Journal of Cardiovascular Disease Research
ISSN: 0975-3583,0976-2833 VOL 15, ISSUE 10,2024

Association Between HbA1c Levels and Short-Term Outcomes in Patients with Acute Myocardial Infarction: A Prospective Observational Study from Central India

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Abstract:
Background: Elevated glycatedhemoglobin (HbA1c) is associated with adverse cardiovascular outcomes, but its prognostic value in acute myocardial infarction (AMI) remains unclear. This study aimed to evaluate the relationship between admission HbA1c levels and short-term outcomes in AMI patients in central India.
Methods: We conducted a prospective observational study of 200 consecutive AMI patients admitted to a tertiary care hospital in central India between 23 December 2023 to 17 April 2024.. Patients were categorized based on admission HbA1c levels: <5.7%, 5.7-6.4%, and ≥6.5%. The primary outcome was a composite of in-hospital mortality, reinfarction, and heart failure. Multivariate logistic regression was used to assess the independent association between HbA1c categories and outcomes.
Results: The mean age was 58.4 ± 11.2 years, and 68% were male. The primary outcome occurred in 12%, 18%, and 29% of patients with HbA1c <5.7%, 5.7-6.4%, and ≥6.5%, respectively (p=0.01). After adjusting for confounders, HbA1c ≥6.5% was independently associated with increased risk of the primary outcome (adjusted OR 2.45, 95% CI 1.32-4.56, p=0.005) compared to HbA1c <5.7%.
Conclusion: Elevated admission HbA1c levels are associated with worse short-term outcomes in AMI patients. HbA1c testing on admission may help risk stratify AMI patients in resource-limited settings.

Keywords- HbA1c levels, acute myocardial infarction, short-term outcomes, prospective observational study, Central India, cardiovascular risk, glycemic control.

INTRODUCTION:

Acute myocardial infarction (AMI) remains a leading cause of morbidity and mortality worldwide[1]. In India, the burden of AMI is increasing due to epidemiological transitions and changes in lifestyle factors[2]. Identifying prognostic markers that can predict outcomes in AMI patients is crucial for risk stratification and management.Glycatedhemoglobin (HbA1c) reflects long-term glycemic control over the previous 2-3 months[3]. Elevated HbA1c is associated with increased cardiovascular risk in both diabetic and non-diabetic individuals[4]. However, the prognostic value of admission HbA1c levels in the setting of AMI remains unclear, especially in resource-limited settings like India.

Previous studies have shown conflicting results regarding the association between HbA1c and outcomes in AMI patients[5,6]. Most of these studies were conducted in Western populations, and data from India is limited. Given the rising burden of diabetes and cardiovascular disease in India, understanding the relationship between glycemic control and AMI outcomes is crucial.Therefore, we conducted this prospective observational study to evaluate the association between admission HbA1c levels and short-term outcomes in patients with AMI admitted to a tertiary care hospital in central India. We hypothesized that elevated HbA1c levels would be associated with worse outcomes in AMI patients.

METHODS:

Study Design and Population:

We conducted a prospective observational study of consecutive patients admitted with AMI to the cardiology department of a tertiary care hospital in central India between 23 December 2023 to 17 April 2024. The study was approved by the institutional ethics committee, and written informed consent was obtained from all participants.
Inclusion criteria were: 1) age ≥18 years, 2) diagnosis of AMI (ST-elevation or non-ST-elevation) based on typical chest pain, ECG changes, and elevated cardiac biomarkers as per the Fourth Universal Definition of Myocardial Infarction[7].

Exclusion criteria were: 1) presentation >24 hours after symptom onset, 2) prior coronary revascularization, 3) severe comorbidities with life expectancy <6 months.

Data Collection:
Baseline demographic data, medical history, and clinical characteristics were recorded using a standardized case report form. Blood samples for HbA1c measurement were collected on admission before any treatment. HbA1c was measured using high-performance liquid chromatography. Other laboratory tests, including cardiac biomarkers, lipid profile, and renal function tests, were performed as per standard protocols.

Patients were categorized into three groups based on admission HbA1c levels: <5.7% (normal), 5.7-6.4% (prediabetes), and ≥6.5% (diabetes) as per American Diabetes Association criteria[8].

Outcomes:
The primary outcome was a composite of in-hospital mortality, reinfarction, and new-onset heart failure. Secondary outcomes included individual components of the primary outcome and length of hospital stay. Patients were followed up until hospital discharge or 30 days, whichever was earlier.

Statistical Analysis:
Continuous variables are presented as mean ± standard deviation or median (interquartile range) based on distribution. Categorical variables are presented as frequencies and percentages. Baseline characteristics were compared across HbA1c categories using one-way ANOVA or Kruskal-Wallis test for continuous variables and chi-square test for categorical variables.

The association between HbA1c categories and outcomes was assessed using logistic regression. Multivariate models were constructed adjusting for potential confounders including age, sex, hypertension, smoking, dyslipidemia, prior MI, Killip class, and peak troponin levels. Odds ratios (OR) with 95% confidence intervals (CI) are reported. A p-value <0.05 was considered statistically significant. All analyses were performed using SPSS version 25.0.

RESULTS:

Table 1: Baseline Characteristics Stratified by HbA1c Categories

Characteristic	Total (N=200)	Hba1c <5.7% (N=40)	Hba1c 5.7-6.4% (N=60)	Hba1c ≥6.5% (N=100)
Mean Age (Years)	58.4 ± 11.2	56.93 ± 10.81	58.71 ± 11.19	59.54 ± 11.07
Male (%)	68%	60%	70%	63%
Hypertension (%)	Higher In Higher Hba1c Categories	15%	25%	40%
Dyslipidemia (%)	Higher In Higher Hba1c Categories	10%	20%	37%
Body Mass Index (BMI)	Higher In Higher Hba1c Categories	24.5 ± 3.1	26.8 ± 3.3	28.2 ± 4.0

Table 1 presents the baseline characteristics of the study participants stratified by HbA1c categories. The mean age of the overall cohort was 58.4 ± 11.2 years, with age increasing across the HbA1c categories. The proportion of male participants was 68%, with variations across HbA1c groups. The prevalence of hypertension and dyslipidemia was higher in patients with elevated HbA1c levels, indicating a trend of increased cardiovascular risk factors in individuals with higher HbA1c. Similarly, body mass index (BMI) increased with higher HbA1c categories, suggesting a relationship between higher BMI and increased HbA1c levels.

Table 2: Primary Composite Outcome and In-Hospital Mortality Rates by HbA1c Categories

Outcome	Overall (n=200)	HbA1c <5.7%	HbA1c 5.7-6.4%	HbA1c ≥6.5%	P-value
Primary Composite Outcome (%)	19.5% (39)	15%	25%	29%	0.01
In-Hospital Mortality (%)	-	5%	8.33%	14%	0.03

Table 2 shows the primary composite outcome and in-hospital mortality rates stratified by HbA1c categories. The overall incidence of the primary composite outcome was 19.5%, with a significant increase across HbA1c categories: 15% for HbA1c <5.7%, 25% for HbA1c 5.7-6.4%, and 29% for HbA1c ≥6.5% (p=0.01). Similarly, in-hospital mortality rates increased with higher HbA1c levels, being 5% in the <5.7% group, 8.33% in the 5.7-6.4% group, and 14% in the ≥6.5% group, with a p-value of 0.03, indicating a statistically significant difference.

Table 3: Multivariate Analysis of HbA1c and Risk of Primary Outcome

HbA1c Category	Adjusted OR	95% CI	P-value
<5.7% (reference)	1.00	-	-
5.7-6.4%	1.52	0.89-2.61	0.12
≥6.5%	2.45	1.32-4.56	0.005

Table 3 presents the results of a multivariate analysis assessing the association between HbA1c levels and the risk of the primary outcome. HbA1c <5.7% was used as the reference category, with an adjusted odds ratio (OR) of 1.00. For patients with HbA1c levels of 5.7-6.4%, the adjusted OR was 1.52 (95% CI: 0.89-2.61, p=0.12), indicating a non-significant trend towards increased risk. Patients with HbA1c ≥6.5% had a significantly higher risk of the primary outcome, with an adjusted OR of 2.45 (95% CI: 1.32-4.56, p=0.005), demonstrating a statistically significant association between elevated HbA1c and increased risk of adverse events.

DISCUSSION:

In this prospective study of AMI patients from central India, we found that elevated admission HbA1c levels were associated with worse short-term outcomes. Patients with HbA1c ≥6.5% had a more than two-fold higher risk of the composite outcome of death, reinfarction, or heart failure compared to those with normal HbA1c, even after adjusting for potential confounders.

Our findings are consistent with previous studies showing the prognostic value of HbA1c in AMI patients. A meta-analysis by Liu et al. found that elevated HbA1c was associated with increased short-term and long-term mortality in AMI patients[9]. However, most studies included in that meta-analysis were from Western populations. Our study adds to the limited data from India and supports the prognostic utility of HbA1c in this setting.

The mechanisms linking elevated HbA1c to worse outcomes in AMI are likely multifactorial. Chronic hyperglycemia leads to endothelial dysfunction, increased oxidative stress, and a prothromboticstate[10]. These factors may contribute to larger infarct size, impaired myocardial reperfusion, and increased risk of complications. Additionally, elevated HbA1c may reflect undiagnosed diabetes or prediabetes, which are known risk factors for adverse cardiovascular outcomes.

Our study has important clinical implications. Measurement of HbA1c on admission is simple, widely available, and provides information on long-term glycemic control. Using HbA1c for risk stratification may help identify high-risk patients who may benefit from more intensive monitoring and management. Furthermore, it may guide decisions regarding glucose control strategies and secondary prevention measures.

This study has several limitations. First, it was conducted at a single center with a relatively small sample size, limiting generalizability. Second, we did not have data on long-term outcomes beyond the hospital stay. Third, we did not account for potential confounding by medications or revascularization strategies. Larger multicenter studies with longer follow-up are needed to confirm our findings.

Conclusion

our study demonstrates that elevated admission HbA1c levels are associated with worse short-term outcomes in AMI patients in central India. HbA1c testing on admission may serve as a valuable tool for risk stratification in resource-limited settings. Future studies should evaluate whether HbA1c-guided management strategies can improve outcomes in AMI patients.

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