Frequency of Undiagnosed Diabetes Mellitus and its Short Term Complication in Hyperglycemic Patients of Acute Myocardial Infarction

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ABSTRACT

Aim: To determine the frequency of undiagnosed diabetes mellitus and stress hyperglycemia in hyperglycemic patients of acute myocardial infarction presenting in emergency department of a tertiary care hospital.

Methods: It was descriptive case study done at emergency ward and medical wards of mayo hospital Lahore. A total of 300 patients were included in this study. Accucheck alpha glucometer was used for capillary glucose measurement in each patient. HbA1c was sent to lab on the same day. Analysis for HbA1c for all samples was done to determine frequency of stress hyperglycemia and undiagnosed diabetes mellitus.

Results: Mean age of the patients was 56.9±9.3 years. Out of 300 patients, 197 patients (65.7%) were male while remaining 103 patients (34.3%) were female. Undiagnosed diabetes mellitus was diagnosed in 165 patients (55%). Stress hyperglycemia was present in 135 patients (45%) Regarding outcome, post-MI angina was present in 35 patients (21.2%) of undiagnosed diabetes (n=165) and 11 patients (8.1%) of stress hyperglycemia (n=135). Heart failure developed in 41 patients (24.9%) of undiagnosed diabetes and in 13 patients (9.6%) of stress hyperglycemia.

Conclusion: It is concluded that post-MI angina and heart failure is more common in patients of undiagnosed diabetes when compared with stress hyperglycemia.

Keywords: Undiagnosed DM, Stress hyperglycemia, acute myocardial infarction

INTRODUCTION

Diabetes is a strong risk factor for coronary artery disease. Macro vascular complications, though not correlated linearly with glycosylated hemoglobin (HbA1c), still may develop early in diabetes mellitus. Concomitant atherosclerosis may follow an accelerated course in type 2 diabetes[1].

The prevalence of diabetes for all age-groups worldwide was estimated 2.8% in 2000 and going to be 4.4% by 2030. The total number of people with diabetes worldwide is projected to rise from 171 million in 2000 to 366 million in 2030. Pakistan is going to be ranked 5th in world by 2030 expecting to harbor 14 million people with diabetes mellitus[2]. In Pakistan, the estimated prevalence of diabetes by Shera et al is 12.14% in males and 9.83% in females. Overall total glucose intolerance (diabetes and impairedglucose tolerance) was present in 16.68% males and 19.37% females[3].

There are well defined guideline for diagnosis of diabetes mellitus laid down by American Diabetes Association[4] and International Diabetic Federation[5]. Despite this, single measurement of blood sugar may

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not be sufficient and need repeat measurements for definite diagnosis. National Health and Nutrition Examination Survey III group found high variability in 2-hour glucose levels relative to fasting glucose levels and high variability in both of these values relative to HbA1c levels[6].

Okosieme et al found a high prevalence of abnormal glucose tolerance in patients with acute coronary syndrome. The prevalence of diabetes and impaired glucose tolerance were 27 and 39%, respectively, according to oral glucose tolerance test criteria[7]. Ishihara et al found that in non-diabetic patients with acute myocardial infarction, admission hyperglycaemia did not necessarily represent previously undiagnosed diabetes. Fasting glucose and HbA1c, rather than admission glucose, might be more useful to predict abnormal glucose tolerance[8]. Mani said that the hyperglycaemia could represent stress hyperglycaemia which is a common occurrence in patients admitted to ICU with acute coronary syndrome. Stress hyperglycaemia is defined as a transient elevation of blood glucose due to stress of illness[11].

American Diabetes Association (ADA) has recently included HbA1c >6.5% being diagnostic of diabetes mellitus in addition to its already ascribed criteria of fasting plasma glucose >126mg/dl and 2-

hours plasma glucose >200mg/dl in oral glucose tolerance test or random glucose >200mg/dl with classical symptoms of hyperglycaemia. This new criteria may be helpful in cases where only conventional measurements of blood sugar do not lead to a confirm diagnosis of diabetes mellitus[4]. International Federal of Clinical Chemistry and Laboratory Medicine have issued a consensus statement for worldwide standardization of HbA1c measurement[9].

Previous literature shows the frequency of undiagnosed diabetes in patients of acute coronary syndrome to be 24%[10] and that of stress hyperglycemia to be 13.7%[10]. The frequencies of unstable angina, arrhythmias and heart failure among these undiagnosed diabetic patients are 75.7%, 52.9% and 73%, respectively and the frequencies of unstable angina, arrhythmias and heart failure among stress hyperglycemic patients are 24.3%, 47.1% and 27% respectively.

This study will help to encourage the screening of patients of acute myocardial infarction with admission hyperglycemia for diabetes mellitus in previously undiagnosed cases which is not routinely, done which results in many patients discharged undiagnosed and at a very high risk of macro and micro vascular complication in future, although recommended by various studies listed above and will also help us to manage complication vigilantly developing secondary to myocardial infarction in patients with undiagnosed diabetes and with stress hyperglycemia. Secondly we will compare the outcome of the patients with stress hyperglycemia and diabetes mellitus (undiagnosed) to further emphasize its timely diagnoses and risk stratification.

MATERIAL AND METHODS

It was case descriptive study done at emergency and medical wards of mayo hospital Lahore study was carried out over a period of six months from 02-02-2012 to 31-07-2012. A total of 300 patients of acute myocardial infarction with hyperglycemia were included in our study according to inclusion and exclusion criteria who presented in emergency department of Mayo hospital, Lahore, through informed consent. Accucheck alpha Glucometer by Rosche was used for capillary glucose measurement in each patient. HbA1c was sent to lab on the same day. Analysis for HbA1c for all samples were done on Architect ci800 analyzer manufactured and provided by Abbott diagnostics. Pakistan to determine frequency of stress hyperglycemia and undiagnosed diabetes mellitus. All this information was collected through a proforma.

Patients were admitted in the hospital and followed up for three days to look for outcome i.e. angina and heart failure in both groups as per operational definitions. All data were entered and analyzed in SPSS 12 version. Age was presented in the form of mean±SD. Gender, undiagnosed diabetes mellitus and stress hyperglycemia and its complications were presented in the form of frequency and percentages i.e. (post MI angina and heart failure).

RESULTS

A total of 300 patients of acute transmural MI (patients presenting with typical ischemic chest pain along with electrocardiographic changes of acute ST elevation MI) with hyperglycemia were included in this study during the study period of 6 months from 01-04-2012 to 30-09-2012. Majority of the patients i.e., 103(34.3%) were between 41-60 years of age and minimum patients 35(11.7%) were 20-30 years old. Mean age was 56.9±9.3 (Table 1). Out of 300 patients, 197 patients (65.7%) were male while remaining 103 patients (34.3%) were female (Table 2).

Undiagnosed diabetes mellitus was diagnosed in 165 patients (55%). Stress hyperglycemia was present in 135 patients (45%) (Table 3, 4). Regarding outcome, post-MI angina was present in 35 patients (21.2%) of undiagnosed diabetes (n=165) and 11 patients (8.1%) of stress hyperglycemia (n=135). Heart failure developed in 41 patients (24.9%) of undiagnosed diabetes and in 13 patients (9.6%) of stress hyperglycemia (Table 4, 5).

Table-1: Distribution of cases by age

Age (Year)	n	%age
20-30	35	11.7
31-40	89	29.7
41-60	103	34.3
61-70	73	24.3
Total	300	100.0
Mean±SD	56.9±9.3	

Table 2: Distribution of cases by gender

Gender	n	%age
Male	197	65.7
Female	103	34.3
Total	300	100.0

Table-3: Distribution of cases by undiagnosed diabetes mellitus (DM)

Undiagnosed DM	n	%age
Yes	165	55.0
No	135	45.0
Total	300	100.0

Table 4: Distribution of cases by stress hyperglycemia

Stress hyperglycemia	n	%age
Yes	135	45.0
No	165	55.0
Total	300	100.0

Table-5: Comparison of outcome of patients having undiagnosed diabetes mellitus with those having stress hyperglycemia

Outcome	Undiagnosed diabetes n=165	Stress hyperglycemia n=135
Post-MI angina	35(21.2%)	11(8.1%)
Heart failure	41(24.9^	13(9.6%)

DISCUSSION

Diabetes is considered a highly 'vascular disease' with both micro vascular and macro vascular complications. Macro vascular complications start taking place long before the patient has overt diabetes[14]. Hyperglycemia is an independent risk factor for cardiovascular disease[15].

HbA1c levels of more than 7% are associated with a significant increase in the risk of cardiac events and deaths. Interestingly, this correlation between higher HbA1c levels and increased cardiovascular morbidity occurs even before the diagnosis of clinical diabetes[16].

Heart disease in patients with Diabetes Mellitus (DM) is different from that in non-diabetics. Diabetics develop coronary artery disease (CAD) earlier, and have more extensive atherosclerosis[17]. Several previous studies have shown that the prevalence of coronary artery disease (CAD) is higher in patients with diabetes[18].

The 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[19].

Glucose appears to be a more favorable 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. 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.

The hyperglycemia after AMI is associated with an increased risk of CHF, cardiogenic shock, arrhythmia and hospital mortality regardless of diabetic status. The recent studies have also shown that hyperglycemia increases the risk of mortality during cardiopulmonary bypass. Intensive secondary preventive measures and intensive insulin treatment improve outcome of AMI in patients with hyperglycemia.

In the present study adverse cardiovascular events i.e. heart failure, unstable angina, were detected with hyperglycemia in both groups.

In present study, complications like heart failure and post-MI angina were seen more in diabetics with HbA1c >7% as compared to patients with stress hyperglycemia. These results are consistent with the study of Mani et al[11]. Our findings are supported by the study of Bertoni et al[20] and Lu et al.

Hyperglycemia directly induces apoptosis and myocyte necrosis, which in turn leads to systolic and diastolic dysfunction. The UKPDS study showed that by maintaining intensive glycemic control with (HbA1c < 7%), there was a 16% reduction in the risk of myocardial infarction, but this correlation was not statistically significant.

Stress hyperglycemia even in non-diabetics, is associated with many abnormalities usually seen in diabetics, like increased oxidative stress, inflammation and activation of stress responsive kinases. In fact, some studies have shown even higher cardiovascular mortality and morbidity in patients with hyperglycemia in previously undiagnosed diabetes than in patients with known diabetes or normoglycemic subjects.

CONCLUSION

It is concluded that post-MI angina and heart failure is more common in patients of undiagnosed diabetes when compared with stress hyperglycemia. These patients with hyperglycemia developed more adverse cardiovascular events as compared to patients with normal glucose tolerance.

REFERENCES

1. Stolar M. Glycemic control and complications in type 2 diabetes mellitus. Am J Med 2010;123:3–11.
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27:1047-53.
3. Shera AS, Basit A, Fawwad A, Hakeem R, Ahmedani MY, Hydrie MZ, et al. Pakistan National Diabetes Survey: prevalence of glucose intolerance and

associated factors in the Punjab Province of Pakistan. Prim Care Diabetes 2010;4:79-83.

4. American Diabetes Association: Executive Summary: Standards of Medical Care in Diabetes—2010. Diabetes Care 2010;33:S4-10.

5. IDF clinical guidelines task force. Global guideline for Type 2 diabetes. Brussels: International diabetes federation. [Online] 2005 [cited 2010 April 30]; Available from: http://www.idf.org/ webdata/docs/IDF%20GGT2D.pdf

6. Selvin E, Crainiceanu CM, Brancati FL, Coresh J. Short-term variability in measures of glycemia and implications for the classification of diabetes. Arch Intern Med 2007;167:1545-51.

7. Okosieme OE, Peter R, Usman M, Bolusani H, Suruliram P, George L, Evans LM. Can admission and fasting glucose reliably identify undiagnosed diabetes in patients with acute coronary syndrome? Diabetes Care. 2008;31:1955-9.

8. Ishihara M, Inoue I, Kawagoe T, Shimatani Y, Kurisu S, Hata T, et al. Is admission hyperglycaemia in non-diabetic patients with acute myocardial infarction a surrogate for previously undiagnosed abnormal glucose tolerance? EurHeart J2006;27:2413–9.

9. American Diabetes Association, European Association for the Study of Diabetes, International Federation of Clinical Chemistry and Laboratory Medicine, International Diabetes Federation Consensus statement on the worldwide standardisation of the HbA1c measurement. Diabetologia 2007;50:2042–3.

10. Ramachandran A, Chamukuttan S, Immaneni S, Shanmugam RM, Vishnu N, Viswanathan V, et al. High incidence of glucose intolerance in Asian-Indian subjects with acute coronary syndrome. Diabetes Care 2005;28:2492-6.

11. Mani VE, John M, Calton R. Impact of HbAlc on acute cardiac states. J Assoc Physicians India 2011;59:356-8.

12. Haffner SM, Stern MP, Hazuda HP. Cardiovascular risk factors in confi rmed prediabetic individuals. Does the clock for coronary heart disease start ticking before the onset of clinical diabetes. JAMA 1990;263;2893-8.

13. Laakso M. Dyslipidemia, morbidity and mortality in non-insulin dependent diabetes mellitus: lipoprotein and coronary heart disease in Non-insulin Dependent Diabetes Mellitus. J Diabetes Complication 1999;11:137-41.

14. Brownlee M. Advanced glycosylation in diabetes and aging. Ann Rev Med 1988;46:223-4.

15. Garcia MJ, McNamara PM, Gordon T, Kannel WB. Morbidity and mortality in diabetes in the Framingham population. Diabetes 1974;23:105-16.

16. Gerstein HC. Glycosylated Hemoglobin. Finally ready for prime time as a cardiovascular risk factor. Ann Intern Med 2004;141:475-6.

17. Goraya TY, Leibson CL, Palumbo PJ. Coronary atherosclerosis in diabetes mellitus. A population based study. J Am Coll Cardiol 2002;40:946-53.

18. Mohan V, Shanthirani CS, Deepa R. Urban diff erences in the prevalence of the metabolic syndrome in Southern India. The Chennai Urban Population Study (No.4). Diabet Med 2001;18:280-7.

19. Oswald SB. Determinants and importance of stress hyperglycemia in non-diabetic patients with myocardial infarction. Br Med J 1986;293:921.

20. Bertoni AG, Hundley WG, Massing MW. Heart failure prevalence, incidence and mortality in the elderly with diabetes. Diabetes Care 2004;27:699-703.