



ADMISSION HYPERGLYCEMIA AS A PROGNOSTIC MARKER FOR ACUTE ST ELEVATION MYOCARDIAL INFARCTION.

Dr. C. Anjani Kumar

Associate Professor, Dept. Of General Medicine, Dr. PSIMS&RF

Dr. Lata Gudivada*

Final Year Resident, Dept. Of General Medicine, Dr. PSIMS&RF. *Corresponding Author

Dr. Jinnuri Swapna

First Year Resident, Dept. Of General Medicine, Dr. PSIMS&RF.

Dr. Bupesh Parasa

Final Year Resident, Dept. Of General Medicine, Dr. PSIMS&RF.

ABSTRACT **BACKGROUND:** Hyperglycemia is common in patients admitted with acute myocardial infarction and it is associated with increased mortality and morbidity. Patients either with or without prior history of diabetes mellitus may present with hyperglycemia during acute myocardial infarction and it is uncertain whether hyperglycemia upon admission remains an independent predictor of in hospital morbidity and mortality. This study was aimed to assess the impact of admission blood glucose levels on the hospital course and outcome in diabetic and non-diabetic patients admitted with acute myocardial infarction. **METHODS:** 50 patients with acute myocardial infarction were divided into two groups based on their prior diagnosis of diabetes mellitus. Each group was further divided into two groups with admission blood glucose levels less than 180 mg/dl and greater than 180mg/dl. All patients were subjected to complete history taking and clinical examination, ECG, routine laboratory investigation including cardiac enzymes, admission blood glucose level, HbA1c. **RESULTS:** In this study of 50 patients, 25 were diabetic and 25 non diabetic. 22 had blood glucose levels less than 180 mg/dl and 28 had greater than 180mg/dl. Patients who had arrhythmia were 10, of which 2 had blood glucose level less than 180mg/dl and 8 had blood glucose more than 180mg/dl. 7 had heart failure of which 3 had blood glucose less than 180mg/dl and 4 had greater than 180mg/dl. Total 3 deaths had occurred and all had blood glucose greater than 180mg/dl. **CONCLUSIONS:** Admission hyperglycemia was associated with increased complication in both diabetic and non-diabetic patients with acute myocardial infarction.

KEYWORDS :

INTRODUCTION:

Hyperglycemia is seen in patients admitted to hospital with acute myocardial infarction irrespective of their prior history of diabetes mellitus⁽¹⁾. We studied the impact of admission hyperglycemia in the outcome of the disease.

METHODS AND RESULTS:

50 patients with acute STEMI myocardial infarction were divided into two groups based on their prior diagnosis of diabetes mellitus. Each group was further divided into two groups with admission blood glucose levels less than 180 mg/dl and greater than 180mg/dl.

CONCLUSIONS:

Hyperglycemia on admission was a common finding in nondiabetic (50%) as well as diabetic (50%) patients with STEMI and higher admission glucose levels were associated with adverse outcomes⁽²⁾.

INTRODUCTION:

Hyperglycemia is a frequent condition in patients with acute coronary syndromes (ACS) and it is associated with increased mortality and morbidity⁽³⁾.

Among patients with no prior history of diabetes, hyperglycemia may denote undiagnosed diabetes, impaired glucose tolerance, uncontrolled diabetes.

Many studies demonstrated that elevated blood glucose upon admission, increased adverse events, including congestive heart failure (CHF), cardiogenic shock and death.

In fact, as demonstrated by a meta-analysis of 13 prospective cohort studies, for every one-percentage point increase in glycosylated hemoglobin (HbA1c), the relative risk for any cardiovascular event was 1.18 (95% CI 1.10–1.26).

Patients either with or without prior history of diabetes mellitus may present with hyperglycemia during acute myocardial infarction and it is

uncertain whether hyperglycemia upon admission remains an independent predictor of in hospital morbidity and mortality.

Hyperglycemia during ACS is caused by an inflammatory and adrenergic response to ischemic stress when catecholamines are released and induce glycogenolysis⁽³⁾.

Although the involved pathophysiological mechanisms have not yet been fully elucidated, it is believed that hyperglycemia is associated with an increase in free fat acids (which induce cardiac arrhythmias), insulin resistance, chemical inactivation of nitric oxide and the production of oxygen reactive species (with consequent microvascular and endothelial dysfunction), a prothrombotic state and vascular inflammation.

It is also related to myocardial metabolic disorders, leading to thrombosis, extension of the damaged area, reduced collateral circulation, and ischemic preconditioning⁽⁵⁾.

In addition, patients with hyperglycemia had a longer length of hospital stay, a higher admission rate to an intensive care unit, and were less likely to be discharged home, frequently requiring transfer to a tertiary care unit or nursing home facility⁽⁶⁾.

The presence of hyperglycemia is also associated with increased morbidity and mortality, regardless of the reason for admission (e.g. acute myocardial infarction, surgery, stroke, sepsis)⁽⁸⁾.

This study was aimed to assess the impact of admission blood glucose levels on the hospital course and outcome in diabetic and non-diabetic patients admitted with acute myocardial infarction.

AIM OF THE STUDY: Our study aim was to evaluate the effect of admission hyperglycemia in STEMI patients and its outcome in diabetic and non diabetic patients.

MATERIALS AND METHODS:

50 patients with acute STEMI myocardial infarction were divided into

two groups based on their prior diagnosis of diabetes mellitus. Each group was further divided into two groups with admission blood glucose levels less than 180 mg/dl and greater than 180mg/dl

In our study, we included 50 patients with STEMI, patients were men and were women, divided into two groups: Group A included patients with admission blood glucose level less than 180 mg/dl and Group B included patients with admission blood glucose level 180 mg/dl or more (the level 180 was chosen according to the NICE-SHUGAR study investigators). All patients were subjected to complete history taking and complete clinical examination; 12-lead ECG was performed for every patient and routine laboratory investigations were performed, including cardiac enzymes, which were important for diagnosis of ACS. Admission blood glucose level and HbA1c were estimated at the time of admission of the patients.

INVESTIGATIONS:

- Serial electrocardiogram
- Echocardiography
- Cardiac enzymes CKMB troponin T
- Other biochemical test including HbA1c, blood glucose at admission, FBS, PPBS, Renal function test.

EXCLUSION CRITERIA

were previous fibrinolysis, emergency coronary artery bypass surgery.

STATISTICAL ANALYSIS AND MANAGEMENT:

Data were statistically described in terms of mean±SD, median and range, or frequencies (number of cases) and percentages when appropriate. All statistical calculations were performed using computer program SPSS. P value greater than 0.05 was considered significant, P value less than 0.05 was considered insignificant, and P value less than 0.01 was considered highly significant.

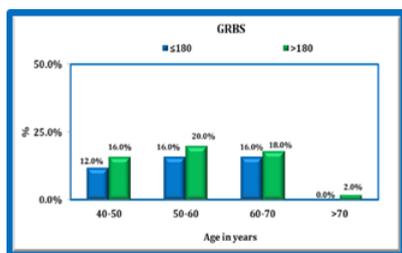
RESULTS

1. Comparison between the two studied groups regarding age.

Table (1), show the comparison between the two studied groups regarding age

VARIABLE	CATEGORY	GRBS			
		≤ 180		>180	
		Count	%	Count	%
Age	40-50	6	12%	8	16%
	50-60	8	16%	10	20%
	60-70	8	16%	9	18%
	>70	0	0.0%	1	2%

Graph no.1 showing patients according to age in the 2 groups



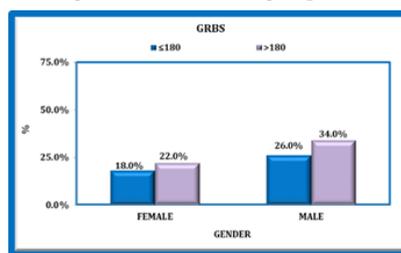
This study comprised 50 patients (range from 40 to 75 years). 22 had blood glucose less than 180mg/dl at time of admission and 28 had above 180mg/dl. Maximum patients were in the age group of 50 to 60 years.

2. Comparison between the two studied groups regarding Sex.

Table (2) showing sex distribution in the 2 groups

VARIABLE	CATEGORY	GRBS			
		≤ 180		>180	
		Count	%	Count	%
SEX	FEMALE	9	18%	11	22%
	MALE	13	26%	17	34%

Graph (2) showing sex distribution in 2 groups



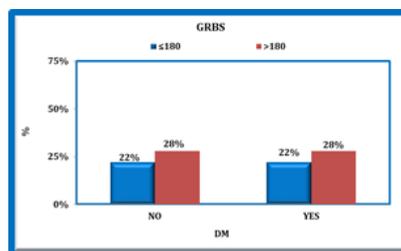
Female patients were 20 and male patients were 30 in number. 9(18%) female and 13(26%) male were in group A (≤180mg/dl of admission blood glucose). 11(22%) female and 17(34%) male were in group B (>180mg/dl admission blood glucose)

3. Comparison between the two studied groups regarding diabetes status

Table 3 showing comparison in 2 groups regarding previous diabetes

VARIABLE	CATEGORY	GRBS			
		≤ 180		>180	
		Count	%	Count	%
DM	NO	11	22%	14	28%
	YES	11	22%	14	28%

Graph 3 showing comparison in 2 groups regarding previous diabetes status



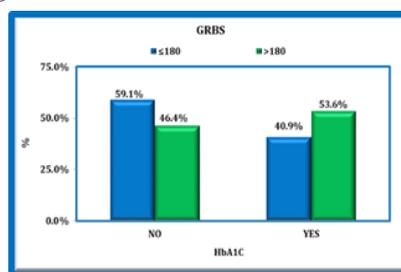
In group A (≤ 180 mg/dl of admission blood glucose) 11(22%) were previously diagnosed diabetic and 11(22%) had no previous history of diabetes. In other group B (>180 mg/dl of admission blood glucose) 14 (28%) had previous history of diabetes and 14 (28%) did not have diabetes.

4. Comparison between the two studied groups regarding HbA1c

Table(4) showing Comparison between the two studied groups regarding HbA1c

VARIABLE	CATEGORY	GRBS				P-value
		≤ 180		>180		
		Count	%	Count	%	
HbA1C	≤ 6.5	13	26%	13	26%	0.41
	> 6.5	9	18%	15	30%	

Graph (4) showing Comparison between the two studied groups regarding HbA1c



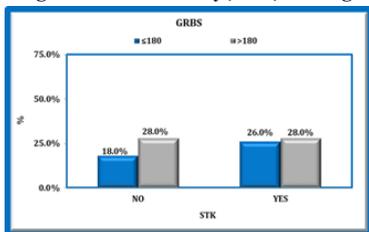
In group A 13(26%) had HbA1C ≤6.5% and 9(18%) had HbA1C >6.5%. In group B 13(26%) had HbA1C ≤6.5% and 15(30%) had HbA1C >6.5%.

5. Comparison between the two studied groups regarding Treatment

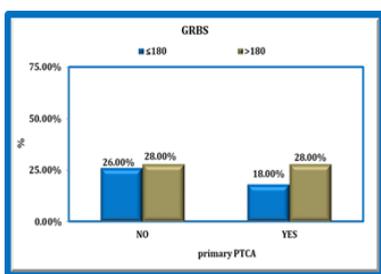
Table (5) showing comparison between two groups regarding treatment modality

VARIABLE	CATEGORY	GRBS				P-value
		≤ 180		>180		
		Count	%	Count	%	
STK	NO	9	18%	14	28%	0.58
	YES	13	26%	14	28%	
primary PTCA	NO	13	26%	14	28%	0.58
	YES	9	18%	14	28%	

Graph 5 showing treatment modality(STK) in two groups



Graph 6 showing treatment modality(primary PTCA) in two groups



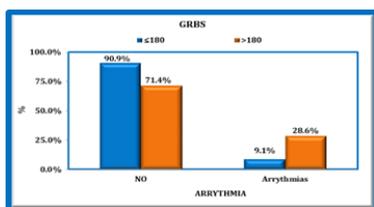
In group A 13(26%) were treated with STK and 9(18%) underwent primary PTCA. In group B 14(28%) were treated with STK and 14(28%) underwent primary PTCA.

6.Comparison between the two studied groups regarding complications.

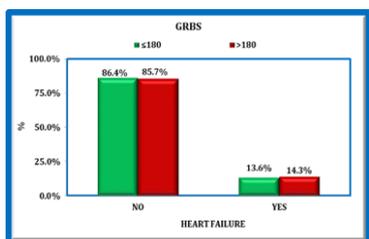
Table (6) showing complications in two groups

VARIABLE	CATEGORY	GRBS				P-value
		≤ 180		>180		
		Count	%	Count	%	
ARRHYTHMIA	NO	20	40%	20	40%	0.15
	YES	2	4%	8	16%	
HEART FAILURE	NO	19	38%	24	48%	1
	YES	3	6%	4	8%	
DEATH	NO	22	44%	25	50%	0.25
	YES	0	0.0%	3	6%	

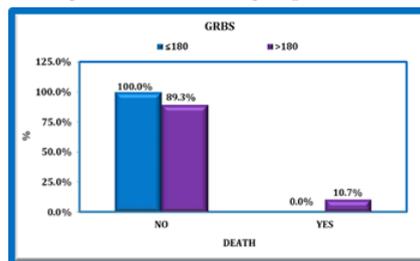
Graph (7) showing arrhythmia in two groups



Graph 8 comparing two groups regarding heart failure



Graph 9 showing death between two groups



In group A 2(4%) patients had arrhythmia 3(6%) had heart failure and there were no deaths. In group B 8 (16%) had arrhythmia 4(8%) had heart failure and 3(6%) deaths had occurred.

DISCUSSION:

The association between elevated glucose levels on admission and adverse clinical outcomes has been a focus of growing attention in patients with MI.

Numerous studies have shown that elevated glucose levels are associated with an increased risk of death or cardiovascular complications in patients both with and without known DM₁₀.

Confirming previous studies, hyperglycemia on admission was a common finding in nondiabetic (50%) as well as diabetic (50%) patients with STEMI and higher admission glucose levels were associated with adverse outcomes.

Our study substantially expands the current understanding of the relationship between admission glucose values and adverse outcomes in patients with STEMI.

Of the total population 30 were males & 20 were females. The mean RBS value and HbA1c among females were 200.05mg% and 6.8% and that of males were 238.66mg% and 8.18% . Our study shows that admission blood glucose and HbA1c was higher in males compared to females.

The mean RBS value among 40-50, 50-60, 60-70 were 200.42, 216.77, 230.76mg% and mean HbA1c among 40-50, 50-60, 60-70 were 7.52%, 7.46%, 7.52%. Our study shows no age preponderance.

Mean HbA1c among diabetics was 9.4% indicating a poor control prior to diabetes. This high value of HbA1c also indicates that though majority of the diabetics have received some treatment with either oral hypoglycemic agents or insulin, the treatment was not adequate. This may be either due to lack of compliance or improper follow up.

In our study 28 patients had admission RBS ≥180mg/dl. Among this 14 patients were known diabetics. That means 56% of the study population presented with acute hyperglycemia irrespective of their diabetic status. And among the hyperglycemia group 50% were having previous history of diabetes. This clearly shows that in patients with STEMI there is a high incidence of elevated admission plasma glucose value.

In this study, 24 patients had admission HbA1c value >6.5, of which majority, ie 23 patients (more than 95%) were known case of diabetes. In our patients acute LVE, arrhythmias were found in 14%, 20% respectively. 3 deaths were found out of which 2 patient had arrhythmia. In this study, the most common adverse cardiac event observed was arrhythmia.

The patients with adverse cardiac events had mean admission RBS& HbA1c of 276.33mg% and 9.02% respectively, while it was 193.34mg% and 6.86% for those without adverse cardiac events. In this study the mean admission RBS and HbA1c were significantly high in patients with adverse cardiac events.

However, the risk for clinical events differed between patients with and without known DM.

Thus far, it remains controversial whether acute hyperglycemia predisposes to adverse outcome or is simply a consequence of increased sympathetic and catecholamine response to a large infarct

size, thereby reflecting greater disease severity⁽¹⁰⁾.

Recent experimental studies have suggested that hyperglycemia may have a direct detrimental effect on ischemic myocardium. Glucose can induce reactive oxygen species generation resulting in increased oxidative stress and subsequent myocardial injury.⁽³⁾

The substantial harm associated with hyperglycemia in patients with ACS suggests that glucose management strategies might improve outcome in patients with hyperglycemia [Angeli *et al.* 2010, 2013(3); Senthinathan *et al.* 2011⁽¹¹⁾].

Despite hyperglycemia as a factor of worse outcome is documented in several prospective studies, many gaps in knowledge currently exist in our understanding of the association between elevated glucose levels and adverse outcomes in patients with ACS; Angeli *et al.* 2013(3)

Of note, the meta-analysis by Capes and coworkers has reported that patients without diabetes with ACS are at risk for in-hospital complications for blood glucose levels over 110 mg/dl, while patients with diabetes and ACS are at risk for in-hospital complications for admission blood glucose concentrations equal to or over 180 mg/dl [Capes *et al.* 2000]⁽¹²⁾.

CONCLUSION:

Hyperglycemia during ACS is a common finding and also an adverse prognostic marker that increases the risk of immediate and long-term complications in patients both with and without diabetes mellitus.⁽⁷⁾

Thus, intervention trials are needed to optimize the definition of new hyperglycemia and to establish appropriate modalities and goals of glucoselowering treatment.

Admission hyperglycemia was associated with increased complication in both diabetic and non-diabetic patients with acute myocardial infarction.

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