Original Article

Relationship between Haemoglobin A1c and Short Term Outcome in Patients with ST-elevation Myocardial Infraction (STEMI)

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Abstract:

Introduction: Every year, 17.1 million lives are claimed by the global burden of cardiovascular disease (CVD), 82% of which are in the developing world. Glycated hemoglobin (HbA1c), even at levels considered in the "normal" range, emerged as an independently significant predictor of heart-disease events, stroke, and death over more than a decade.

Methodology: After applying the inclusion and exclusion criteria, 113 patients with ST segment elevation myocardial infarction were enrolled in this study after taking informed written consent from the patient or attending guardian. Follow up was done during hospital stay for mortality, arrhythmia, cardiogenic shock, cardiac arrest, congestive heart failure, mechanical complication (eg ventricular septum rupture, wall rupture), left ventricular systolic dysfunction, stroke etc.

Result: The median age of patients was 53.4 years (range 22 to 85 years), patients with an HbA1c >6.5% were slightly older than those with HbA1c <6.5%(53.1 vs. 54.6),and 82% were male; and 43% had an HbA1c >6.5%. Patients with elevated HbA1c had more LVSD (54%) (p=0.022), heart failure (81%) (p= < .001).

However, patients with HbA1c >6.5% were more likely to have cardiogenic shock as an outcome but it is not statistically significant (p= .528), whereas cardiac arrest, arrythmia and mechanical complication were more among HbA1c <6.5 group but it was not statistically significant.

During hospital stay 16 (14%) patients died. Mortality was much higher among all STEMI patients, those with elevated hemoglobin A1c level as an outcome compared to patients with normal haemoglobin A1c level (26% vs. 5%) (p= .002).

Conclusion : STEMI patients who has haemoglobin HbA1c level < 6.5 have better in hospital outcome compared to elevated (>6.5) haemoglobin A1c level.

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Introduction :

Coronary artery disease (CAD) is the leading cause of mortality and morbidity in western society and is a worldwide epidemic. In 2001, worldwide death due to ischemic heart disease (IHD) was 11.8% in low income countries and 17.3% in high income countries[1].

Every year, 17.1 million lives are claimed by the global burden of cardiovascular disease (CVD) - 82% of which are in the developing world. Myocardial infarction is one of the leading cause of death in Bangladesh mostly in the 4th decade of life. In a study of 2690 patients, in hospital mortality was 11.8 %. The main cause of death was pump failure and ventricular fibrillation [2].

Considering the HbA1c level as a risk factor, it was found that there was significant relationship between HbA1c level and in hospital mortality among STEMI (P=0.006).[3]

Recent evidence has shown that chronic glucose dysregulation, assessed by HbA1c levels, is also of prognostic value with regard to future cardiovascular disease and congestive heart failure[4]. Glycated hemoglobin (HbA1c), even at levels considered in the "normal" range, emerged as an independently significant predictor of heart-disease events, stroke, and death over more than a decade.[5]

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Methodology : All patients admitted in cardiology department with STEMI were evaluated by history taking, standardised clinical examination, Electrocardiogram, Troponin-I, Echocardiogram, blood tests for urea and electrolytes and full blood count.and other necessary investigations as required. On the basis of inclusion and exclusion criteria, patients were enrolled in this study.

Follow up was done for any complication like development of cardiogenic shock, cardiac arrest, appearance of any new murmur, symptoms/signs of heart failure (eg dyspnea, orthopnea, basal crepitation), monitoring of ECG for any arrythmia (eg atrial fibrilation, atrial flutter, ventricular tachycardia, ventricular fibrilation, premature ventricular contraction, etc)

All the patients at first underwent 2D and M mode echocardiography and analysed for chamber dimenssion, ventricular wall thickness, wall motion abnormalities and systolic function.Color flow and Doppler imaging also done to see the mechanical complication, wall motion abnormality were graded from normal to dyskinesia. Ejection fraction was calculated automatically from the above indices. Ejection fraction were taken in two views, parasternal long axis and short axis at the level of tip of the mitral valve leaflets and papilary muscle level and then final EF were taken from their average to reduce the measurement error. Left ventricular systolic impairment was assessed subjectively in all patients on a scale of normal/mild/moderate/severe systolic impairment. Left ventricular systolic dysfunction (LVSD) was considered to be present when left ventricular ejection fraction was <55% or left ventricular systolic impairment was graded as mild.[6]

A non-fasting blood sample was taken within 24 hours of admission for the measurement of random blood glucose and HbA1c level. All routine blood samples were analyzed on the day of sample collection as per standard clinical practice.

HbA1c was measured using high-performance liquid chromatography and HbA1c of 4–6.5% was considered as normal. HbA1c level d" 6.5 was diagnosed as normal and above this value was leveled as elevated HbA1c.[7]

Analysis was done by using SPSS version 11.5 software program. Confidence interval was set at 95% level. Result were considered to be statistically significant if p-value was <0.05. In the statistical analysis, the demographic characteristics age and sex were expressed as proportions. Pearson Chi-square test was used to compare between the categories between elevated and normal glycated haemoglobin A1c, with the interest of outcome.

Result : Among elevated HbA1c group patients, 35 (71%) were male and 14 (29%) were female. Among normal HbA1c group patients, 58 (91%) were male and 6(9%) were female. Mean age was 53.75+/-11.

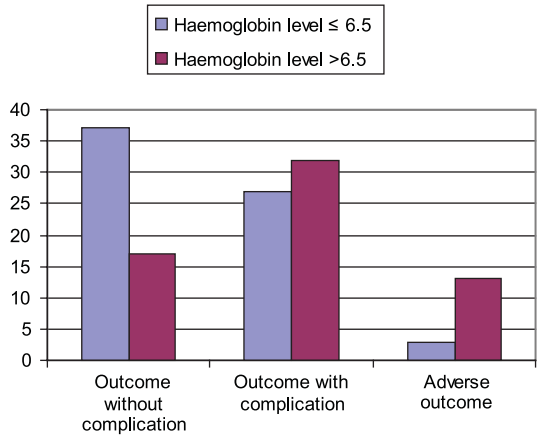

Fig- 1 *shows that patients who has haemoglobin HbAc level ≤6.5 have better in hospital outcome compared to elevated (>6.5) haemoglobin A1c level.*

Table- I
In hospital outcome among normal and elevated HbA1c level

Outcome of interest	HbA1c level ≤6.5 (n=64) n (%)	HbA1c level >6.5 (n=49) n (%)	Total N =113
Cardiac arrest	2(100%)	0(0%)	2
Cardiogenic shock	5(45%)	6(55%)	11
Arrythmia	11(58%)	8(42%)	19
Heart failure	5(19%)	21(81%)	26
Mechanical	2(100%)	0(0%)	2
LV systolic dysfunction	27(46%)	32(54%)	59

Table- I shows the distribution of in hospital outcome among the study subjects when compared the patients with normal HbA1c and elevated HbA1c. Patients with elevated HbA1c are more frequently had cardiogenic shock, heart failure and LV systolic dysfunction (55%, 81% and 54% respectively) and cardiac arrest, arrythmia and mechanical complication are more common among patients with normal hemoglobin A1c level.

Table- II

In hospital mortality as an outcome of the study subjects according to HbA1c level

HbA1c level	In hospital mortality as an outcome			p-value
	In hospital mortality absentn(%)	In hospital mortality presentn(%)	Total N=113	0.002
d”6.5	61 (95%)	3(5%)	64	
>6.5	36(74%)	13(26%)	49	
Total	97	16	113	

P value reached from Pearson Chi-square test

Table- II shows that among all STEMI patients, those with elevated hemoglobin A1c level were more likely to have death as an outcome compared to patients with normal haemoglobin A1c level (26% vs. 5%). (p= .002).

Discussion :

This study evaluated the prognostic value of HbA1c in patients with STEMI. Elevated HbA1c was associated with a worse prognosis. This prognostic cohort study shows that HbA1c levels >6.5% was associated with in hospital outcome in STEMI patients. This association was significant among patients who has heart failure and left ventricular systolic dysfunction. There was no significant association among patients who has cardiac arrest, cardiogenic shock and arrhythmia. In this study mortality is significantly higher among the patients who has elevated haemoglobin A1c level. (p= <.002)

Previous studies have shown that an elevated HbA1c is associated with increased cardiovascular risk in patients with and without diabetes. Malmberg *et al.*(1999) found an association between elevated HbA1c and mortality after myocardial infarction, relative risk (95% CI) 1.07 (1.01-1.21)[8]

In this study 93(82%) patients were male and 34(18%) were female. Female patients comprised a small part of the present study. Other studies also observed a small proportion of female patients. In Bangladesh, all most all of the studies reported an overwhelming majority of male patients. Asaduzzaman (2008) reported 22%, Amanullah (1994) found 11.0% female in their study. The current study result correlates with these studies.[9,10]

This study showed that the mean age of both HbA1c group was around 53±11 years. Mokeddes (1997) reported similar age pattern of 54.0±9.9 years and Rahim (1993) reported a mean age 52.5 years among the patients of STEMI. All these results were comparable with the present study.

STEMI Patients with elevated haemoglobin A1c level has 14% in hospital mortality in my study which is consistent with the findings of Haque, (2001) who showed around 12% in hospital mortality in the same STEMI population group. Haque, (2001) also showed that the main reason of death was pump failure and ventricular fibrillation. In my study, pump failure is also significantly higher in the study population who are in elevated haemoglobin A1c group.[2]

Khaw *et al.* (2004) was carried out a study to examine the relationship between hemoglobin A1c, and mortality and found that, the relationship between hemoglobin A1c and short term mortality was continuous and significant. The relationship was apparent in persons without known diabetes. An increase in hemoglobin A1c of 1 percentage point was associated with a relative risk for death from any cause of 1.24 (95% CI, 1.14 to 1.34; P < 0.001) in men and with a relative risk of 1.28 (CI, 1.06 to 1.32; P < 0.001) in women. In my study, mortality was significantly higher in patients with elevated haemoglobin A1c level which is consistent with the above findings.[11]

Conclusion : An elevated HbA1c, suggesting impaired glucose regulation, indicates a worse prognosis in patients with STEMI. Despite modern therapies for STEMI patient, elevated HbA1c conferred a significant excess adverse in hospital outcome risk following STEMI. This raises the question of whether better glycaemic control might improve outcome in such patients. STEMI patients who has haemoglobin HbA1c level d” 6.5 have better in hospital outcome compared to elevated (>6.5) haemoglobin A1c level.

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