Original Article

Hyperglycemia and in-hospital outcomes after first myocardial infarction

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ABSTRACT

Objective: To determine in-hospital outcomes post AMI hyperglycemia.

Methods: 109 patients of acute myocardial infarction were included in this study. Physical examination, ECG tracings, random plasma glucose, serum cholesterol, triglycerides and cardiac enzymes (CPK, LDH and AST) were measured. Hyperglycemic patients (plasma glucose ≥ 126mg/dl) were sub-divided into those with a previous history of diabetes and those without any such history.

Results: Post AMI plasma glucose levels were exceptionally higher in female patients aged 61-70 years while they were moderately higher in males of age groups 31-40 and 51-60, and females of age group 41-50 years. In-hospital mortality rate was greater in hyperglycemic patients. Most importantly also, significantly greater complications of the heart were encountered in hyperglycemics.

Conclusion: Post AMI patients are at a greater risk of developing diabetes and concurrent AMI attack. (Rawal Med J 2006;31:55-57)

Key Words: AMI, Hyperglycemia, ECG, Cardiac enzymes.

INTRODUCTION

Acute myocardial infarction (AMI) is the rapid development of myocardial necrosis.[1] It is characterized by chest pain, characteristic pattern of cardiac enzymes elevations and development of ECG changes.[2] Positive family history of ischemic heart disease, smoking, hypertension, hyperlipidemia, diabetes mellitus, increasing age are known risk factors of AMI.[3,4] There exists strong evidence that high blood glucose is a powerful predictor for in-hospital mortality following AMI in patients with or without diabetes mellitus.[5] High blood glucose concentration immediately after AMI poses greater risk for subsequent cardiovascular disease (CVD).[6] Capes *et al*[7] found that mean glucose concentrations were consistently greater in patients who died than those who recovered from AMI. Fasting glucose or hemoglobin A concentration just above the normal range increases the risk of CVD.[8] In fact blood glucose predicts increased cardiovascular morbidity and mortality even at levels below the threshold for established diabetes.[9] Diabetic patients therefore have approximately two fold higher risk of short-term morbidity and mortality after AMI.[10] Diabetes and thrombus formation each conveys increased cardiovascular risk but in combination they become even more powerful.[11] The present study was undertaken in hospitalized AMI patients to examine post- AMI patients for hyperglycemic mortality and morbidity.

MATERIALS AND METHODS

The study was conducted at cardiac care unit, Federal Government Services Hospital, Islamabad. 109 AMI patients; 82 males (75.2%) and 27 females (24.8%) (age range 31-70 years) were selected. Patients with age <30 and >70 years, serious disabling illness, unconsciousness, congestive heart failure, rheumatic heart disease, congenital heart disease and arrhythmias were excluded from study. Commercial kits were used to measure plasma glucose, serum cholesterol, triglycerides (TG), lactate dehydrogenase (LDH), Alanine aminotransferase (AST), and creatine phosphokinase (CPK). Low-density lipoprotein cholesterol (LDL-C) was calculated by standard formula.

The study was approved by the ethical committee of Pakistan Medical Research Council, Ministry of Health, Islamabad for research on human subjects. Written informed consent was obtained from patients. Data were analyzed on MS Excel Spreadsheet (Windows 2000). Correlation coefficient (*r*) was determined for each variable and $p<0.05$ was considered significant difference.

RESULTS

Blood sugar and related parameters demonstrated greater in-hospital mortality and significantly greater cardiac pathologic complications in AMI patients who turned hyperglycemic after AMI attack and those who were known diabetics (Table 1). In all age groups except 61-70 years, male AMI patients were predominantly greater than females. ECG recordings showed 87% patients with Q wave MI and 4% with non-QMI.

Hypertensive, hyperglycemic, hyperlipidemic and smokers' percentages in both sexes and age groups showed variation (Fig. 1).

Table 1. In-hospital outcomes after first AMI in patients with and without diabetes

Outcomes	Patients	Hyperglycemic	Non-hyperglycemic
In-hospital death			
	Non-diabetic *(n=77)*	2.6% *(n=2)*	1.3% *(n=1)*
	Diabetic *(n=32)*	3.2% *(n=1)*	--
Complications			
LVF or CHB LBBB or AF or RVF or acute pericarditis	Non-diabetic *(n=77)*	6.4% *(n=5)*	13% *(n=1)*
	Diabetic *(n=32)*	16.1% *(n=5)*	9.7% *(n=3)*

LVF: left ventricular failure
CHB: complete heart block
LBBB: left bundle branch block
AF: atrial fibrillation
RVF: right ventricular failure

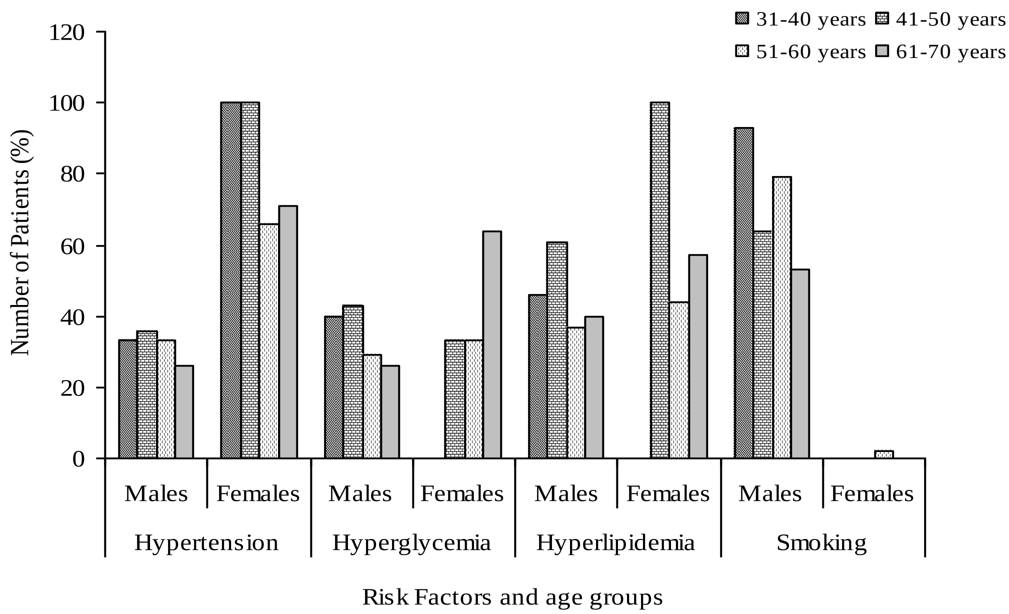
Plasma glucose levels were significantly elevated in males aged 31-40 and 51-60 years while they were elevated in females 41-50 and 61-70 years. Only, males of age group 31-40 years, while both males and females of age group 41-50years had greater cholesterol levels. TG were higher in all patients aged 31-40 and 41-50years while in the age group 51-60 years, only males had higher TG. Mean CPK, LDH and AST levels were significantly elevated in all age groups. Significant and positive correlations were obtained for hyperglycemic condition with parameters indicative of heart failure related complications, risk factors of AMI and cardiac enzymes in age groups 31-40 and 41-50 years and for age groups 51-60 and 61-70 years.

DISCUSSION

This study confirms that diabetic condition before AMI and hyperglycemic condition after AMI significantly increase in-hospital morbidity and mortality. No mortality was recorded in non-hyperglycemic and known diabetics and was understandably due to insulin therapy, as in our study, patients who were admitted to the hospital included both diabetics and non-diabetics. Earlier studies attribute post-AMI elevation of serum glucose levels to the release of glucocorticoids leading to stress hyperglycemia.[12] Hyperglycemia observed by us was quite possibly stress related.

Presently, the percentage of hyperglycemics turned 28.4% in all AMI patients which is noticeably greater than that reported previously where prevalence of diabetes among patients with AMI varied between 10-24%,[13] while the prevalence of previously undetected diabetes was 5%.[14] AMI patients with no previous diagnosis of diabetes have a high prevalence of insulin resistance both during the hospital stay and three months thereafter and that the insulin resistance is unchanged from hospital discharge and during three months of follow-up.[15]

Figure 1. Risk factors in AMI patients of different age groups.



Hypertension may be a more potent risk factor for AMI in women than in men.[16] This study showed the same, since there were more hypertensive women (86%) than men. Conversely, female hyperlipidemics percentage was greater (50%) than males (46%). Hyperlipidemia is already known to be a major contributor to cardiovascular disease and decreasing the cholesterol value by 1mg/dl reduces cardiovascular risk by 2%.[17] Because prevalence of diabetes mellitus in AMI patients is high and diabetic prevalence in populations will increase rapidly over the next few decades,[18] management of diabetic patients with acute coronary syndrome would have a substantial impact on future morbidity and mortality and health care expenditures. The principal finding of the study is that diabetes, cholesterol, HDL, LDL, hypertension and cardiac enzymes were all positively correlated with hyperglycemia. Triglycerides had positive correlation with hypertension, diabetes and LDL. In conclusion, in-hospital mortality which occurred from AMI actually results from stress hyperglycemia and may be a significant finding for the coronary artery disease patients.

REFERENCES

1. Pasternek RC, Braunwald E. Acute myocardial infarction. Harri. Prin.Inte. Med 1997; 13: 1066-1067
2. World Health Organization. Definition diagnosis, and classification of diabetes mellitus and its complications I. Diagnosis and classification of diabetes mellitus 1999; 99: 2
3. Tenerz A, Norhammar A, SIlveria A, Nilsson G, Ryden L, Mamberg K. Diabetes, insulin resistance and the metabolic syndrome in patients with acute myocardial infarction without previously known diabetes. Diabetes Care 2003; 26:2770-2776
4. Zaman, SK, Roohi S, Faruqui MA. Clinical Profile of 400 cases of acute MI admitted at N.I.C.V.D. Pak Heart J 1995; 28:78-81
5. Holt BD, Gilpin EA, Maisel AA. Influence of obesity on morbidity and mortality after acute myocardial infarction. Am Heart J 1987; 14: 1333 -1341
6. Young ME, McNulty P, Taegtmeyer H. Adaptation and maladaptation of the heart in diabetes. Circulation 2002;105:1861-1870

7. Capes SE, Houd D, Malmberg K, Gerstein HC. Stress hyperglycemia and increased risk of death after myocardial infarction in patients with and without diabetes: a systematic overview Lancet 2000; 355:733-778

8. Wannamethee SG, Perry IJ, Shaper. A non-fasting serum glucose and insulin concentrations and the risk of stroke. Stroke 1999;30:1780-1786.

9. U.K. Prospective Diabetes Study (UKPDS) Group. Intense blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998;352: 837-853

10. Karlson BW, Herlitz J, Hjalmarson A. Prognosis of acute myocardial infarction in diabetics and non-diabetic patients. Diabet Med 1993;10:449-454

11. Raeven R. Role of Insulin resistance in human disease. Diabetes 1988;37:1596-1607

12. Fava S, Azzopardi J, Muscat HA, Fenech FF. Factors that influence out come in diabetic subjects with myocardial infarction. Diabetes Care 1993;16:1615-1618

13. Gu K, Cowie CC, Harris MI. Diabetes and decline in heart disease mortality in US adults. JAMA 1999;281:1291-1297

14. Oswald G, Corcoran S, Yudkin J. Prevalence and risks of hyperglycemia and undiagnosed diabetes in patients with acute myocardial infarction. Lancet 1984; 1:1264–7

15. Tenerz A, Norhammar A, SIlveria A, Nilsson G, Ryden L, Mamberg K. Diabetes, insulin resistance and the metabolic syndrome in patients with acute myocardial infarction without previously known diabetes. Diabetes Care 2003;26:2770-2776
16. Bell MD, Matthew AF, Michael DE, Alan KH, Carlton HP, Jain CA. Characteristics of west Virginians having myocardial infarction. SMJ 1998:91 :1042-1046
17. Rosenson RS. Myocardial injury; the acute phase response and lipoprotein metabolism. J Am Col Cardiol 1993;22:933-940
18. King L, Aubert R, Herman W. Global burden of diabetes, 1995-2025. Prevalence, numerical estimates, and projections. Diabetes Care 1998;21:1414-1431