Original Research Article

HbA1c: A Marker for Severity of Acute Myocardial Infarction

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International Archives of Integrated Medicine, Vol. 3, Issue 5, May, 2016.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 07-04-2016 **Accepted on:** 15-04-2016
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Gosavi S, Karande S, Raut K. HbA1c: A Marker for Severity of Acute Myocardial Infarction. IAIM, 2016; 3(5): 89-93.

Abstract

Introduction: Diabetes mellitus is considered a disease with a major impact on the vascular tree with both microvascular and macrovascular complications. Hyperglycaemia is independent risk factor for cardiovascular diseases. HbA1c could be considered as a good marker for glycemic control. Recent reports have found that elevated HbA1c levels are also predictive for cardiovascular disease and mortality. Present study was undertaken to find out the correlation between HbA1c levels and complications and outcome in patients of acute myocardial infarction.

Materials and methods: Present prospective observational study was conducted on 200 patients admitted to the medical wards in hospital with acute myocardial infarction with or without diabetes mellitus. After a detailed history and physical examination, HbA1c, lipid profile, cardiac enzymes, ECG and echocardiogram were performed in all patients. The patients were then divided into two groups based on the HbA1c levels i.e. good glycemic control (HbA1c< 7%) and poor glycemic control (HbA1c>/= 7%).Data was analysed using SPSS software ver. 21 using appropriate statistical tests. P-value of less than 0.05 was taken as level of significance

Results: Poor glycemic control was seen in 52.5% patients. No difference was observed between the groups with respect to gender distribution, duration of hospital stay and patient's outcome. Past history of MI was found to be significantly associated with poor glycemic control (53.3% vs 38.9%). On comparing the association of outcome in high risk groups as per glycemic control, we observed that poor outcome in MI was significantly associated with elderly population (16.9% vs 3.5%; p< 0.05).

Conclusions: In patients with age greater than 60 years, the occurrence of higher HbA1c levels is found to be associated with increased incidence of mortality. So, high HbA1c in elderly population should be considered a risk factor for mortality and hence active management should be done to keep HbA1c level strictly below 7 in this population.

Key words

Acute Myocardial Infarction, BMI, Dyslipidemia, Elderly, HbA1c.

Introduction

Diabetes mellitus is considered a disease with a major impact on the vascular tree with both microvascular and macrovascular complications. It is well known that microvascular complications start taking place long before the patient has overt diabetes. Hyperglycaemia is independent risk factor for cardiovascular diseases (CVD). Hyperglycaemia accelerates the process of atherosclerosis by the formation of glycated proteins and products, which act by increasing the endothelial dysfunction leading to macrovascular complications.

In acute coronary syndromes, glucose metabolism is modified, and stress hyperglycaemia commonly occurs [1] secondary to increased catecholamine levels. Due to stress hyperglycaemia, a method looking only at plasma glucose levels at the time of an AMI cannot be used to predict the prognosis. Thus, glycosylated haemoglobin (HbA1c) values may reveal diabetes in cases of AMI [2]. The Framingham study has shown that the cardiovascular mortality is twice in diabetic men and four times in diabetic women when compared to their non-diabetic counterparts.

HbA1c could be considered a good marker of glycated proteins and its assay has been used as a measure of glycemic control in several landmark trials. Moreover, a recent report found that elevated HbA1c levels are also predictive for cardiovascular disease and mortality in patients without diabetes mellitus, regardless of fasting glucose levels, indicating that long-term glycometabolic derangement in the sub-diabetic range also poses a risk for cardiovascular disease [3]. HbA1c levels of more than 7% are associated with a significant increase in the risk of cardiac events and deaths [4].

Present study was undertaken to find out the correlation between HbA1c levels and complications and outcome in patients admitted with acute myocardial infarction in our hospital.

Materials and methods

Present prospective observational study was conducted on 200 Patients admitted during the period of 1st January 2014 to 31st December 2014. Patients admitted to the medical wards in hospital with acute myocardial infarction with or without diabetes mellitus were included in the study.

Inclusion Criteria

Patients with Acute Myocardial Infarction includeed Acute myocardial infarction(AMI) both ST elevation (STEMI) and non ST elevation (NSTEMI).

Exclusion Criteria

- Patient‘s refusal to participate
- Patient with sepsis, hemoglobinopathy or hypothyroidism.
- Those patient who’sHbA1c cannot be obtained.
- Those with sub-acute or chronic MI (longer than 48 hours between first symptom and admission)

Methodology

After a detailed history and physical examination, HbA1c, lipid profile, cardiac enzymes, ECG and echocardiogram were performed in all patients. Blood was collected by co-investigator in vaccutainors (1 ml in EDTA bulb for CBC, 1 ml in fluoride bulb for blood sugar levels and 3 ml each for LFT/RFT/ Sr. lipids and sent to central laboratory by morning/afternoon trolley that comes for collections.

Sample for serum HbA1c level (3 ml in EDTA bulb, collected within 3hrs of admission) was sent to Endocrine laboratory in our hospital for HbA1c level. The patients were then divided into two groups based on the HbA1c levels i.e. good

glycemic control (HbA1c< 7%) and poor glycemic control (HbA1c>/= 7%). The treatment was given as per treatment protocol. Patients were followed up till discharge/death and all complications like arrhythmias, cardiac failure and cardiogenic shock were noted.

Statistical Analysis

After data collection, the analysis was done by SPSS software ver. 21 using appropriate statistical tests. p value of less than 0.05 was taken as level of significance.

Results

Out of the total 200 patients, 58.5% were males and 52.5% had HbA1c levels of 7% or more. No difference was observed between the patients with good and poor glycemic control with respect to gender distribution, duration of hospital stay and patient's outcome. Past history of MI was found to be significantly associated with poor glycemic control (53.3% vs 38.9%) (**Table - 1**).

On comparing the association of outcome in high risk groups as per glycemic control, we observed that poor outcome in MI was associated with elderly population (16.9% vs 3.5%; p< 0.05), obesity (9.1% vs. 0%; p-0.09) and dyslipidemia (15.2% vs 4.2%; p- 0.24). Thought the association was only significant with age above 60 years (**Table - 2**).

Table – 1: Comparison of various parameters among glycemic control groups.

Variable	HbA1c		p- value
	<7	>/= 7	
Male	61 (64.2%)	56 (53.3%)	**0.15**
Deaths	8 (8.4%)	12 (11.4%)	**0.64**
Past history of MI	37 (38.9%)	56 (53.3%)	**0.047**
Hospital stay (days)	5.84 +/- 1.15	5.8 +/- 1.36	**0.83**

Table – 2: Association of outcome in high risk groups with glycemic control.

Poor outcome (Death)	HbA1c		p- value
	<7	>/= 7	
Age > 60 years (n=128)	2 (3.5%)	12 (16.9%)	**0.02**
Male (n=117)	5 (8.2%)	9 (16.1%)	**0.25**
BMI > 25 Kg/m^2 (n=71)	0 (0.0%)	3 (9.1%)	**0.09**
Dyslipidemia (n=70)	1 (4.2%)	7 (15.2%)	**0.24**
Hypertension (n=110)	5 (10.6%)	8 (12.7%)	**1**

Discussion

Major advances in cardiovascular disease, and specifically the treatment of acute coronary syndrome (ACS), have had a significant impact on the morbidity and mortality of patients with acute myocardial infarctions (AMI). Despite these advances, diabetes continues to put patients with and without a prior history of myocardial infarction at significant cardiovascular risk [5].

The presence of diabetes doubled the age-adjusted risk for cardiovascular disease in men and tripled it in women in the Framingham Heart Study, and it remained an independent risk factor even after adjusting for age, hypertension, smoking, hyperlipidemia, and left ventricular hypertrophy [6]. In a meta-analysis of 13 prospective cohort studies, for every one-percentage point increase in glycosylated haemoglobin (HbA1c), the relative risk for any

cardiovascular event was 1.18 (95% CI 1.10–1.26) [7]. Interventional studies have established that cardiovascular complications are mainly or partly dependent on sustained chronic hyperglycaemia [8, 9]. This glycemic disorder can be estimated as a whole from the determination of HbA1c level, which integrates both basal and postprandial hyperglycaemia [10, 11]. HbA1c reflects the average blood glucose concentrations over the preceding 2-3 months. There are advantages of HbA1c testing compared with plasma glucose. The measurement of HbA1c is well standardized, and the biologic variability is less and does not require fasting. In addition, it is relatively unaffected by acute changes in glucose levels. Therefore, we assessed the correlation betweenHbA1c levels and severity and complications of patients admitted with acute myocardial infarction in our hospital.

In our prospective observational study of 200 patients, we studied correlation between age, sex, BMI, hypertension, dyslipidemia and outcome in acute myocardial infarction with respect to HbA1c level. The duration of hospital stay in our study amongst patients with HbA1c<7 and HbA1c>7 was similar. This was in contradiction to the study conducted by Bhatia et al in which it was shown that there is a positive correlation between duration of hospital stay and HbA1c level [12].

With respect to sex, there was no significant correlation with elevated HbA1c in these cardiac disease patients; this is in agreement with the study conducted by Cakmak, et al.[13] who studied 100 patients with elevated HbA1c and could not detect any significant correlation between sex and clinical results. In patients aged above 60, we observed that the incidence of death is significantly higher in patients whose HbA1c levels were higher than 7. We also found out that the incidence of previous history of AMI/acute myocardial infarction is significantly higher in patients with HbA1c>7. However, we did not find any correlation between elevated HbA1c levels and outcome in patients with BMI (below or above 25), dyslipidemia and hypertension.

Several studies showed that although crude mortality data was higher in patients with elevated HbA1c following adjustment for many cardiovascular risk factors, HbA1c values failed to predict mortality independently. Others suggested that HbA1c level was a potent predictor of in-hospital and long-term death [14-19]. A recent study reported the association between mortality and HbA1c among 5815 diabetic patients with heart failure appeared U-shaped, HbA1c $\leq$ 7.1 and > 7.8% all associated with higher risk of death [20].

Conclusion

In patients with age greater than 60 years, the occurrence of higher HbA1c levels is found to be associated with increased incidence of mortality. So, high HbA1c in elderly population should be considered a risk factor for mortality and hence active management should be done to keep HbA1c level strictly below 7 in this population.

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