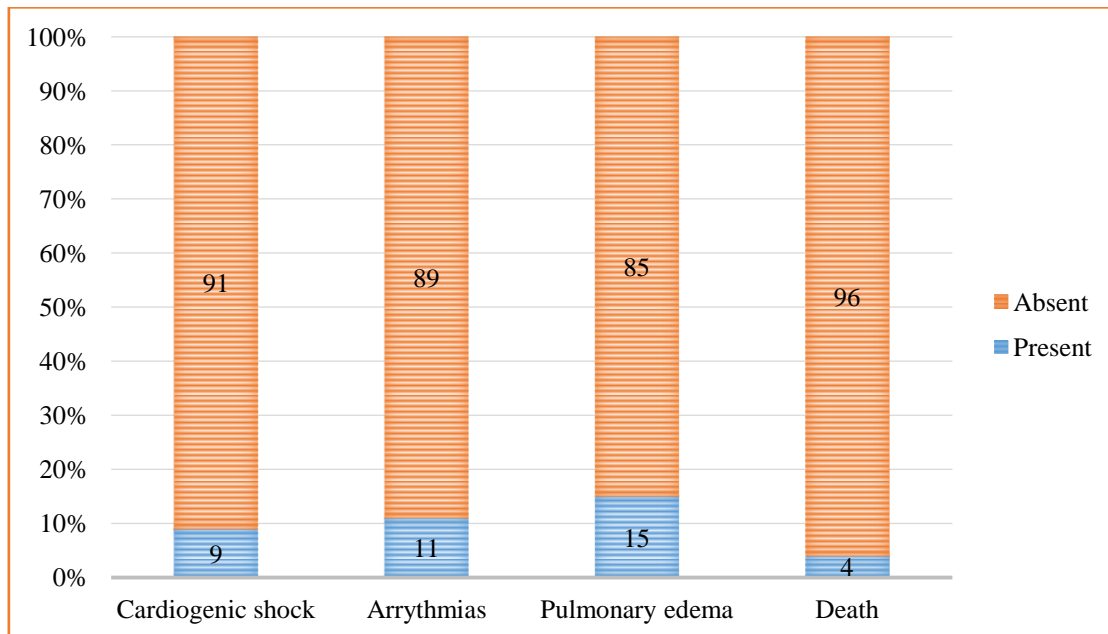
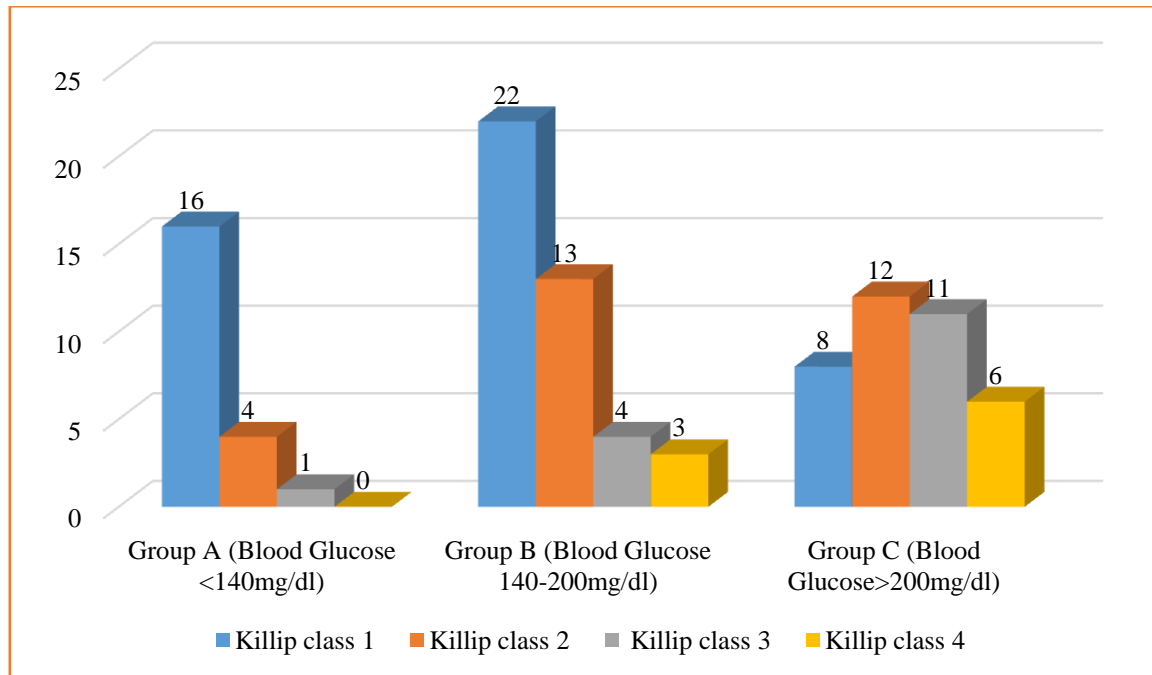


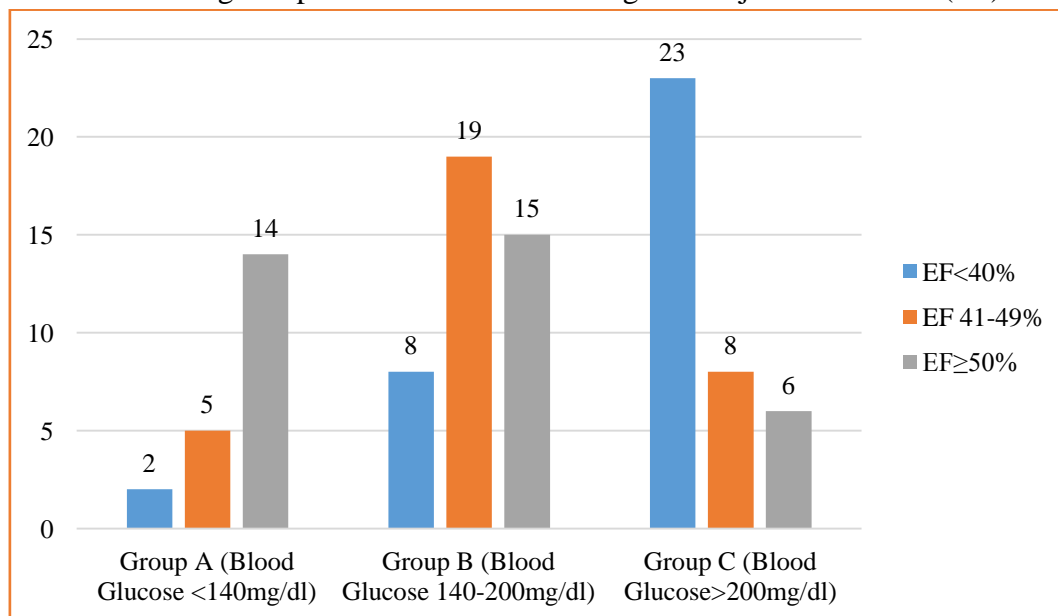
Table- 3 Blood glucose values and adverse cardiovascular events

Variables	Outcome variable		X ²	P-value
	Present	Absent		
Blood glucose values (mg/dl)	Cardiogenic shock		4.534 (linear by linear)	<0.05
Group A (<140)	0(0)	21(23.1)		
Group B (140-200)	3 (33.3)	39 (42.9)		
Group C (>200)	6 (66.7)	31 (34.1)		
Blood glucose values (mg/dl)	Arrhythmias		1.713	>0.05
Group A (<140)	2(18.2)	19(21.3)		
Group B (140-200)	3(27.3)	39(43.8)		
Group C (>200)	6(54.5)	31(34.8)		
Blood glucose values (mg/dl)	Pulmonary oedema		6.912	<0.05
Group A (<140)	1 (6.7)	20 (23.5)		
Group B (140-200)	4(26.7)	38 (44.7)		
Group C (>200)	10 (66.7)	27 (31.8)		
Blood glucose values (mg/dl)	Death		2.788	>0.05
Group A (<140)	0(0)	21 (21.9)		
Group B (140-200)	1 (25.0)	41 (42.7)		
Group C (>200)	3 (75.0)	34 (35.4)		

Graph – 2: Bar chart showing comparison between blood sugar and Killip class



Graph – 3: Bar chart showing comparison between blood sugar and ejection fraction (EF)



- In this study 65% of the participants were in the age group between 50-70 years.
- Out of the total study population 64 were male and 36 were female.
- Majority of the patients who presented in Killip class 1(47.8%) and 2 (44.8%) belong to Group B.
- Majority of the patients who presented in Killip class 3 (68.8%) and 4 (66.7%) belong to Group C.
- Total 15 patient developed pulmonary edema, of them 10 patients (66.7%) belong to Group C, 4 patients (26.7 %) in Group B and one patient (6.7%) in Group A.
- Cardiogenic shock was found more in Group C (66.7%) with 6 patients and in Group B 3 patients (33.3 %).
- No patient in Group A had cardiogenic shock.

- 6 patients (54.5%) in Group C, 3 (27.3%) in Group B and 2 (18.2%) in Group A developed arrhythmias.
- There is an inverse correlation between blood glucose level and left ventricle ejection fraction. 23 patients (69.7%) in the Group C, 8 (24.2%) in Group B and 2 (6.1%) in Group A had ejection fraction of less than 40%.
- 8 patients (25%) in Group C, 19 (59.4%) in Group B and 5 (15.6%) in Group C had ejection fraction between 41% and 49%.
- 14 patients (40%) in Group A, 15 (42.9%) patient in Group B and 6 (17.1%) in Group C had ejection fraction more than 50 %.
- In total 4 patients died before hospital discharge, of them 3 belong to Group C and one belong to Group B.

Discussion

In ST elevation myocardial infarction patients high blood glucose level on admission is attributed to stress hyperglycemia. Our study demonstrates that in nondiabetic patients with STEMI, elevated glucose level on admission are associated with significant increase in the complications.

According to study by Hanan E Zaghla et al., stress hyperglycemia increases congestive heart failure, cardiogenic shock and mortality after acute myocardial infarction.⁸

Jeong Hoon Yang et al in their study concluded that in STEMI complicated by cardiogenic shock, the admission blood glucose level was independently associated with increased risk of 30-day mortality.⁵

Gasior et al in their study found that there is high significant correlation between increased incidence of heart failure and elevated admission blood glucose level.⁶

Rafael sanjuan et al in their study found that the incidence of arrhythmias are more frequent in patients with glycemia>140mg/dl than in those with <140 mg/dl.¹

M kosiborod et al in their study found that higher admission blood glucose level was associated with

higher killip classification and lower ejection fraction.⁷

Japanese acute coronary syndrome study is a retrospective and multicenter observational study which found that there was a linear relation between blood glucose level on admission and in-hospital mortality.⁴

In our study adverse cardiovascular events like arrhythmias, cardiogenic shock, pulmonary edema and death were more common in Group C. our findings matched with other studies.

Conclusion

Hyperglycemia at the time admission is very common in patients presenting with ST elevation myocardial infarction. It is associated with greater myocardial injury and an increased risk of major adverse cardiovascular events like arrhythmias, cardiogenic shock, pulmonary edema and death when compared to those present with normal admission blood glucose level.

Therefore in all patients with STEMI random blood sugar level should be estimated at the time of admission which will predict cardiovascular complications and could be used in the risk stratification of these patients.

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