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Stress Hyperglycemia an Independent Predictor of Underlying LV Systolic Dysfunction

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ABSTRACT

Aim: *The aim of this study was to assess the incidence of stress hyperglycemia as an independent predictor of underlying Left Ventricular systolic dysfunction in patients with AMI in non diabetic patients and to compare the severity of coronary artery disease in patients with stress hyperglycemia to those with normal glucose tolerance and those known to have DM in the setting of AMI.* ***Design/Methods:*** *A total of 100 patients with AMI (both with ST segment and Non ST segment elevation) were included, of which 73 were male and 27 were female patients. Blood samples were collected at the time of admission and analyzed for blood glucose and cardiac enzyme levels. Echocardiography was performed on 3-5days and left ventricular ejection fraction (LVEF) was measured.* ***Results:*** *In 33.8 % patients with stress hyperglycemia , 54.1 % diabetic patients and 12.2 % patients with normal glucose tolerance had multi vessel disease with significant P value of <.001* ***Conclusions:*** *We conclude that this study provides further evidence to support the previous finding that stress hyperglycemia is common in AMI in non diabetic patients and also suggests that the severe coronary artery disease is present not only in the diabetes group but also in the stress hyperglycemia group. Statistically association was observed between stress hyperglycemia and underlying severe LV dysfunction in patients with AMI.*

KEYWORDS : Hyperglycemia, Diabetes Mellitus, Acute Myocardial Infarction and Left Ventricular systolic dysfunction

I. Introduction:

Diabetes Mellitus (DM) is an established major cardio vascular risk factor for coronary artery disease[1]. Patients with DM have higher incidence of acute myocardial infarction and congestive cardiac failure[2].

Abnormally elevated blood glucose is a common finding in patients with acute myocardial infarction and has been referred to as stress hyperglycemia[3] .The significance of hyperglycemia observed after AMI has stimulated renewed interest .Studies done earlier has shown that stress hyperglycemia in patients has diabetes mellitus or not.

Data regarding the relationship between stress hyperglycemia and extent of coronary artery disease in non diabetic patients with AMI are limited. [4]

Cardio vascular disease is the leading global cause of death worldwide accounting for 17.3 million deaths / year and is commonly associated with myocardial infarction[5].

Acute myocardial infarction is characterized by loss of contractile tissue and changes in ventricular geometry. Complications of MI include ischemic, mechanical, arrhythmic, embolic and inflammatory of which LV dysfunction accounts for most fatalities. Despite the progress in the diagnosis and treatment of AMI 40% of the patients develop LVSD after AMI[2]

Diabetes is associated with a higher risk of death or heart failure hospitalization across the spectrum of left ventricle ejected fraction (LVEF) in high-risk post-myocardial infarction patients. The magnitude of reduction in risk of death or heart failure hospitalization associated with increasing LVEF is significantly attenuated among patients with diabetes when compared to patients without diabetes.

The aim of our study is assess the incidence of stress hyperglycemia an independent predictor of underlying LV systolic dysfunction in patients with AMI in non diabetic patients and to compare the severity of coronary artery disease in patients with stress hyperglycemia to those with normal glucose tolerance and those known to have DM in the setting of AMI[5].

II. MATERIALS AND METHODS

IIa. Experimental Design

One Hundred patients in the age group of 30-80 admitted in the intensive care unit of Meenakshi Medical College Hospital and Research Institute, Kanchipuram, Tamil Nadu were included in the study. This includes 73 male and 27 female patients with acute myocardial infarction in whom a provisional diagnosis was made with specific changes in electrocardiogram, indicating STEMI and NSTEMI patients. Patients demographic data, including sex, age, and risk factors for cardiac events including high-risk age (men >45, women >55 years old), smoking history, medical history of hypertension, hyperlipidemia, diabetes, and a positive family history, drug history, presence of arrhythmia, laboratory data, ECG, and echocardiography findings, were recorded. Blood samples were collected at the time of admission and analyzed for cardiac enzyme levels and cell count. Echocardiography was performed on 3-5days and left ventricular ejection fraction (LVEF) was measured.

The inclusion criteria for the patients with acute coronary syndrome (ACS) were.

The criteria for STEMI were as follows[6]:

An increase in the levels of myocardial necrosis (troponin >1 ng/ml);

New ST elevation from the J point in two or more contiguous leads with an elevation of at least 0.2 mV in leads V1, V2 and V3 or at least 0.1 mV in the remaining leads during the first 24 hours following the onset of the symptoms.

Patients were also included if a new ST-segment elevation in the pre-

senting electrocardiogram was associated with a recent episode of chest pain but in whom it was not possible to obtain analysis of myocardial necrosis.

The criteria for defining of NSTEMI[6] were:
Increased levels of markers for myocardial necrosis (as for STEMI) along with the presence of either symptoms of ischemia or alterations of ST-segment (except persistent ST-segment) elevation.

Exclusion Criteria
Patients with history of infection or systemic inflammation during the last 15 days, or with hepatic, renal or haematologic disease at admission, and those who did not sign the informed consent proforma were excluded from the study.

IIb. Echocardiographic studies :
Echocardiographic measurements were obtained by using the HP Sonos 5500 echocardiography machine on 3-5 days of admission. Left ventricular end diastolic volume, end systolic volume and ejection fraction, were assessed from the apical four-chamber view using Simpson's rule. Based on LVEF patients were divided into

Normal- LVEF>50%
Mild- LVEF 40-50%
Moderate-LVEF 30-40%
Severe-LVEF<30%

III. Statistical Analysis
Datas were analyzed using the SPSS software package, version 17.0 (SPSS Inc., Chicago, Illinois, USA).. Qualitative data were analyzed using the χ^2 -test;. The Pearson coefficient was used to analyze the correlation between any two variables. *P* value was assumed to be statistically significant at0.05.

IV. ETHICAL CONCERN
Ethical clearance was obtained from the Ethical committee meeting conducted at Meenakshi Medical College and Research institute, Kanchipuam, Tamil Nadu, India

V. Results
Of the Total 100 patients, 73 were male and remaining 27 were female (Fig.1). The age of the patients ranged from 30-80 years (Fig.2). Most of the patients were male with a mean age of 56.2+14.2.

Fig 1 -Sex Distribution

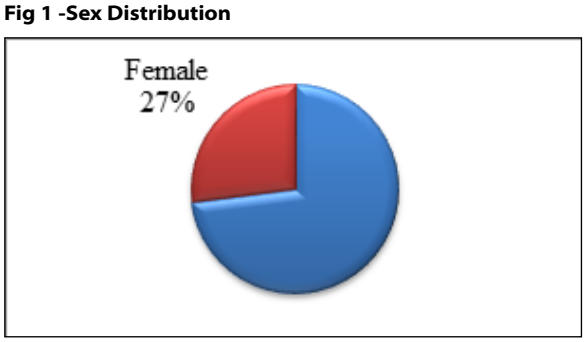

Fig 2 -Age Distribution

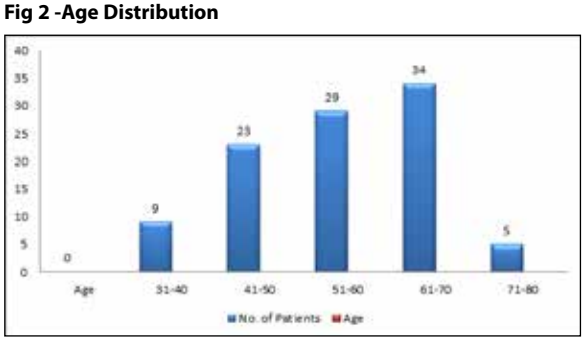

Table:1. Baseline characteristics of the study population (n-100) according to absence/presence of stress hyperglycaemia on admission

Particulars	Glycaemia < 7 mmol/L	Glycaemia > 7.0 mmol/L	P-value
Body mass index, kg/m2	25.2±2.3	27.4±4.5	0.96
Heart rate, b.p.m	64±9	67±10	0.84
Systolic blood pressure, mmHg	113±13	108±11	0.06
Diastolic blood pressure, mmHg	68±13	63±10	0.12

Median glycaemia on admission was 7.0 (6.1–8.7) mmol/L. Table 1 summarizes the baseline characteristics of the study population according to the presence or absence of SH defined as a glycaemia on admission >7.0 mmol/L. Patients with SH were older and more frequently female; peak CK and the proportion of patients with a final TIMI flow grade ,3 were higher in patients with SH.

STEMI and NSTEMI Myocardial Infarction
Table 2. shows that Anterior wall MI was diagnosed in 53 patients followed by inferior wall MI in 27 patients. NSTEMI was diagnosed in 20 patients.

Table 2 : Diagnosis at the time of presentation n = 100

Diagnosis	No. of patients	Percentage
Anterior-wall MI	53	53%
NSTEM1	20	20%
Inferior wall M1	27	27%

LVEF measured showed 25 patients with severe LVEF(LVEF<30%).,-followed by 30 patients with moderate LVEF(30-40%) and 25 patients had mild LVEF (LVEF-40-50%) 20 patients had normal LVEF

Multivariate analysis shows stress hyperglycemia is independent predictor of multi vessel
Table.3. shows that Multivariable analyses were performed to determine independent predictors of LV remodeling. We performed univariate and multivariate analyses to investigate which of the clinical variables and risk factors were independently associated with multi vessel disease in acute MI. Age, male sex, LDL level, stress hyperglycemia, Anterior wall myocardial infarction and inferior wall infarction were significant predictors of multi vessel disease by univariate analysis. By multivariate analysis, age, male sex and stress hyperglycemia were independent predictors. Among these parameters, stress hyperglycemia were independently and significantly associated with multivessel disease (odds ratio 4.6,95 % confidence interval 1.17 to 18.7) with significant P value of 0.028.

Variables	Odds ratio		95 % confidence interval		P value
	Multivessel disease	Single vessel disease	Multivessel disease	Single vessel disease	
Age > 55	3.376	1.921	.869	13.169	.079
Male sex	6.223	6.282	1.488	26.027	.012
LDL > 130	1.982	.991	.272	3.612	.989
Stress hyperglycemia	4.6	2.1	1.177	18.752	.028
AWMI	.298	2.1	6.7 E	1.3	.110
IWMI	.189	1.117	.308	7.567	.186

VI. DISCUSSION
Previous studies have demonstrated that patients with SH on admission for acute MI are at increased risk of mortality and congestive heart failure[6]. Moreover, it has been suggested that SH-associated risk may be greater in patients with MI who do not have antecedent

diabetes than in those with diabetes. In a systematic overview of the literature, SH was associated with a highly significant increase in risk of in-hospital death in non-diabetic patients, whereas in diabetic patients the risk of death was only moderately increased. More recently, a study performed in a very large sample of elderly patients demonstrated that the association between admission glucose and mortality was not limited to the early in-hospital phase but extended up to 1-year follow-up. In this study, the relationship significantly higher in patients with SH. SH was also associated with more systolic abnormalities at predischarge echocardiography as judged by the WMSI; however, there was only a non-significant trend for a lower EF in patients withSH. Although parameters measured at hospital admission or discharge is helpful to predict mid- and long-term clinical outcome after MI, they may not be the most accurate prognostic indicators. Indeed, follow-up studies have documented progressive changes in the LV chamber size, shape, muscle mass, and function during the early months or years following MI, a process known as LV dysfunction. LV dysfunction has been recognized as a major predictor of heart failure and cardiovascular death after MI.

Previous studies have suggested that SH could reduce collateral flow to the risk area[6], could abolish the effect of preconditioning[7], or may be associated with the no-reflow phenomenon[8].

The CARISMA study enrolled patients with a recent MI and LV systolic dysfunction. The patients were implanted with an implantable loop recorder and followed for 2 years allowing continuous monitoring and diagnosis of asymptomatic and symptomatic arrhythmias[9]. Diastolic dysfunction in post myocardium infracted patients with moderate to- severe left ventricle systolic dysfunction predisposes to cardiovascular ischemic events such as re-infarction and stroke. New-onset atrial fibrillation also occurs more frequently in patients with diastolic dysfunction. Re-infarction and stroke were more frequent in patients with new onset atrial fibrillation, but the increased risk of ischemic events was independent of development of atrial fibrillation, suggesting that diastolic dysfunction in infracted patients by itself is an important risk factor for ischemic events[10].

Although various predictive factors of LV dysfunction have been suggested by prior studies[11,12], there is still a need for non-invasive, widely available, and relatively inexpensive methods to estimate the risk of LV dilation after MI in routine clinical practice. At present, risk stratification is largely based on the results of predischarge echocardiography. If confirmed in independent studies, our finding that SH is a strong independent predictor of LV dysfunction, even when predischarge echocardiographic variables are taken into account, may have important clinical implications.

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