Volume : 2 | Issue : 8 | August 2013 • ISSN No 2277 - 8179

Research Paper

In-Hospital Morbidity and Mortality of Nondiabetic Patients of Acute Myocardial Infarction In Relation to their Blood Glucose Status

Medical Science

KEYWORDS : Stress hyperglycemia, AMI - Acute myocardial infarction.

Dr.Haridas B .Prasad	Associate Professor, Department of Medicine ,B.J. Govt Medical College Pune
Dr.Prashant Mahajan	Ex Lecturer DY Patil medical college , Pune
Dr.Dilip B.Kadam	Professor and Head, Department of Medicine ,B.J Govt Medical College Pune

ABSTRACT

INTRODUCTION-Transient hyperglycemias during AMI is related to stress hence labeled as stress Hyperglycemia . It is related to higher mortality and cardiac complications in diabetic as well as in non diabetic patients with higher frequency of cardiogenic shock. AIMS This study compared the complications of AMI in non-diabetic patients with stress hyperglycemia and those without it , assessed the prognostic significance of stress hyperglycemia and mortality .MATERIALS AND METHODS: 90 patients were incuded.Detailed clinical examination and laboratory work up including ECG ,Echo and HbA1c was done EXCLUSION CRITERIA:Those with diabetes. non-Q wave MI or unstable angina or previous history of MI and on (5% dextrose or DNS) and LBBB were excluded. RESULTS Non-diabetic patients of AMI with stress hyperglycemia developed significantly higher complications, as compared to controls i.e. 66.6% in cases and 23.31% in control.The patients who died had significant higher mean admission blood glucose (203.44 +67.57) (mg %) than in survivors (153.09 + 63.94)(mg %).Causes of infarct related death were cardiogenic shock and ventricular arrhythmias. Incidence of heart failure was significantly higher in non-diabetic patients with stress hyperglycemia (59.94%) as compared to the control patients (10%) Mortality rate increased with increasing blood glucose level on admission and was related to higher frequency of heart failure and cardiogenic shock. CONCLUSION Stress hyperglycemia plays an important role in prognosis and outcome in non-diabetic patients admitted with AMI.

INTRODUCTION :-

Transient hyperglycemia is a recognized finding during acute myocardial infarction and is considered to be related to stress (Lakhdar et al 1984).1 An unusually high prevalence of glycosuria in patients without diabetes who have acute myocardial infarction was noted as far back as 1931(Cruickshank N) .2 In patients who have had myocardial infarction, the lack of adequate insulin associated with hyperglycemia may lead to a decrease in glycolytic substrate for cardiac muscle and excessive free fatty acids ; these changes may reduce myocardial contractility leading to pump failure and promote arrhythmias.

(Oliver et al 1994).3. Graber et al4 (2000) stated that hyperglycemia is often first identified in hospitalized patients under stress from acute illness, surgery or steroid treatment; this condition is referred to as 'stress hyperglycemia'.

Stress hyperglycemia has been defined as transient increase in blood glucose concentration during an acute stress (Hashemipour et al 2002).[5]However, threshold glucose concentration used to define hyperglycemia varies from study to study i.e. from 6.1mmol/l to 10mmol/l (Capes et al).[6] The phenomenon of **'stress hyperglycemia'** results primarily from excessive release of counter regulatory hormones and cytokines. Hyperglycemia as a manifestation of stress is most often evident shortly after admission to ICU and may resolve as the underlying catabolic illness subsides. (McCowen et al 2001).[7]

AIMS AND OBJECTIVES:

1). To compare the complications of acute myocardial infarction in non-diabetic patients with stress hyperglycemia and those without stress hyperglycemia.2).To assess the prognostic significance of stress hyperglycemia in non-diabetic patients with acute myocardial infarction.3)To assess the relationship between stress hyperglycemia and heart failure in non-diabetic patients with acute myocardial infarction.4)To assess the relationship between stress hyperglycemia and mortality in non-diabetic patients having acute myocardial infarction.

MATERIALS AND METHODS:

This prospective study included patients admitted for acute myocardial infarction in the MICU, of our hospital over a period of 15 months.. Myocardial infarction was diagnosed according to WHO criteria8. Stress hyperglycemia in the present study has been defined as admission fasting blood sugar level >126mg/dl in non diabetic patients of acute myocardial infarction. INCLUSION CRITERIA:Non-diabetic patients suffering from acute myocardial infarction. EXCLUSIONCRITERIA:Known patients of diabetes.Patients with non-Q wave myocardial infarction or unstable angina or previous history of myocardial infarction. Patients who received intravenous fluids (5% dextrose or DNS) before admission to MICU.Patients having LBBB on admission, as electrocardigraphic criteria for diagnosing acute myocardial infarction in presence of LBBB are relatively insensitive and not specific for particular location of infarction. (Wacker s et al 1981).[9]

Patients were divided into three groups based on admission blood glucose levels and Glycosylated Hemoglobin levels (ion resin column chromatography method).

Group A: Normal fasting blood sugar and normal HbA1c levels on admission i.e.BSL <126mg% and HbA1c <7.5%

Group B: Raised fasting blood sugar and normal HbA1c levels:i.e.BSL >126mg% and HbA1c <7.5%

Group C: Raised fasting blood sugar and raised HbA1c levels i.e.BSL >126mg% and HbA1c >7.5%

Subjects belonging to group (A) were referred to as "Controls" and those belonging to groups (b) and (c) formed the "Cases ".Group (B) patients were referred to as having "**Stress Hyperglycemia**";Group(C)patients referred to as having "**Diabetes"** Thirty patients were studied from each group. No patients with hyperglycemia were given insulin.Any complication like arrhythmia (which required intervention), conduction blocks (LBBB developing after admission, RBBB, bifasicular block, CHB), left ventricular failure, cardiogenic shock and death developed during hospital stay was noted in each case.An oral Glucose Tolerance Test was done in all those patients belonging to groups (B) and (C) at the time of discharge, by giving 75 gm oral glucose to the patients and obtaining a baseline and at 2 hrs. Patients with persistently deranged blood sugars at 3 months were then switched to group (C) and considered as having Diabetes mellitus as per the WHO definition of diabetes.8

OBSERVATIONS AND ANALYSIS:

O1)AGE- mean age was 63,61.2 and 59.8 years in Gr A,B,C respectively with a SD of 12.2,8.7 and 12.5 respectively in the three groups p>0.05 (not significant).

O2)SEX-there were 19 males and 11 females in Gr A.14 males

Volume : 2 | Issue : 8 | August 2013 • ISSN No 2277 - 8179

and 16 females in GrB and 17 males and 13 females in Gr C respectively.the P value was >0.05 hence not statistically significant

O3)MEAN AGE OF SURVIVORS AND NON SURVIVORS IN THE STUDY IRRESPECTIVE OF GROUP DISTRIBUTION
The mean age of survivors was 61.3 + 11.9 yrs and for non survivors was 61.44+8.1 years respectively with P value of >0.05 ie not significant.

O4) INCIDENCE OF LVF IN PATIENTS OF AMI BELONGING TO THE THREE DIFFERENT GROUPS:
18,16 nd 3 patients respectively developed LVF .The incidence of LVF was significantly higher in patients having stress hyperglycemia and diabetes as compared to controls.

O5) GROUPWISE INCIDENCE OF VENTRICULAR ARRHYTHMIAS (REQUIRING TREATMENT):
Comments: Ventricular Arrhythmias were seen in 4, 3 and 2 pts respectively in GrA, B and C. there was no statistically significant difference in the incidence of Ventricular Arrhythmias (requiring treatment) in the three different groups

O6) GROUPWISE INCIDENCE OF BUNDLE BRANCH BLOCKS AND COMPLETE HEART BLOCK:
3(10%),4 9(13.33%)and 2(6.7%) pts respectively had Bundle branch blocks in GrA,B and C.

O7) MEAN ADMISSION BLOOD SUGAR LEVELS IN SURVIVORS AND NON-SURVIVORS:
Mean blood sugar on admission in survivors was 153.09+63.94 and that in non survivors was 203.44 +67.57.the **t** value was 3.24 and the P value was <0.01 which is significant

TABLE 1
PREVALENCE OF VARIOUS COMPLICATIONS OF AMI IN THE THREE GROUPS:

SR NO	GROUP	PTS WITH COMPLICATIONS	PTS WITHOUT COMPLICATIONS
1.	A	20	10
2.	B	24	6
3.	C	7	23

This table shows that the incidence of complications of AMI is significantly higher in patients having stress hyperglycemia and diabetes as compared to control patients having normoglycemia**.**

TABLE 2 –
INCIDENCE OF LVF IN RELATION TO BLOOD SUGAR LEVEL IRRESPECTIVE OF GROUP DISTRIBUTION:

SR NO	BSL ON ADMISSION mg%	TOTAL PATIENTS	PTS WITH LVF	PERCENT HAVING LVF (%)
1.	<126	30	3	10
2.	126-200	37	19	51
3.	>200	23	15	65

The incidence of LVF was directly related to Blood sugar level df = 2 p <0.001,highly significant.

TABLE 3 -GROUPWISE DISTRIBUTION OF CARDIOGENIC SHOCK

SR NO	GROUP	SHOCK	TOTAL NO OF PATIENTS
1.	A	9	30
2.	B	9	30
3.	C	3	30

The incidence of Cardiogenic shock was higher in pts with stress hyperglycemia and diabetes

TABLE 4 .MORTALITY RATE IN ALL PATIENTS IN RELATION TO ADMISSION BLOOD SUGAR LEVELS:

SR NO	BSL ON ADMISSION (mg %)	TOTAL NO. OF PATIENTS	NON-SURVIVORS	PERCENTAGE
1.	<126	30	2	6.7
2.	126-200	37	8	21.6
3.	>200	23	8	34.8

The mortality was higher in patients with stress hyperglycemia and diabetes

TABLE 5 GLYCOSYLATED HEMOGLOBIN LEVELS IN AMI PATIENTS AT THE TIME OF ADMISSION-

HbA_{1C} (%)	BLOOD SUGAR ON ADMISSION (mg %)	GROUP NAME	GROUP DIAGNOSIS	NO OF PATIENTS STUDIED
4.4 to 7.5%	>126	A	STRESS HYPERGLYCEMIA	30
7.5 to 12.8%	>126	B	DIABETES	30
4.3 to 7.5%	<126	C	CONTROL	30

All Normal pts and those with stress hyperglycemia had normal HbA1c,whereas in diabetic patients HbA1c was abnormal

DISCUSSION
Hyperglycemia is common in patients with acute myocardial infarction. The significance of hyperglycemia on admission in non-diabetic patients observed after acute myocardial infarction has stimulated renewed interest. High blood glucose concentration may increase the risk of death and poor outcome after acute myocardial infarction (Swedarsena1988)10

The present study was undertaken to assess the prognostic significance of stress hyperglycemia in non-diabetic patients of acute myocardial infarction.

In the present study, out of 30 patients with stress hyperglycemia, 6 patients died; 5 due to cardiogenic shock and 1 patient due to ventricular arrhythmias. Out of the 30 patients who were found to be having Diabetes, 10 patients died; 9 deaths were due to cardiogenic shock and 1 due to ventricular arrhythmia. Amongst the control group, 2 deaths were observed, both being due to cardiogenic shock, none due to arrhythmias. Thus we observed cardiogenic shock as the major cause of death both among study and control group. In the present study, statistically significant difference was not observed in mean age amongst survivors and non-survivors.(**O1)**

In the present study, the incidence of various complications of AMI like left ventricular failure, cardiogenic shock, arrhythmias and conduction blocks during hospital stay was significantly higher in patients with stress hyperglycemia as compared to controls. This difference was found to be statistically significant. **(TABLE 1).**

In study by Singhvi et al 2000 12 , 85.29% of patients with stress hyperglycemia developed complications following myocardial infarction. Capes et al 2000 6 and Bellodi et al 11 (1989) also reported similar observation, with higher incidence of complications like congestive heart failure, cardiogenic shock and mortality in patients with stress hyperglycemia associated with myocardial infarction without diabetes.

PERCENTAGE OF MORTALITY IN VARIOUS STUDIES

Study	Year	No. of pts.	% mortality in normoglycemic	% mortality in hyperglycemic
Swedarsen et al *[10]	1988	277	4.00	35.00

Bellodi et al*[11]	1989	330	3.00	43.00
Singhvi et al**[12]	2000	60	0.00	8.8

*Stress hyperglycemia defined as blood glucose > 180 mg%.

** Stress hyperglycemia defined as plasma glucose > 120 mg% equivalent to blood glucose >140 mg%.

In the present study, there was only 6.7% mortality in patients with normal blood sugar on admission, while 34.8 % mortality was seen in those having blood sugar levels above 200 mg% at the time of admission. This difference was statistically significant. **(O7).**

The mortality was higher in patients with stress hyperglycemia and mortality increased with increasing blood sugar.(**TABLE4**) These observations were consistent with findings of Oswald et al (1986) 13 and Yudkin et al (1987)14. Swedarsen et al 10 (1988) reported that mortality in hospital in patients not known to have diabetes increased significantly from 4% in patients with admission plasma glucose below 8 mmol/L to 35% in patients with admission plasma glucose above 11 mmol/L.

Bellodi et al 11 (1989) observed that mortality rate in non-diabetic patients with acute myocardial infarction increased with higher admission plasma glucose levels and they reported mortality as 3% in normoglycemic patients (i.e. < 120 mg%) versus 15% in borderline class (120-180 mg%) versus 43% in hyperglycemic class (>180 mg%).

LVF-PERCENTAGE OF LEFT VENTRICULAR FAILURE IN PREVIOUS STUDIES

Study	Year	No. of pts.	% LVF in normoglycemic	% LVF in hyperglycemic
Bellodi et al *[11]	1989	330	21.00	86.00
Singhvi et al**[12]	2000	60	38.40	73.13

*Stress hyperglycemia defined as blood glucose > 180 mg%.
** Stress hyperglycemia defined as plasma glucose > 120 mg%. equivalent to blood glucose >140 mg%.

In the present study, the incidence of heart failure was significantly higher in patients with stress hyperglycemia. **(TABLE 2,04).** The incidence of left ventricular failure was 10% in patients with blood sugar < 126 mg%, 51.3% in patients having blood sugar 126-200 mg%, and 65.2% in patients having blood sugar > 200 mg%.**(TABLE 2).** Capes et al 6 (2000) did a systematic review and meta-analysis and reported that glucose concentrations higher than values in the range of 8-10.00 mmols/L on admission were associated with higher risk of heart failure.

CARDIOGENIC SHOCK

In the present study, there was no significant difference between the incidence of cardiogenic shock between those having hyperglycemia either stress related or diabetes related . **(TABLE 3).** Capes et al 6 (2000) reported that glucose concentrations higher than the 8 mmols/L on admission were associated with cardiogenic shock in patients without diabetes .But such a significant association was not seen in the present study.

ARRHYTHMIAS:

In the present study there was no significant difference in the development of arrhythmia in patients with or without stress hyperglycemia. **(O6).** The study considered only specific arrhythmias i.e. arrhythmias which required treatment. This finding was consistent with observation by Bellodi et al 11 (1989) who reported that there is no significant relation between plasma glucose and arrhythmia.

Singhvi et al 12 (2000) reported 34% patients developed conduction blocks in patients with stress hyperglycemia versus 19.36% in patients without stress hyperglycemia. We did not find any significant difference in the conduction blocks in cases and controls. **(O5).**

High mortality in hyperglycemic class was related to higher incidence of heart failure in that class. We did not assess infarct size. Bellodi et al 11(1989) reported that, when patients were matched for age and infarct site, hyperglycemia was significantly associated with heart failure and this association was characterized by remarkable mortality rate.

Stress hyperglycemia occurring in the early stages of acute myocardial infarction increases the risk of future cardiovascular morbidity and mortality. Evidence that use of insulin to lower glucose concentration, decreases the mortality in patients with diabetes who have myocardial infarction suggests that hyperglycemia is not simply an epiphenomenon of stress response mediated by cortisol and catecholamines (Swedarsen et al 1988).10

HBA1C AND BLOOD SUGARS (TABLE 5)- the HBA1c was normal in Group A and Group B but was abnormal only in diabetes group.ie Group C.

CONCLUSION

We therefore conclude that in non diabetic patients with acute myocardial infarction and stress hyperglycemia the risk of cardiac failure, arrhythmias, cardiogenic shock and death are higher. Also the complications are directly proportional to level of blood glucose on admission and adequate control of hyperglycemia will help to decrease morbidity and mortality.

ABBREVIATIONS:

1. AMI- Acute myocardial Infarction
2. O – Observation.

REFERENCE

1. Lakhdar A and Stromberg P: Prognostic importance of hyperglycemia induced by stress after acute myocardial infarction. BMJ 1984: 288: 288. | 2. Cruickshank N : Coronary thrombosis and myocardial infarction with glycosuria. BMJ 1931 : 1 : 618-19.(Quoted by Capes et al2000). | 3. Oliver MF, Opie LH : Effects of glucose and fatty acids on myocardial ischemia and arrythmias. Lancet 1994 : 343 : 155-58. | 4. Graber AL, McDonald Teresa: Newly identified hyperglycemia a among hospitalized patients. Southern medical journal, vol 93, No 11, Nov2000:1070. | 5. Hashemipour M et al :Stress hyperglycemia in pediatric emergency department. Scientific journal of Kurdistan University of medical sciences, vol.16, No.4, summer2002. | 6. Capes SE et al: Stress hyperglycemia and increased risk of death after acute myocardial infarction in patients with and without diabetes: a systematic overview. Lancet 2000: 355: 773-78. | 7. McCowen K C: Endocrine and metabolic dysfunction syndromes in the critically ill. Stress induced hyperglycemia. Critical Care Clinics : Vol. 17 : 1 : Jan 2001. | 8. Harrison's Principles of internal medicine.15th ed. Criteria for the diagnosis of diabetes mellitus .p2111. | 9. Wackers FJT et al: Assessment of the value of electrocardigraphic signs for myocardial infarction In left bundal branch block,in:Wellens HJJ, Kulbertus HE.eds:Whats new in electrocardiography? The Hague,The Netharlands:Martinus Nuhoff,1981:37-57. | 10. Sewdarsen M: Prognostic importance of admission plasma glucose in diabetic and non-diabetic. Quarterly Journal of Medicine, New Series 71 : No.265 : 461-466, May 1989. | 11. Bellodi G et al: Hyperglycemia and prognosis of acute myocardial infarction in patients without diabetes mellitus. Am J Cardiol 1989: 64: 885-888. | 12. Singhvi D et al: Prognostic significance of stress hyperglycemia in non-diabetic patients of acute myocardial infarction. JAPI Jan 2000. | 13. Oswald GA et al: Prevalence and risk of hyperglycemia and undiagnosed diabetes in patients with acute myocardial infarction. Lancet 1984 : 1 : 1264-1267. | 14. Yudkin JS, Oswald GA : Determinants of hospital admission and case fatality in diabetic patients with myocardial infarction. Diabetes Care 1988 : 11 :355-358. | 15. Oswald GA et al: Determinants and importance of stress hyperglycemia in non-diabetic patients with myocardial infarction. BMJ 1986 : 293 : 917-22.