Section: General Medicine

Original Research Article

# IMPACT OF GLYCOSYLATED HEMOGLOBIN (HBA1C) ON ACUTE CORONARY SYNDROME

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ABSTRACT

**Background:** Diabetes mellitus (DM) is a major non-communicable disease worldwide and an important risk factor for cardiovascular disease. Elevated HbA1c reflects poor glycemic control and has been implicated in the development of acute coronary syndrome (ACS).

**Objective:** To study the relationship between HbA1c levels and the mortality, morbidity, and severity of ACS among patients admitted at R.G. Kar Medical College and Hospital, Kolkata.

**Materials and Methods:** A cross-sectional, hospital-based descriptive study was conducted among 113 ACS patients admitted between October 2020 and September 2021. Patients were assessed clinically and investigated with ECG, echocardiography, cardiac biomarkers, and HbA1c. Statistical analysis was performed using SPSS v22. Chi-square test was applied, with significance set at $p<0.05$.

**Results:** Mean age of the study population was 57.6 ± 10.3 years; 63.7% were males. Diabetes was present in 46.9% of patients. STEMI was found in 54.9%, NSTEMI in 32.7%, and unstable angina in 12.4%. Diabetic patients demonstrated higher complication rates: LV dysfunction (37.7% vs 16.7%, p=0.011), ventricular tachycardia (11.3% vs 1.7%, p=0.034), heart block (9.4% vs 1.7%, p=0.046), and cardiogenic shock (26.4% vs 11.7%, p=0.044). Mortality was significantly higher among diabetics (26.4% vs 8.3%, p=0.010).

**Conclusion:** Elevated HbA1c levels in ACS patients were associated with increased morbidity and mortality. HbA1c estimation at admission can serve as a prognostic marker to differentiate stress hyperglycemia from undiagnosed diabetes and guide early risk stratification.

**Keywords:** Acute coronary syndrome; Diabetes mellitus; HbA1c; Cardiogenic shock; Left ventricular dysfunction; In-hospital mortality; Risk stratification.

## INTRODUCTION

Diabetes mellitus (DM) is one of the most prevalent lifestyle-related diseases worldwide, contributing significantly to morbidity and mortality. It is strongly associated with both microvascular and macrovascular complications.[1] Cardiovascular disease (CVD) is the leading cause of death in diabetic patients, with hyperglycemia accelerating atherogenesis through glycation of proteins and the formation of advanced glycation end-products (AGEs), which impair endothelial function.[2]

Glycosylated hemoglobin (HbA1c) reflects long-term glycemic control over 8–12 weeks and serves as both a diagnostic and prognostic biomarker. An HbA1c level >6.5% is diagnostic of diabetes.[3] Importantly, elevated HbA1c levels predict cardiovascular morbidity and mortality even in non-diabetic individuals.[4,5]

In patients with ACS, hyperglycemia is common at admission, but it is often unclear whether this represents stress-induced hyperglycemia or previously undiagnosed diabetes. HbA1c measurement helps differentiate the two and provides valuable prognostic information.[6] Elevated HbA1c in ACS patients has been associated with more severe coronary artery disease, higher ischemic burden, increased complications, and worse outcomes.[7,8]

This study was conducted to evaluate the association of HbA1c with clinical outcomes in ACS patients admitted to R.G. Kar Medical College and Hospital, Kolkata.

**Aims and Objectives**

**General Objective**

To define the relationship between HbA1c levels and mortality, morbidity, and severity in patients with ACS.

**Specific Objectives**

1. To determine the proportion of different cardiac complications among diabetic ACS patients.
2. To assess the association of diabetic status with various ACS-related complications and outcomes.

## MATERIALS AND METHODS

This hospital-based, cross-sectional study was conducted in the Department of General Medicine, R.G. Kar Medical College and Hospital, Kolkata, between October 2020 and September 2021. A total of 113 patients aged 18–65 years, admitted with a confirmed diagnosis of acute coronary syndrome (ACS), were included by purposive sampling. Patients with cardiomyopathy, valvular heart disease, prior cardiac surgery, atrial fibrillation, acute stroke, sepsis, chronic kidney disease, or hemoglobinopathies and hemodialysis were excluded.

After obtaining informed consent and ethical clearance, relevant clinical data were collected using a structured questionnaire. All patients underwent detailed history-taking, physical examination, and investigations including electrocardiography (ECG), echocardiography, and laboratory tests. Blood samples were analyzed for HbA1c, fasting and post-prandial blood glucose, cardiac enzymes (CPK-MB, Troponin-T), complete hemogram, renal and liver function tests, and serum electrolytes. The primary outcome variables were in-hospital complications and mortality.

Data were compiled, checked for completeness, and analyzed using SPSS version 22. Descriptive statistics were expressed as mean ± SD and percentages. Associations between categorical variables were tested using the chi-square test, with $p < 0.05$ considered statistically significant.

## RESULTS

A total of 113 patients with acute coronary syndrome (ACS) were included in the study. The mean age of the study population was 57.6 ± 10.3 years, with the majority (49.6%) belonging to the 45–60-year age group. Males accounted for 63.7% of patients. Diabetes mellitus was present in 46.9% of cases, while hypertension and smoking were noted in 54.0% and 42.5% of patients, respectively. Regarding ACS types, STEMI was the most common presentation (54.9%), followed by NSTEMI (32.7%) and unstable angina (12.4%). [Table 1]

**Table 1: Baseline characteristics of study population (n = 113)**

| Characteristic | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Age group (years)** | <45 | 14 | 12.4 |
| | 45–60 | 56 | 49.6 |
| | >60 | 43 | 38.1 |
| **Gender** | Male | 72 | 63.7 |
| | Female | 41 | 36.3 |
| **Diabetes mellitus** | Present | 53 | 46.9 |
| | Absent | 60 | 53.1 |
| **Hypertension** | Present | 61 | 54.0 |
| | Absent | 52 | 46.0 |
| **Smoking history** | Present | 48 | 42.5 |
| | Absent | 65 | 57.5 |
| **Type of ACS** | STEMI | 62 | 54.9 |
| | NSTEMI | 37 | 32.7 |
| | Unstable angina | 14 | 12.4 |

The most frequent in-hospital complication observed was left ventricular (LV) dysfunction, affecting 26.5% of patients. Cardiogenic shock occurred in 18.6% of cases, while atrial fibrillation, ventricular tachycardia, and complete heart block were seen in 7.1%, 6.2%, and 5.3% of patients, respectively. [Table 2]

**Table 2: In-hospital complications among ACS patients (n = 113)**

| Complication | Frequency (n) | Percentage (%) |
|---|---|---|
| Left ventricular dysfunction | 30 | 26.5 |
| Cardiogenic shock | 21 | 18.6 |
| Atrial fibrillation | 8 | 7.1 |
| Ventricular tachycardia | 7 | 6.2 |
| Complete heart block | 6 | 5.3 |

When complications were analyzed in relation to diabetes status, a significantly higher prevalence of LV dysfunction (37.7% vs 16.7%, p=0.011), ventricular tachycardia (11.3% vs 1.7%, p=0.034), complete heart block (9.4% vs 1.7%, p=0.046), and cardiogenic shock (26.4% vs 11.7%, p=0.044) was found among diabetic patients compared to non-diabetics. [Table 3]

**Table 3: Comparison of complications between diabetics and non-diabetics**

| Complication | Diabetic (%) | Non-Diabetic (%) | p-value |
|---|---|---|---|
| Left ventricular dysfunction | 37.7 | 16.7 | 0.011 |
| Ventricular tachycardia | 11.3 | 1.7 | 0.034 |
| Complete heart block | 9.4 | 1.7 | 0.046 |
| Cardiogenic shock | 26.4 | 11.7 | 0.044 |

Overall, in-hospital mortality was 16.8% for the entire study population. However, mortality was significantly higher among diabetic patients (26.4%) compared to non-diabetic patients (8.3%) (p=0.010). [Table 4]

**Table 4: In-hospital mortality among diabetics and non-diabetics**

| Group | Mortality (n) | Mortality (%) | p-value |
|---|---|---|---|
| Diabetic (n=53) | 14 | 26.4 | 0.010 |
| Non-Diabetic (n=60) | 5 | 8.3 | |

One-way ANOVA test used; significant differences noted across CKD stages

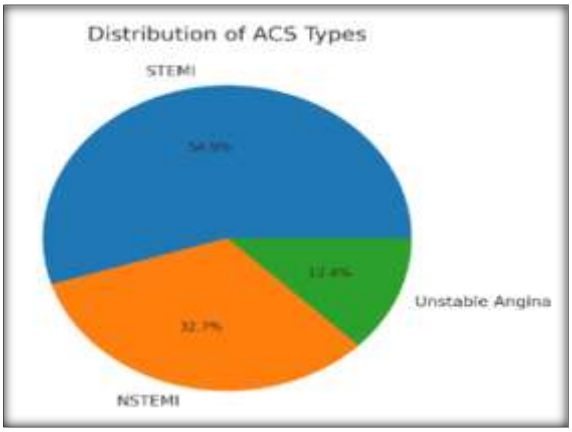


**Figure 1: Distribution of ACS types**

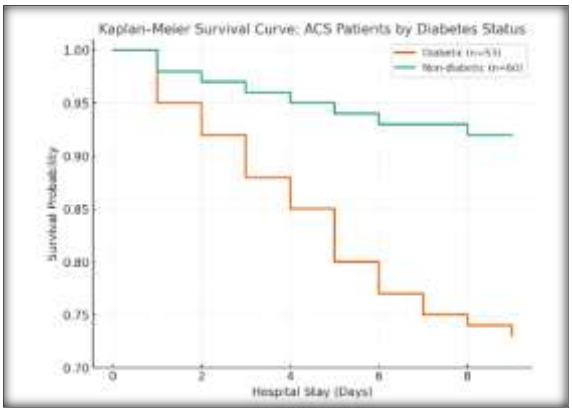


**Figure 2: Kaplan–Meier Survival Curve of ACS Patients by Diabetes Status**

The Kaplan–Meier survival analysis demonstrates a clear difference in in-hospital survival between diabetic and non-diabetic ACS patients. Survival probability declined more rapidly among diabetics, with a noticeable reduction within the first few days of hospitalization, compared to relatively stable survival in non-diabetics. By the end of the hospital stay, overall survival was significantly lower in the diabetic group (~73%) compared with the non-diabetic group (~92%). This trend highlights the adverse prognostic impact of diabetes on short-term survival in ACS.

## DISCUSSION

This study evaluated the relationship between HbA1c levels and in-hospital outcomes among patients with acute coronary syndrome (ACS). The mean age of the cohort was 57.6 years, with nearly half of the patients in the 45–60 year age group, comparable to earlier reports by Ashraf et al.9 and Dubey et al,[10] A male predominance (63.7%) was also consistent with previous studies, reaffirming the greater burden of ACS in men. Nearly half of the study subjects (46.9%) were diabetic, highlighting the strong association between diabetes and ACS. STEMI was the predominant presentation (54.9%), followed by NSTEMI (32.7%) and unstable angina (12.4%), which is in line with Dar et al,[11] although other studies have reported NSTEMI as the leading presentation.

Complications were frequent in our study, with left ventricular dysfunction (26.5%) and cardiogenic shock (18.6%) being most common. Arrhythmias such as atrial fibrillation (7.1%), ventricular tachycardia (6.2%), and complete heart block (5.3%) were also noted. Importantly, diabetics experienced significantly higher rates of LV dysfunction, ventricular tachycardia, complete heart block, and cardiogenic shock compared with non-diabetics, a trend similarly reported by Dubey et al,[10] These findings suggest that poor glycemic control exacerbates myocardial damage and predisposes to electrical instability and hemodynamic compromise.

In-hospital mortality was 16.8% overall but disproportionately higher in diabetics (26.4% vs. 8.3% in non-diabetics). Pandey et al,[12] also demonstrated significantly higher mortality in

diabetic ACS patients, particularly in those with HbA1c >7%. Moreover, atypical presentations such as shortness of breath and palpitations were more frequent in diabetics, whereas chest pain and diaphoresis predominated in non-diabetics, supporting the concept of silent ischemia and autonomic neuropathy in diabetes. Together, these findings indicate that HbA1c is a useful prognostic marker in ACS and should be integrated into routine risk stratification

## CONCLUSION

Diabetes mellitus was highly prevalent among patients with acute coronary syndrome and was strongly associated with worse in-hospital outcomes. Diabetic patients had significantly higher rates of left ventricular dysfunction, arrhythmias, cardiogenic shock, and mortality compared with non-diabetic patients. Moreover, poor glycemic control, reflected by higher HbA1c levels, correlated with greater morbidity and mortality.

These findings highlight the need for early recognition of diabetes, routine HbA1c assessment in ACS patients, and aggressive management strategies tailored to this high-risk group. Strengthening preventive measures, optimizing glycemic control, and ensuring timely reperfusion therapy may improve outcomes in diabetic patients presenting with ACS.

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