Original research-Orijinal araştırma

Stress hyperglycemia as a prognostic indicator in non-diabetic myocardial infarction patients

Non-diabetik miyokard enfarktüsü hastalarında prognostic bir gösterge olarak stres hiperglisemisi

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Abstract

Aim. The present study aims to find out prognostic importance of stress hyperglycemia and incidence of various complications in patients of Acute myocardial infarction (MI) without diabetes mellitus. **Method.** We studied 50 patients admitted with acute MI without previous diabetes mellitus. Blood glucose level were estimated at time of admission and regularly thereafter. Glycosylated hemoglobin was estimated at the time of admission to rule out diabetes. Based on the blood glucose level at time of admission, patients in the study were divided into two groups i.e. Group A (patients with blood glucose level <140 mg/dL) and group B (patients with blood glucose level ≥140 mg/dL). Incidence of various complications of MI and mortality was compared between two groups. **Results.** Incidence of heart failure in group B patients was 52% as compared to group A patients with 36% incidence (p value <0.05). Incidence of arrythmias and heart block in group B patients was 24% and 28% respectively where in group A patients was 12% and 12% respectively (p value <0.05). Mortality rate was 20% in group B patients compared to group A patients (4%)(p value <0.05). **Conclusion.** Stress hyperglycemia is common in patients of acute myocardial infarction. Patient with stress hyperglycemia have more adverse events including heart failure, arrhythmias, heart block, re-infarction and mortality. So it is advised that in all patients with AMI, blood glucose level should be estimated at time of admission to prognosticate and for early initiation of appropriate preventive measures.

Keywords: Myocardial infarction, heart failure, stress hyperglycemia, arrhythmia

Özet

Amaç. Bu çalışmanın amacı diabetes mellitusu olmayan akut myokard enfarktüsü (ME) hastalarında çeşitli komplikasyonların insidansı ve stress hipergilsemisinin prognostic öneminin saptanmasıdır. **Yöntem.** Bilinen diabetes mellitusu olmayan 50 akut myokard enfarktüslü hasta çalışmaya dahil edildi. Kan glukoz düzeylerine hastanın ilk başvurusunda daha sonra da düzenli olarak bakıldı. Hastanın kabülünde diyabetin ekarte edilmesi için glikolize hemoglobin bakıldı. Başlangıç glukoz düzeylerine dayanılarak hastalar 2 gruba ayrıldı. Grup A'yı kan glukoz düzeyleri <140 mg/dL olan hastalar oluştururken grup B'de kan glukoz düzeyleri ≥140 mg/dL olan hastalar yer aldı. Her iki grup ME'nin çeşitli komplikasyonları ve mortalite açısından kıyaslandı. **Bulgular.** Grup B'de kalp yetmezliği insidansı % 52 olarak saptanırken, grup A'da bu oran %36 olarak bulundu. (p <0.05).Grup B'deki hastalarda aritmi ve kalp bloğu insidansı sırasıyla %24 ve %28 iken grup A'da bu oranlar sırasıyla %12 ve%12 olarak bulundu (p <0.05). Grup B'deki hastalarda mortalite oranı %20, grup A'da ise %4 bulundu. (p<0.05). **Sonuç.** Akut miyokard enfarktüslü hastalarda stress hiperglisemisi sık rastlanılan bir durumdur. Stres hiperglisemisi olan hastalarda kalp yetmezliği, aritmi, kalp bloğu, re-enfarktüs ve mortalite gibi yan etkiler daha yüksek oranda görülmektedir. Bu nedenle akut ME'lü tüm hastalarda kabülden itibaren kan şekerinin bakılması özellikle prognozun belirlenmesi ve uygun önlemlerin bir an önce alınabilmesi için önerilmektedir.

Anahtar sözcükler: Miyokard enfarktüsü, kalp yetmezliği, stres hiperglisemisi, aritmi

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Introduction

Ischemic heart disease has become one of the most common illnesses in the today's world with acute myocardial infarction presenting as emergent manifestation having significant mortality and morbidity and complication rate. Various indicators have been proposed to predict the severity and complications of episode of acute myocardial infarction for example clinical profile, electrocardiogram changes, hemodynamic parameters, cardiac size, metabolic acidosis and cardiac enzymes. Elevated free fatty acids, cortisol and catecholamines and depressed insulin secretion have also been characterized in patients with myocardial infarction. Hyperglycemia is common in patients of acute myocardial infarction in the initial phase and appears to be related to stress mechanism and is a reflection of relative insulin deficiency, associated with elevated free fatty acids. Previous reports of relationship between admission plasma glucose levels and development of cardiac failure have been found [1]. Therefore, the present study was planned to assess the prognostic importance of non diabetic hyperglycemia in acute myocardial infarction and to find incidence of various complications in AMI patients without diabetes mellitus, thereby permitting early initiation of appropriate preventive measures.

Material and methods

Present study comprised of 50 consecutive patients who had evidence of AMI diagnosed by clinical examination, electrocardiogram and other investigations. Patients with diabetes mellitus, septicemia, endocrine disorders, comorbid conditions, and on drugs affecting blood glucose levels like - Beta blockers, thiazides, glucocorticoids were excluded from study. Patients with HbA1C values above 6.5% were considered diabetic and were excluded from the study. All patients were briefed about the research protocol and a written consent of participation was taken thereafter. On admission, random blood sugar was determined as early as possible and patients were stratified into two groups i.e. with admission blood glucose levels < 140 mg/dL (Group A) and those with blood glucose levels ≥ 140 mg/dL (Group B). 25 consecutive patients of each group were included in the study. Blood glucose levels were repeated thereafter on 3rd day and 7th day. Electrocardiogram was taken in each and every case immediately after admission and also repeated as and when required. Assessment of cardiovascular system was made daily or as frequently as needed in cases with complications. All cases were followed for 7 day for occurrence of complications. The various values were expressed as mean±1SD. The results were analysed in percentage and compared by using unpaired t-test

Results

There was no statistically significant difference in the mean age, male to female ratio between the two groups (Table I).

Table 1. Showing demographic profile.

Sr. No.	Parameter	Group A	Group B
1	Mean age	48.23±10.23	47.47±11.02
2	Male" Female ratio	4:1	4:1
3	Mean random blood sugar	115.8±16.4	173±23.3
4	Mean fasting blood sugar day 3	102.4±12.6	108.5±12.9
5	Mean PP blood sugar day 3	128.4±14.4	140.5±13.8
6	Mean fasting blood sugar day 7	101.4±12.4	100±11.8
7	Mean PP blood sugar day 7	127.3±13.3	126.8±12.8

All patients were assessed for any adverse cardiovascular events during hospitalization for 7 days. Incidence of heart failure was present in 09 (36%) patients in group A while in

group B was in 13 (52%) while incidence of arrythmias in group A patients in was 3 (12%) compared to group B in 6 (24%) respectively) (Table 2). Incidence of post infarction angina was 3 (12%) in group A, compared to 4 (16%) in group B and incidence of heart block in group A was 3 (12%) compared to group B 7 (28%).

Table 2. Showing comparison of cardiac adverse events.

Sr. No.	Parameter	Group A	Group B
1	Heart failure	9 (36%)	13 (52%)
2	Arrythmias	3 (12%)	6 (24%)
3	Post infarction angina	3 (12%)	4 (16%)
4	Heart block	3 (12%)	7 (28%)
5	Re-infarction	0 (0%)	1 (4%)
6	Mortality	1 (4%)	5 (20%)

Incidence of reinfarction in group A patients was nil compared to 1 patients (4%) in group B and mortality rate in group A was 1 (4%) compared to group B where it was 5 (20%)

Discussion

The hyperglycemia and impaired glucose tolerance (IGT) are common during AMI. This hyperglycemia may result from stress or may be due to preexisting undiagnosed DM or IGT. Stress hyperglycemia in the initial phase of acute myocardial infarction appears to be related to stress mechanism and is a reflection of relative insulin deficiency and excess of adrenaline, glucagon and steroid hormones with elevated free fatty acids. Glucose appears to be a more favourable energy source than free fatty acids for ischemic myocardium by more efficiently replenishing the Krebs cycle and stimulating contractile performance. Insulin is needed for glucose uptake in myocardium and relative insulin deficiency causes suboptimal uptake. Hyperglycemia measured on admission in most non diabetic patients with AMI is determined both by extent of infarction mainly through the secretion of adrenaline and other stress hormones that are independent of infarct size [2]. In experimental myocardial infarction it has been suggested that the stimulus to adrenaline release is a reflex arising from receptors at the site and boundary of the infarct. Hyperglycemia is a reflection of relative insulin deficiency which is associated with increased lipolysis and excess circulating free fatty acids which though normally a substrate of choice for healthy myocardium, are toxic to the ischemic myocardium [3, 4]. Furthermore, acute hyperglycemia may precipitate osmotic diuresis. The resulting volume depletion may interfere with frank starling mechanism [5-7]. Otto et al. [8] showed that hyperglycemia may lead to inflammation by enhancing cytokine production via the direct effects of hyperosmotic stress. Impaired phagocytosis and oxidative burst under hyperglycemia may weaken defense mechanisms of the host, hence attempting to explain the basis of negative outcomes associated with hyperglycemia in various settings of critical illness. The hyperglycemia after AMI is associated with an increased risk of CHF, cardiogenic shock, arrythmia and hospital mortality regardless of diabetic status [9]. The recent studies have also shown that hyperglycemia increases the risk of mortality during cardiopulmonary bypass [10]. Intensive secondary preventive measures and intensive insulin treatment improve outcome of AMI in patients with hyperglycemia [11].

In the present study adverse cardiovascular events i.e. arrythmia, CHF, post infarction angina, heart block, re-infarction and death were more common in group B patients (admission blood glucose $\geq$ 140 mg/dL) than group A patients ($p<0.05$). Our findings matched with other studies. Capes et al. [3] showed that patients of AMI with hyperglycemia are at increased risk of in hospital mortality, CHF and cardiogenic shock. Timmer et al. [12] divided the patients of AMI on basis of admission glucose level, group I (<7.8 mmol/L), group II (7.8-11.0 mmol/L) and group 3 (>11.0 mmol/L). Group III patients had marked reduction in left ventricular function and high mortality rate than group II patients, whereas group I patients had the lowest mortality rate and better left

ventricular function than other groups [11]. Oswald et al. [13] showed that in-hospital mortality increased significantly in patients of AMI with increasing plasma glucose concentration. The finding in the present study released high adverse cardiovascular events in patients of AMI with stress hyperglycemia. Therefore, it is recommended that in all patients with AMI, random blood glucose should be measured at admission and at discharge. In setting of AMI, stress hyperglycemia is very common. These patients with hyperglycemia developed more adverse cardiovascular events as compared to patients with normal glucose tolerance. Therefore, in all patients of AMI, a basal blood glucose level be performed at admission to predict cardiovascular complications and early institution of therapy. Also blood glucose levels may be repeated at discharge from hospital to detect glucose abnormalities as early as possible to prevent future adverse cardiovascular events.

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