

ORIGINAL ARTICLE

A Study of Clinical Significance of HbA1c  
In Acute Myocardial Infarction

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**ABSTRACT**

**BACKGROUND AND OBJECTIVES:** Our study was performed in 100 patients, divided into two groups – Diabetics and non-Diabetics, to analyse the significance of HbA1c in patients with acute Myocardial Infarction. Study was concentrated on how two groups with different average HbA1c presented with regards to various complications of acute MI. To study To determine level of HbA1c in patients with acute myocardial infarction in both groups of patients (Diabetics and Non-Diabetics) and 2) Prospective observation of outcome in form of severity and complications in patients admitted with acute myocardial infarction in group A & group B. **METHODS:** Total 100 patients with acute MI were observed during this study, 52 of which were Diabetics (Group A) and 48 were Non-Diabetics (Group B). HbA1c levels were done in all patients and patients were observed for outcome in form of severity and complications. **RESULTS:** Group A patients (Diabetics), the ones with high HbA1c levels, had a significantly higher incidence of complications of acute MI, even death, when compared with group B non-diabetics with lower HbA1c. Even among group B patients without overt Diabetics, average HbA1c was higher than normal. **CONCLUSION:** We conclude at the end of this study that there is a strong correlation between HbA1c levels and various complications associated with acute myocardial infarction. There is also a significant correlation of mortality due to acute MI and HbA1c levels. We conclude that HbA1c might be considered a marker for prognosis for acute MI patients.

**Keywords:** Diabetes, Hba1c, Acute Myocardial infarction, complication of AMI.

**INTRODUCTION**

Diabetes is one of the leading causes of death and disability. The worldwide prevalence of diabetes has risen dramatically from 30 million cases in 1985 to 382 million in 2013. A recent estimate suggest that diabetes is responsible for almost 5.1 million (8%) death worldwide.<sup>1</sup> Not only that, India is soon going to be the “Diabetes capital of the world” with number of patients expected to cross 79.4 million by year 2030.<sup>2</sup> Which means the deaths due to Diabetes are going to spiral out of control too. Diabetes mellitus is a disease with a major impact on the vascular bed, with both microvascular and macrovascular complications.

It is well known that microvascular complications start taking place long before the patient has overt Diabetes Mellitus. Hyperglycemia is independent risk factor for cardiovascular diseases (CVD). Hyperglycemia accelerates the process of atherosclerosis by the formation of glycated protein and products, which act by increasing the endothelial dysfunction leading to macrovascular complications. Diabetes is also a risk factor for other risk factors for CVD or Myocardial Infarction, like Hypertension and Obesity. If we look from the other side, Coronary artery disease (CAD) is the cause of death in more than half of all diabetic patients. Patients with diabetes but without other conventional risk factors for atherosclerosis have a risk of death from CAD 2– 4 times that of age-matched controls.<sup>3–6</sup> Women with diabetes are at increased risk, with a risk of cardiovascular death up to 7.5 times that of women without diabetes. Diabetic women

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do not have the premenopausal benefit seen in the general female population.<sup>4,5,7</sup> The incidence of triple vessel or multi-vessel disease is significantly higher with the duration of diabetes more than 10 years. Patients with poor glycemic control with elevated levels of HbA1c have diffuse pattern of atherosclerotic disease and are more likely to require CABG.<sup>8</sup> So, it stands to reason that an index for Diabetes could be considered to be having clinical significance in outcome of Diabetes Mellitus. In acute coronary syndromes, glucose metabolism is modified, and stress hyperglycemia commonly occurs secondary to increased catecholamine levels. Due to stress hyperglycemia, a method looking only at plasma glucose levels at the time of an AMI cannot be used to predict the prognosis. Thus Glycosylated Haemoglobin may not only be very important for diagnosis of Diabetes in the patients of MI (as it depends on the average glycemic control over last 3 months, but might be considered to have a prognostic value. Despite all this, Traditional risk factors for myocardial infarction, such as elevated blood lipids, hypertension and smoking, have been paid much attention, whereas blood glucose per se seems to have been neglected. So, our study aims to find out the correlation between HbA1c levels and severity and complications of patients admitted with acute myocardial infarction in our hospital in ICCU.

#### **OBJECTIVES**

- To study To determine level of HbA1c in patients with acute myocardial infarction in both groups of patients (Diabetics and Non-Diabetics)
- Prospective observation of outcome in form of severity and complications in patients admitted with acute myocardial infarction in group A & group B.

#### **MATERIALS AND METHODS**

A prospective observational study was conducted among 100 Diabetics attending OPD and the patients admitted in the

wards of Department of medicine, Medical College, Baroda from November 2015 to November 2016. All the patients were recruited after getting their free, fair and full written consent. The study protocol was approved by the institutional ethical committee. We enrolled patients into Group A (Diabetics) and B (Non-Diabetics), with 52 and 48 patients respectively. Our sample size was counted using software n Master 2.0, with 90% power and 99% confidence interval considering minimal sample size of 44 per group. All our patients suffered from Acute myocardial infarction (AMI), including both ST elevation MI (STEMI) and non ST elevation MI (NSTEMI). (Duration of symptoms <48 hours). We identified patients as having Myocardial infarction as per the Universal definition of MI (as per European Society of Cardiology [ESC], the American college of Cardiology Foundation [ACCF], the American Heart Association [AHA], and the World Heart Federation as detection of cardiac biomarker, along with at least one of the 5 diagnostic criteria

1. Symptoms of ischemia.
  2. New [or presumably new] significant ST/T wave changes, i.e. ST Segment elevation (with reciprocal depression in the opposite leads) > 2 mm in leads v1-v3 or >1 mm in two contiguous leads or new left bundle –branch block [LBBB].
  3. Development of pathological Q waves on ECG (Initial Negative deflection of 0.04 seconds or more in leads other than avR and v1).
  4. Imaging evidence of new loss of viable myocardium or regional wall motion abnormality on echocardiography.
  5. Identification of intracoronary thrombus by coronary angiography or autopsy
- The patients were then divided into group A (Diabetics) and B (no-Diabetics). In patients without prior history of diabetes mellitus, a diagnosis of diabetes mellitus will be made,
- 1) If they have HbA1c 6.5 or higher or
  - 2) If FBS>126 and PP2BS>200 .<sup>9</sup>

Patients who refused to participate or those without an ACUTE MI (Those >48 hours since onset of symptoms) were excluded from the study. After admission, Hb1Ac level was done in all patients and they were followed up till discharge and all complications like, Accelerated hypertension, Arrhythmia, heart failure, chamber dilatation, Systolic dysfunction, Diastolic dysfunction, effect on left ventricular ejection fraction, Cardiogenic shock, Death observed in both group. The analysis was done with appropriate statistical software. Qualitative data was presented with the help of free and % table, association among various study parameters were assessed with chi square test.  $p < 0.005$  was taken as level of significance. Thus severity and complication in patient with AMI in group A and group B was assessed with chi-square test. Result was analysed using excel sheet and epi info software for “p” value.

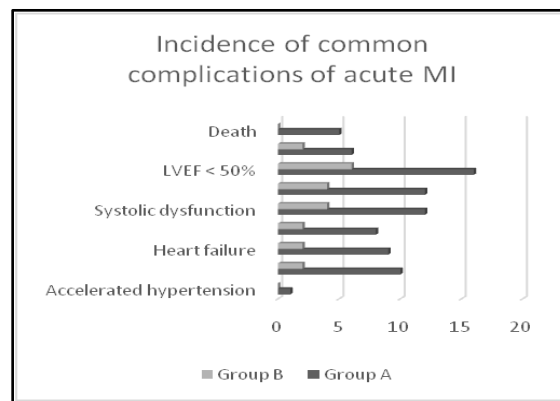
**OBSERVATIONS**

During our study, following distribution of HbA1c level was noted among our patients.

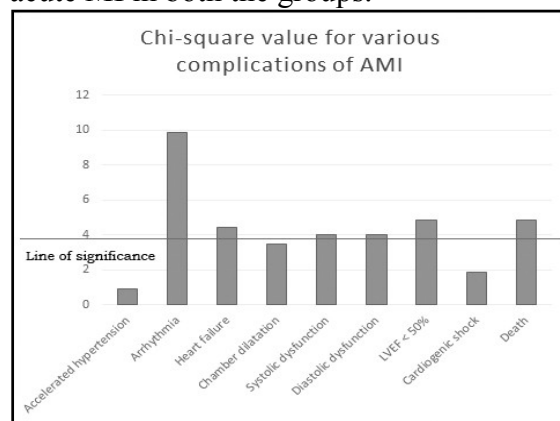
**Table 1 and Figure 1 & 2: Distribution HbA1c levels in both groups**

HbA1c	Group A Diabetics (n= )		HbA1c	Group B Non Diabetics (n= )	
	No.	%		No.	%
<6.5	11	21.28	<5	01	2.24
7-9	16	30.72	5-5.5	14	29.16
9-11	18	34.56	5.6-6	15	31.20
>11	07	13.44	>6	18	37.40
<b>Total</b>	<b>52</b>	<b>100</b>	<b>Total</b>	<b>48</b>	<b>100</b>

During our study, we followed patients for multiple complications, including death and compared both groups using Pearson chi-square test to see if occurrence was comparable in both groups. Our study revealed following data. We analysed the data with Pearson Chi-square test to see if incidence of complication was comparable in various complications commonly associated with acute MI in both the groups.



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We further analysed the results to see if the results were significant at p value of <0.05, to determine if the Group A patients were indeed more likely to have certain complications, statistically speaking.

**Table 2: comparison of various complications of acute MI in both groups**

Parameters	Group A		Group B		P value
	No. of patients	%	No. of patients	%	
Accelerated hypertension	1	1.92	0	0.00	0.3342
Arrhythmia	10	19.23	2	4.17	<b>0.0017</b>
Heart failure	9	17.31	2	4.17	<b>0.0359</b>
Chamber dilatation	8	15.38	2	4.17	0.0617
Systolic dysfunction	12	23.08	4	8.33	<b>0.0445</b>
Diastolic dysfunction	12	23.08	4	8.33	<b>0.0445</b>
LVEF < 50%	16	30.77	6	12.50	<b>0.0276</b>
Cardiogenic shock	6	11.54	2	4.17	0.1745
Death	5	9.62	0	0.00	<b>0.0275</b>

## DISCUSSION

On analysing the data, we found that there was an extremely significant correlation between arrhythmias high HbA1c levels, as chi-square value for this analysis was as high as 9.83, with highly significant p value of 0.0017. Furthermore, as seen in table 2 and chart 2, there was a significant correlation between systolic and diastolic dysfunction and HbA1c levels, which is similar to studies by Bertoni et al<sup>10</sup> and Lu et al.<sup>11</sup> Hyperglycemia directly induces apoptosis and myocyte necrosis, which in turn leads to systolic and diastolic dysfunction.<sup>12</sup> The UKPDS study showed that by maintaining intensive glycaemic control with showed that by maintaining intensive glycaemic control with (HbA1c < 7%), there was a 16% reduction in the risk of myocardial infarction, but this correlation was not statistically significant.<sup>13</sup> Our study also found a statistically significant correlation between Heart Failure/Low ejection fraction,(Table 2 and Chart 2) cardiogenic shock and death, which is comparable with our reference study of Vinita et al.<sup>14</sup> Our study, however, did not find a statistically significant correlation between HbA1c and chamber dilatation, cardiogenic shock and accelerated Hypertension, which differed from Vinita et al. The correlation between HbA1c and cardiovascular disease was seen even among the non-diabetics in our study. The mean HbA1c level of non-diabetics was 5.7 + 0.6, (Table 1) which is higher than that of mean HbA1c levels of normal population studied earlier.<sup>15</sup> Majority of our non-diabetic patients i.e. 33/48 (68.6%) had HbA1c levels  $\geq 5.5\%$  and 18/48 (37.4%) had HbA1c levels  $\geq 6\%$  (Table 1). It is well known that the macrovascular complications start taking place at lower blood sugar levels than the diagnostic cut off values for diabetics.<sup>16</sup> Our study had a relatively smaller subgroup size which did not allow us to perform a subgroup analyse to see if the relationship between the cardiac complications and HbA1c levels was linear, which is something that really

needs to be looked into with depth. However, the stark difference between the two groups in number of complications, (Chart 1) and how both groups have significantly different HbA1c levels, it definitely points in this direction.

## CONCLUSION

We conclude at the end of this study that there is a strong correlation between HbA1c levels and various complications associated with acute myocardial infarction. There is also a significant correlation of mortality due to acute MI and HbA1c levels. We conclude that HbA1c might be considered a marker for prognosis for acute MI patients, as well as a target to prevent the mortality and morbidity associated with it. With this study, we recommend considering HbA1c testing yearly in patients with age more than 35 years and introduce lifestyle modifications, not just for Diabetes, but also for prevention of ischaemic heart disease, if HbA1c was found to be higher than 5.5. A more aggressive approach to testing for Ischaemic heart disease in patients with HbA1c more than 5.5 is also advisable. An HbA1c level measurement at the time of admission for all acute MI patient is also advisable for both treatment and prognosis purpose. An early diagnosis of Diabetes and an aggressive early management of the same can significantly reduce not only the incidence of ischaemic heart disease, but also the complication associated with it, which in turn would significantly reduce the mortality and morbidity associated with it.

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