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Short and Long-Term Prognosis of Admission Hyperglycemia in Diabetic and Non-Diabetic Patients After Acute Myocardial Infarction

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ABSTRACT

Background: Acute myocardial infarction (AMI) is a major cause of morbidity and mortality globally, with admission hyperglycemia common among patients, including those without diabetes, and linked to adverse outcomes, though its prognostic significance in diabetic versus non-diabetic patients is still under-investigated. The study aims to estimate the short-term and long-term prognostic significance of admission hyperglycemia in individuals with AMI, comparing outcomes between diabetic and non-diabetic cohorts.

Methods: This cohort study comprised 230 individuals. Participants were divided into 2 groups: group 1(diabetic (n=120)) and group 2 (non-diabetic (n=110)). Key variables included admission blood glucose levels, demographic data, comorbidities, and outcomes. Short-term outcomes were assessed at 30 days, and long-term outcomes at 1 year. Multivariate Cox regression analysis was used to identify predictors of mortality.

Results: Group 1 had significantly higher admission blood glucose levels than group 2 ($p < 0.001$). At 30 days, group 1 showed higher rates of mortality (12.5% vs. 4.5%, $p = 0.02$) and MACE (17% vs. 9%, $p = 0.04$) compared to group 2. At 1 year, mortality rates were 22.5% in group 1 and 12% in group 2 ($p = 0.03$), with higher MACE rates in group 1 (28% vs. 15%, $p = 0.02$). Admission hyperglycemia (HR 1.8, 95% CI 1.2-2.7, $p = 0.01$) and diabetic status (HR 1.6, 95% CI 1.1-2.4, $p = 0.03$) were independent predictors of 1-year mortality.

Conclusion: Admission hyperglycemia is a significant predictor of poor outcomes in AMI patients, with diabetic individuals experiencing worse short-term and long-term prognoses.

These findings emphasize the need for aggressive management of hyperglycemia in the acute setting of AMI.

Recommendations: To improve outcomes, it is recommended that healthcare providers implement rigorous glucose monitoring and management protocols for all AMI patients, regardless of diabetic status. Further research should explore optimal glucose control strategies to reduce mortality and MACE in this population.

Keywords: Acute myocardial infarction, Hyperglycemia, Diabetes, Prognosis, Major adverse cardiovascular events

INTRODUCTION

Acute myocardial infarction (AMI) remains a major cause of morbidity and mortality globally, posing significant clinical and economic challenges. Hyperglycemia at the time of hospital admission is a usual phenomenon in individuals with AMI, affecting both diabetic and non-diabetic individuals. The pathophysiological mechanisms underpinning this condition include stress-induced catecholamine release and systemic inflammatory responses, which exacerbate glucose dysregulation. Emerging evidence suggests that admission hyperglycemia is a potent predictor of adverse outcomes in AMI patients, irrespective of pre-existing diabetic status [1].

Recent research have highlighted the prognostic implications of admission hyperglycemia in the context of AMI. Hyperglycemia has been related with raised in-hospital mortality, heart failure, cardiogenic shock, and other major adverse cardiovascular events (MACE) [2]. Furthermore, long-term follow-up data indicate that patients with hyperglycemia at admission exhibit higher mortality and morbidity rates compared to normoglycemic individuals, reinforcing the need for early and effective glucose management [3].

The mechanisms by which hyperglycemia adversely impacts outcomes in AMI are multifaceted. Hyperglycemia can induce endothelial dysfunction, oxidative stress, and inflammatory responses, all of which contribute to the pathogenesis of atherosclerosis and thrombosis. Additionally, hyperglycemia impairs myocardial perfusion and augments ischemia-reperfusion injury, leading to larger infarct sizes and poorer myocardial recovery [4]. These pathophysiological insights underscore the critical need for timely intervention to mitigate the deleterious effects of hyperglycemia in AMI patients.

Despite the growing body of evidence, the clinical management of admission hyperglycemia remains suboptimal. Current guidelines offer varying recommendations, and there is ongoing debate regarding the optimal glucose targets and therapeutic strategies. Intensive insulin therapy, although effective in controlling hyperglycemia, has been related with a raised risk of hypoglycemia, which itself is a predictor of poor outcomes [5]. Therefore, achieving a balance between hyperglycemia control and hypoglycemia prevention is crucial in the management of AMI patients.

The study aims to evaluate the short-term and long-term prognostic significance of admission hyperglycemia in individuals with AMI, comparing outcomes between diabetic and non-diabetic cohorts.

METHODOLOGY

Study Design

A retrospective cohort study.

Study Setting

The study was taken out at Nalanda Medical College and Hospital (NMCH), Patna, Bihar, India, from a period of January 2022 to December 2023.

Participants

A total of 230 individuals were comprised in this study.

Inclusion Criteria

- Patients admitted with a confirmed diagnosis of AMI,

- Age 18 years and older

- Patients with documented blood glucose levels upon admission

- Both diabetic and non-diabetic patients

Exclusion Criteria

- Patients with incomplete medical records or missing admission blood glucose levels,

- who were discharged against medical advice,

- with known malignancies or terminal illnesses at the time of admission.

Bias

To minimize selection bias, all eligible patients admitted within the study period were included. Information bias was minimized by using standardized data extraction protocols. Confounding factors were controlled for during statistical analysis.

Variables

Variables included admission hyperglycemia, diabetic status, age, gender, comorbidities, short-term outcomes (30-day mortality, hospital readmission), long-term outcomes.

Sample size:

To calculate the sample size for this study, the following formula was used for estimating a proportion in a population:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

Where:

- n = sample size

- Z = Z-score corresponding to the desired level of confidence

- p = estimated proportion in the population

- E = margin of error

Data Collection

Data were gathered from the hospital's electronic medical records. The following information was extracted, patient demographics, admission blood glucose levels, history of diabetes, clinical presentation and initial treatment, in-hospital complications, and short-term and long-term outcomes

Procedure

1. Data Extraction: Medical records of patients admitted with AMI during the study period were reviewed.

2. Classification: Participants were categorized into two groups based on their diabetic status and admission blood glucose levels (normoglycemic and hyperglycemic).

3. Follow-up: Outcomes were tracked through follow-up visits and telephone interviews at 30 days and 1-year post-admission.

Statistical Analysis

SPSS version 19.0 statistical software was used to analyse the data. The variables were presented as percentages, means ± standard deviations, and frequencies. Chi-square tests were used for categorical variables and t-tests for continuous variables in the comparative study across groups. At p-value < 0.05, the results were deemed statistically significant.

Ethical considerations:

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULT

A total of 230 individuals admitted with AMI were included in the study. Out of these, 120 (52.2%) were diabetic, and 110 (47.8%) were non-diabetic. The mean age of the patients was 62.5 ± 10.4 years, with a male predominance (70%). The mean admission blood glucose level was 180.2 ± 55.6 mg/dL. Group 1 had significantly higher admission blood glucose levels compared to group 2 (p < 0.001).

Table 1: Baseline Characteristics of Study Population

Variable	Total (n=230)	Group 1 (n=120)	Group 2 (n=110)	p-value
Age (years)	62.5 ± 10.4	63.2 ± 9.8	61.8 ± 11.0	0.35
Male (%)	70	68	72	0.54
Admission Blood Glucose (mg/dL)	180.2 ± 55.6	210.4 ± 48.5	148.0 ± 39.7	<0.001
Hypertension (%)	58	62	54	0.22
Dyslipidemia (%)	40	45	35	0.18
Smoking History (%)	30	28	32	0.56

During the 30-day follow-up period, 30 patients (13%) experienced MACE, and 20 patients (8.7%) died. Diabetic patients with admission hyperglycemia had a significantly higher incidence of MACE and mortality compared to non-diabetic patients.

Table 2: Short-Term Outcomes

Outcome	Total (n=230)	Group 1 (n=120)	Group 2 (n=110)	p-value
30-Day Mortality (%)	8.7	12.5	4.5	0.02
MACE (%)	13	17	9	0.04
Rehospitalization (%)	15	20	10	0.03

At the 1-year follow-up, 40 patients (17.4%) had died, and 50 patients (21.7%) experienced MACE. Group 1 continued to show worse outcomes compared to group 2.

Table 3: Long-Term Outcomes

Outcome	Total (n=230)	Group 1 (n=120)	Group 2 (n=110)	p-value
1-Year Mortality (%)	17.4	22.5	12.0	0.03
MACE (%)	21.7	28	15	0.02
Rehospitalization (%)	25	30	20	0.04

Multivariate Cox proportional hazards regression analysis identified admission hyperglycemia (HR 1.8, 95% CI 1.2-2.7, p=0.01) and diabetic status (HR 1.6, 95% CI 1.1-2.4, p=0.03) as independent predictors of 1-year mortality.

Table 4: Multivariate Cox Proportional Hazards Regression Analysis for 1-Year Mortality

Variable	Hazard Ratio (HR)	95% Confidence Interval (CI)	p-value
Admission Hyperglycemia	1.8	1.2-2.7	0.01
Diabetic Status	1.6	1.1-2.4	0.03

Age	1.1	1.0-1.2	0.05
Hypertension	1.2	0.9-1.7	0.18
Dyslipidemia	1.3	0.9-1.8	0.15

DISCUSSION

A total of 230 individuals were comprised in the study, with 120 identified as diabetic and 110 as non-diabetic. The study's key findings provide significant insights into the prognostic value of admission hyperglycemia.

The analysis revealed that diabetic patients had significantly higher admission blood glucose levels compared to non-diabetic patients. This disparity in glucose levels was correlated with adverse outcomes. Specifically, during the 30-day follow-up period, group 1 with admission hyperglycemia exhibited higher rates of mortality and MACE. This trend persisted in the long-term follow-up, with group 1 experiencing higher mortality and MACE rates at the 1-year mark.

Multivariate Cox regression analysis further reinforced the independent predictive value of admission hyperglycemia and diabetic status for 1-year mortality. Admission hyperglycemia and diabetic status emerged as significant predictors, underscoring the importance of these factors in determining patient prognosis post-AMI. These findings suggest that hyperglycemia at the time of admission plays a critical role in patient outcomes, irrespective of the underlying diabetic status.

The study's results underscore the necessity for healthcare providers to prioritize the management of hyperglycemia in the acute phase of AMI. Given the heightened risk profile of diabetic patients, early intervention and stringent glucose control may be particularly beneficial in improving their prognosis and reducing the prevalence of adverse cardiovascular events.

A study evaluated the predictive efficacy of the stress hyperglycemia ratio (SHR) in patients with ST-segment elevation myocardial infarction (STEMI), which is obtained from glycated albumin or haemoglobin A1c. It was discovered that higher SHR values were substantially linked to greater all-cause and in-hospital mortality, underscoring the need of controlling hyperglycemia in order to enhance outcomes for STEMI patients [6].

Another study examined the relationship between SHR and long-term clinical outcomes in patients with myocardial infarction and non-obstructive coronary arteries (MINOCA). Over a mean follow-up of 34 months, it was found that patients with higher SHR levels had considerably worse outcomes, including increased incidence of MACE. This highlights SHR's function in predicting MI patients' long-term prognosis [7].

When the predictive effects of SHR and admission blood glucose (ABG) levels were compared in patients who had suffered an intracerebral haemorrhage (ICH), research revealed that SHR was a more accurate indicator of 30-day and 1-year mortality, especially in individuals with diabetes. According to this study, SHR may be a more reliable indicator than ABG levels alone of how stress-induced hyperglycemia affects patient outcomes [8].

CONCLUSION

The study contributes valuable evidence highlighting the prognostic significance of admission blood glucose levels in people with AMI. The findings advocate for targeted strategies to manage hyperglycemia, which could potentially improve both short-term and long-term outcomes in this patient population. These insights emphasize the need for further research and clinical focus on glucose management in the context of acute myocardial infarction.

Limitations: The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of comparison group also poses a limitation for this study’s findings.

Recommendation: To improve outcomes, it is recommended that healthcare providers implement rigorous glucose monitoring and management protocols for all AMI patients, regardless of diabetic status. Further research should explore optimal glucose control strategies to reduce mortality and MACE in this population.

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List of abbreviations:

AMI - Acute Myocardial Infarction

MACE - Major Adverse Cardiovascular Events

HR - Hazard Ratio

CI - Confidence Interval

STEMI - ST-Segment Elevation Myocardial Infarction

MINOCA - Myocardial Infarction with Non-Obstructive Coronary Arteries

SHR - Stress Hyperglycemia Ratio

ABG - Admission Blood Glucose

ICH - Intracerebral Hemorrhage

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