HbA1c: A Marker for Severity of Acute Myocardial Infarction

Santosh Gosavi, Shilpa Karande, Kapil Raut

Abstract

Hyperglycaemia is independent risk factor for cardiovascular diseases. HbA1c could be considered as a good marker for glycaemic 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. 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 glycaemic control (HbA1c<7%) and poor glycaemic 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. Poor glycaemic 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 glycaemic control (53.3% vs 38.9%). On comparing the association of outcome in high risk groups as per glycaemic control, we observed that poor outcome in MI was significantly associated with elderly population (16.9% vs 3.5%; p<0.05). It was concluded that 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, Dyslipidaemia, 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 glycaemic 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 includes Acute myocardial infarction (AMI) both ST elevation (STEMI) and non ST elevation (NSTEMI).

*Exclusion Criteria*

1. Patient’s refusal to participate
2. Patient with sepsis, haemoglobinopathy or hypothyroidism.
3. Those patient who’s HbA1c cannot be obtained.
4. 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 vaccutainers (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 glycaemic control (HbA1c < 7%) and poor glycaemic 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 glycaemic 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 glycaemic control (53.3% vs 38.9%)(table 1). On comparing the association of outcome in high risk groups as per glycaemic 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 dyslipidaemia (15.2% vs 4.2%; p= 0.24). Thought the association was only significant with age above 60 years (table 2).

**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, hyperlipidaemia, 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]. Intervventional studies have established that cardiovascular complications are mainly or partly dependent on 
sustained chronic hyperglycaemia [8,9]. This glycaemic 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 between HbA1c 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, dyslipidaemia 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), dyslipidaemia 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 ≤ 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 
imcreased 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.

**References**

1. Husband DJ, Alberti KG, Julian DG. —Stress‖ hyperglycaemia during acute myocardial infarction: An 
2. Oswald GA, Yudkin JS. Hyperglycaemia following acute myocardial infarction: The contribution of 


TABLES

Table 1. Comparison of various parameters among glycaemic control groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>HbA1c</th>
<th>p-value</th>
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<tbody>
<tr>
<td></td>
<td>&lt;7</td>
<td>&gt;/= 7</td>
</tr>
<tr>
<td>Males</td>
<td>61</td>
<td>56</td>
</tr>
<tr>
<td>Deaths</td>
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<td>12</td>
</tr>
<tr>
<td>Past History of MI</td>
<td>37</td>
<td>56</td>
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<tr>
<td>Hospital Stay (days)</td>
<td>5.84 +/- 1.15</td>
<td>5.8 +/- 1.36</td>
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</table>

Table 2. Association of outcome in high risk groups with glycaemic control

<table>
<thead>
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<th>Poor Outcome (Death)</th>
<th>HbA1c</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>&lt;7</td>
<td>&gt;/= 7</td>
</tr>
<tr>
<td>Age &gt; 60 years (n=128)</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Males (n=117)</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>BMI &gt; 25 Kg/m2 (n=71)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Dyslipidaemia (n=70)</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Hypertension (n=110)</td>
<td>10.6%</td>
<td>12.7%</td>
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