

Streptokinase Thrombolysis Outcomes in Patients with ST-Elevation Myocardial Infarction: A Comparative Cross-Sectional Study of Type 2 Diabetic and Non-Diabetic Patients

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Abstract

Background: ST-elevation myocardial infarction (STEMI) requires timely reperfusion to reduce myocardial damage. In resource-limited healthcare settings, streptokinase remains one of the most commonly used thrombolytic agents. Diabetes mellitus may impair the effectiveness of streptokinase thrombolysis. However, local evidence comparing thrombolytic outcomes between diabetic and non-diabetic STEMI patients remains limited.

Objective: To compare the thrombolysis outcomes of streptokinase between type 2 diabetic and non-diabetic patients presenting with ST-elevation myocardial infarction. **Methodology:** This cross-sectional study was conducted from January to April 2026 at Mardan Medical Complex. A total of 170 STEMI patients eligible for streptokinase thrombolysis were enrolled using consecutive sampling. Patients with contraindications to thrombolysis, cardiogenic shock, severe comorbidities, or incomplete records were excluded. Data were collected using a predesigned questionnaire. Outcomes were assessed by ST-segment resolution on ECG at 90 minutes and clinical improvement in chest pain and dyspnea. Data were

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analyzed using SPSS version 26, applying Chi-square and independent t-tests, with $p < 0.05$ considered significant.

Results: Among 170 STEMI patients (mean age 59.05 ± 12.18 years; 58.8% males), 57.6% were diabetic. Complete ST-segment resolution occurred in 47.1%, while 28.8% and 24.1% showed partial and failed resolution, respectively. Diabetes was significantly associated with lower ST-segment resolution and longer CCU stay ($p = 0.006$ and $p = 0.048$). No significant differences were observed for gender ($p = 0.94$) or history of CAD ($p = 0.14$), whereas infarct site showed a significant association with ST-segment resolution ($p = 0.003$).

Conclusion: ST-segment resolution after streptokinase was achieved in less than half of STEMI patients. Diabetes mellitus was associated with poorer ST-segment resolution and longer CCU stay. Infarct site significantly influenced reperfusion outcomes, while gender and history of coronary artery disease showed no significant effect.

Introduction

Cardiovascular diseases are the leading cause of global disease burden, accounting for an estimated 437 million disability-adjusted life years (DALYs) worldwide as of 2023 according to the Global Burden of Disease study (1). The burden of cardiovascular diseases is disproportionately higher in low- and middle-income countries, where they account for over three-quarters of global CVD deaths and nearly 38% of the 18 million premature deaths due to non-communicable diseases in 2021(2). Coronary heart disease accounts for nearly half of all cardiovascular deaths, and ST-segment elevation myocardial infarction (STEMI), its most severe acute manifestation, remains a major global cause of morbidity and mortality with over 3 million cases annually (3).

Rapid restoration of coronary blood flow is critical for limiting myocardial damage, preserving left ventricular function, and improving survival(4). Rapid reperfusion in STEMI management is achieved through thrombolysis, primary PCI and CABG (5). Among these primary percutaneous coronary intervention (PCI) is the preferred reperfusion strategy, thrombolytic therapy continues to play a pivotal role in resource-limited healthcare settings where timely access to PCI is often unavailable(6).

Streptokinase is one of the most commonly used fibrinolytic agents for STEMI management in developing countries due to its affordability and widespread availability(7). The success of fibrinolytic therapy can be evaluated by assessment of ST-segment resolution at 90 minutes after streptokinase infusion on a 12-lead ECG (8). However, the effectiveness of thrombolytic therapy may be influenced by several patient-related factors, particularly diabetes mellitus, which is associated with endothelial dysfunction, impaired microvascular perfusion, inflammation, and a prothrombotic state that may compromise myocardial reperfusion and worsen clinical outcomes following STEMI(9,10).

Diabetes mellitus is one of the six major risk factors for myocardial infarction, along with dyslipidemia, hypertension, smoking, male gender, and a family history of atherosclerotic disease(11). Patients with diabetes have a two to four fold increased risk myocardial infarction compared with individuals without diabetes(12). Consequently, diabetic patients experiencing STEMI frequently demonstrate poorer myocardial reperfusion, reduced recovery of left ventricular function, prolonged hospitalization, and increased morbidity and mortality compared with non-diabetic patients due to increased platelet reactivity and reduced responsiveness to antiplatelet (13,14).

Several international studies suggest reduced ST-segment resolution after streptokinase thrombolysis in diabetic patients; however, evidence from Pakistan particularly Khyber Pakhtunkhwa, remains limited and inconsistent, with most data derived from different healthcare settings.

This study aimed to compare streptokinase thrombolysis outcomes between type 2 diabetic and non-diabetic patients with ST-elevation myocardial infarction at Mardan Medical Complex, generating locally relevant evidence to support improved risk stratification and management in resource-limited settings.

Material and Methods

This was a comparative cross-sectional study, conducted in the Coronary Care Unit of Mardan Medical Complex, Mardan, from January to April 2026. Ethical approval was obtained from the Ethical Review Board of MTI Bacha Khan Medical College, and informed verbal consent was taken from all participants prior to enrollment.

Data were collected using a predesigned structured questionnaire. The sample size was calculated using OpenEpi (www.openepi.com). A non-probability convenience sampling technique was employed. Adult patients with ST-elevation myocardial infarction, including both type 2 diabetic and non-diabetic individuals eligible for thrombolytic therapy, were included. Patients with contraindications to thrombolysis, cardiogenic shock, severe comorbid conditions, or incomplete clinical records were excluded.

Thrombolytic efficacy was assessed 90 minutes after streptokinase (SK) administration using repeat ECG and clinical assessment (chest pain and dyspnea). ST-segment resolution was measured against baseline ECG and categorized as complete ($\geq 70\%$ resolution of ST elevation), partial (30–69% resolution), or failed ($< 30\%$ resolution).

The data was analyzed via IBM SPSS version 26. A mean and standard deviation were used for continuous variables. Frequency and percentages were used for categorical variables. Independent t-test and Chi-square test were used. A p-value of < 0.05 was considered statistically significant

Results

A total of 170 STEMI patients enrolled in the study. The mean age of the participants was 59.05 ± 12.18 years. The cohort comprised 100 (58.8%) males and 70 (41.2%) females. Regarding diabetes status, 98 (57.6%) patients were diabetic and 72 (42.4%) were non-diabetic. Detailed baseline characteristics are presented in Table 1.

Table 1: Baseline Sociodemographic and Clinical Characteristics of the Study Participants

Variables	Category	Value n (%)
Age in Years, mean ($\pm$ SD)		59.05 $\pm$ 12.18
Gender	Male	100 (58.8)
	Female	70 (41.2)
Diabetes	Yes	98 (57.6)
	No	72 (42.4)
History of CAD	Yes	56 (32.9)
	No	114 (67.1)
Site of MI	Anterior	66 (38.8)
	Inferior	49 (28.8)
	Lateral	20 (11.8)
	Anterolateral	22 (12.9)
	Inferolateral	13 (7.6)
Chest pain	Yes	151 (88.8)
	No	19 (11.2)
Dyspnea	Yes	108 (63.5)
	No	62 (36.5)

RBS Level (mg/dl), mean ($\pm$ SD)	215.19 (94.490)
Pain to needle time (min), mean ($\pm$ SD)	99.96 (41.33)
CCU Stay in hours, mean ($\pm$ SD)	67.20 (8.06)

CAD = coronary artery disease, n = total number, RBS : Random blood sugar
Streptokinase was administered to 98 (57.6%) diabetic and 72 (42.4%) non-diabetic patients. Among the total 170 patients, complete ST-segment resolution was observed in 80 (47.1%) cases, while partial and failed resolution occurred in 49 (28.8%) and 41 (24.1%) patients, respectively. ST-segment resolution following streptokinase administration showed variation between diabetic and non-diabetic patients. Complete resolution was observed in 21.2% of diabetic patients compared to 25.9% of non-diabetic patients. Partial ST-segment resolution occurred in 20.6% of diabetic patients and 8.2% of non-diabetic patients. Failed thrombolysis was noted in 15.9% of diabetic patients, whereas 8.2% of non-diabetic patients demonstrated failed resolution.(Figure 01).

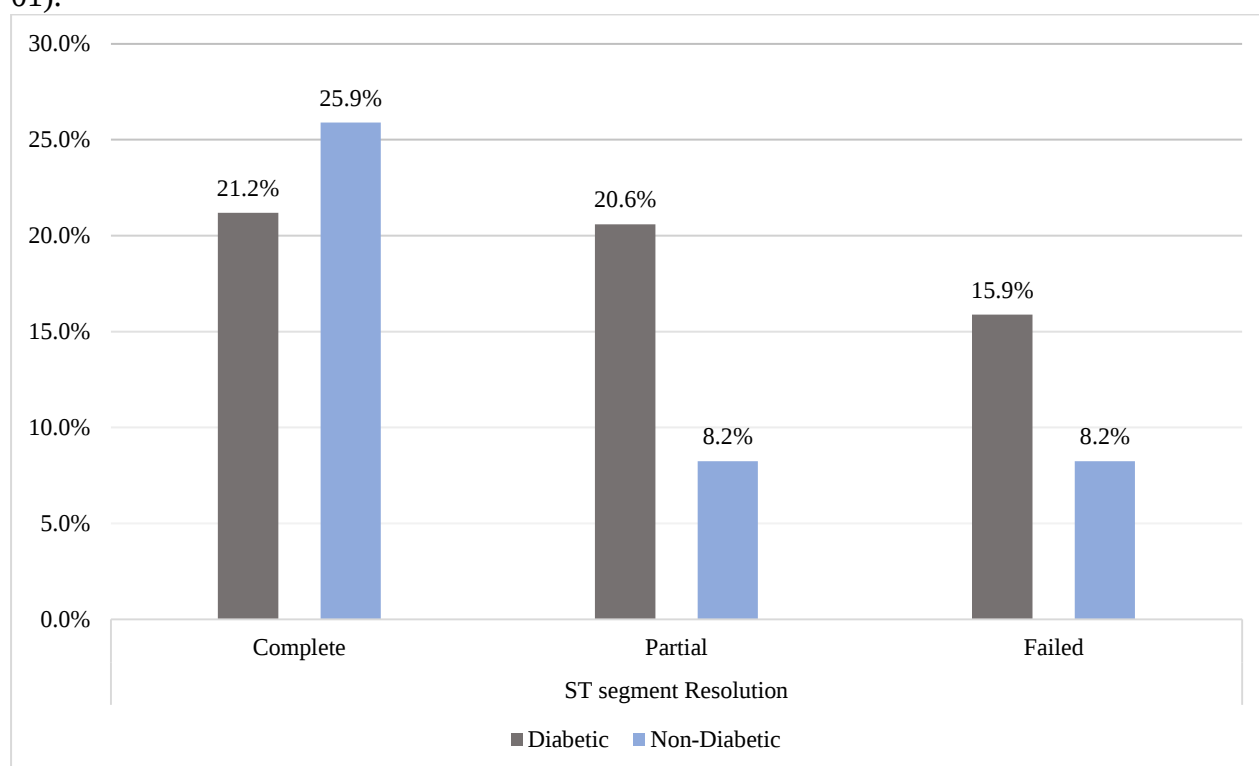


Figure 1: Comparison of ST-Segment Resolution Following Streptokinase Administration Between Diabetic and Non-Diabetic Patients

Diabetic patients had a higher mean CCU duration (68.24 ± 7.98) compared to non-diabetic patients (65.78 ± 8.02), with a statistically significant difference observed ($p = 0.048$). A statistically significant difference in ST-segment resolution was observed between diabetic and non-diabetic groups ($p = 0.006$), with diabetics demonstrating lower complete resolution and comparatively higher partial and failed resolution than non-diabetics.

No statistically significant difference in ST-segment resolution was observed between male and female patients ($p = 0.94$), with similar distributions across all resolution categories. Likewise, history of coronary artery disease showed no significant difference in ST-segment resolution ($p = 0.14$). In contrast, a statistically significant difference in ST-segment resolution was observed across different sites of myocardial infarction ($p = 0.003$), with inferior MI associated with a higher proportion of complete resolution, while anterior MI demonstrated a relatively higher frequency of failed resolution (Table 2).

Table 02: Factors Associated with ST-Segment Resolution in Patients with STEMI Treated with Streptokinase

		ST segment Resolution n (%)			P-value
		Complete	Partial	Failed	
Gender	Male	48 (28.2)	28 (16.5)	24 (14.1)	0.94
	Female	32 (18.8)	21 (12.4)	17 (10)	
Diabetes	Yes	36 (21.2)	35 (20.6)	27 (15.9)	0.006
	No	44 (25.9)	14 (8.2)	14 (8.2)	
History of CAD	Yes	21 (12.4)	21 (12.4)	14 (8.2)	0.14
	No	59 (34.7)	28 (16.5)	27 (15.9)	
Site of MI	Anterior	24 (14.1)	14 (8.2)	28 (16.5)	0.003
	Inferior	30 (17.6)	15 (8.8)	4 (2.4)	
	Lateral	10 (5.9)	8 (4.7)	2 (1.2)	
	Anterolateral	11 (6.5)	7 (4.1)	4 (2.4)	
	Inferolateral	5 (2.9)	5 (2.9)	3 (1.8)	

Discussion

This study evaluates the post thrombolytic resolution of ST-segment in STEMI diabetic and non-diabetic patients.

The mean age of participants included in this study was 59.05±12.18. Out of 170 patients, 58.8% were male and 41.2 % were female. In our study 57.6 % were diabetic while 42.4 % were non diabetic. Comparing our finding with Dr. Ashish C et al study there mean age was 55.59 year, 80% (N=160) were male and 20% (N=40) were female and about 127(63.2%) were non-diabetics and 74(36.8%) were diabetics these finding did not align with our study findings.

The mean pain-to-needle time in our study was 99.96 ± 41.33 minutes, which was substantially lower than the 5.01 ± 3.09 hours reported by Badar G et al (15), and the 3.48 ± 1.75 hours and 3.79 ± 1.98 hours reported by I Shah et al. in non-diabetic and diabetic patients, respectively(16). This finding suggests a relatively earlier initiation of reperfusion therapy in our cohort. Since timely thrombolysis remains a critical determinant of myocardial salvage and clinical outcomes in STEMI, the shorter pain-to-needle interval observed in our study may have contributed to the overall successful reperfusion rate achieved following streptokinase administration.

The distribution of complete, partial, and failed ST-segment resolution was comparable between male and female patients there was no notable significance seen (p= 0.09), in male about 48% achieved complete, 28% achieved partial and 24% failed to achieve ST resolution while in female 32% achieved complete ST segment resolution, 21% achieved partial resolution and 17% failed to achieve ST segment resolution. Similarly, the rates of chest pain and dyspnea resolution did not differ significantly according to gender (75.0% vs. 74.3%, p = 0.91). These results were consistent to previous study conducted by A. Hasan et al. in which they found that ST segment resolution was achieved in 22.4% male and 21.6% in female with insignificant association between them p=0.783. The resolution of chest pain within 90 mins occurred more in males (69.5%) as compared to females (49.7%)(p =0.001) (17)

In our study, frequency of complete, partial and failed ST segment resolution in diabetic patients are 36 %, 35 % and 27 % reported respectively, while in non-diabetic

patients it is reported as 44%, 14% and 14% respectively showing significant association ($p=0.005$), while Dr. Sreedhar V et al study's finds out that failed thrombolysis (<30% resolution) is more in diabetics (61.42%) than non-diabetics (21%) (p value is 0.0045) which is significant whereas successful thrombolysis (>70% resolution) is more in non-diabetics (44%) than diabetics (21.42%) (p value is 0.04; significant)(18). Similarly SAIRA F et al reported effectiveness of streptokinase in diabetic cases presenting with (STEMI) as 38.5%($n=77$) while 61.5%($n=123$) failed to be treated effectively(19). Kazim K et al reported that effectiveness (showing 50% depression) of streptokinase in diabetics was 25% and those in non-diabetics was 71.4% (20). These findings aligned with our findings as showing significant association of diabetes and streptokinase efficacy.

In the present study, prolonged hospitalization was assessed using the duration of coronary care unit (CCU) stay. Diabetic patients demonstrated a significantly longer mean CCU stay compared with non-diabetic patients (68.24 ± 8.80 vs. 65.78 ± 8.02 hours; $p = 0.048$). Our results are supported by the findings of Shahriar I et al., who reported a significantly greater proportion of prolonged hospitalizations among diabetic patients compared with non-diabetic patients (60% vs. 40%; $p = 0.006$)(21). Although Shahriar et al. evaluated hospital stay as a categorical variable rather than reporting mean duration of hospitalization, but both studies consistently demonstrate a significant association between diabetes mellitus and prolonged inpatient stay following acute myocardial infarction. The longer hospitalization observed among diabetic patients may be attributed to greater disease severity, impaired myocardial recovery, higher burden of comorbidities, and an increased risk of in-hospital complications.

This study is limited by a relatively small sample size, which may affect the generalizability of the findings. The cross-sectional design does not allow assessment of temporal outcomes or establishment of causal relationships. In addition, key confounders such as coronary artery disease severity, renal function, and prior medication use were not included, which may have influenced the observed associations.

Conclusion

This study concludes that in STEMI patients treated with streptokinase, complete ST-segment resolution was achieved in 47.1% of cases, while the remainder exhibited partial or failed reperfusion. Diabetes mellitus was significantly associated with poorer ST-segment resolution and prolonged CCU stay. No significant differences were observed in ST-segment resolution with respect to gender or history of coronary artery disease. However, the site of myocardial infarction significantly influenced reperfusion outcomes, with inferior MI demonstrating more favorable ST-segment resolution compared to anterior MI. Overall, diabetes status and infarction site were the principal determinants of thrombolytic response in this cohort.

Strict glycemic control and early risk stratification based on infarction site should be emphasized to improve thrombolytic outcomes in STEMI patients.

Declaration

The authors affirm that the study was conducted in accordance with institutional ethical guidelines, and informed consent was obtained from all participants.

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Conflict of Interest

None

Author Contributions

Zaib un Nisa, Mahrukh Dawood, and Amna Bibi contributed to study design, data collection, and manuscript drafting. Muhammad Uzair and Muhammad Bilal assisted in data acquisition and literature review.. Syed Arshad Ullah supervised the study, conducted statistical analysis, and revised the manuscript. All authors approved the final manuscript.

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