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No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

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Post-Thrombolysis Immediate Clinical Outcome in Diabetic vs Non-Diabetic STEMI Patients at FGPC Cardiology Unit Islamabad

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ABSTRACT

***Background**: Diabetes mellitus is a major independent risk factor for cardiovascular disease and is associated with increased morbidity and mortality following acute ST-elevation myocardial infarction (STEMI). Despite the proven efficacy of thrombolytic therapy, diabetic patients often exhibit impaired reperfusion outcomes and greater complication rates due to underlying microvascular dysfunction and delayed myocardial recovery. Evaluating post-thrombolytic outcomes in diabetic versus non-diabetic patients provides valuable insight into disease-specific prognostic differences. **Objective**: To compare the efficacy of thrombolysis with streptokinase in diabetic and non-diabetic patients presenting with STEMI using electrocardiographic (ECG) parameters and to assess the incidence of short-term in-hospital complications within 24 hours post-thrombolysis. **Methods**: This prospective cohort study was conducted in the Department of Cardiology, Federal Government Polyclinic Hospital, Islamabad, from January to May 2025. A total of 115 patients diagnosed with STEMI were included, comprising 48 (41.7%) diabetics and 67 (58.3%) non-diabetics. All patients received streptokinase within 12 hours of symptom onset. ST-segment resolution was evaluated 90 minutes post-thrombolysis, categorized as >70%, 30–70%, or <30%. Clinical outcomes, including resolution of chest pain, arrhythmia, heart failure, cardiogenic shock, and need for rescue PCI, were observed for 24 hours. Statistical analysis was performed using SPSS version 23, with a p-value <0.05 considered significant. **Results**: Complete chest pain resolution occurred in 37.5% of diabetics and 56.2% of non-diabetics (p=0.023). ST-segment resolution >70% was observed in 31.3% of diabetics versus 46.3% of non-diabetics (p=0.093). Heart failure developed in 60.4% of diabetics and 31.3% of non-diabetics (p=0.006), while cardiogenic shock occurred in 22.9% and 4.4%, respectively. Arrhythmias were noted in 10.4% of diabetics and 5.9% of non-diabetics. One non-diabetic patient died within 24 hours post-thrombolysis. **Conclusion**: Diabetic patients demonstrated poorer immediate outcomes after thrombolysis, with reduced ST-segment and symptom resolution and a higher incidence of early complications. Diabetes adversely affects reperfusion efficacy and short-term prognosis, emphasizing the need for early recognition and individualized management in this high-risk group.*

Keywords
Arrhythmia, Cardiogenic shock, Diabetes mellitus, Heart failure, Myocardial infarction, Reperfusion, Thrombolytic therapy

INTRODUCTION

Myocardial infarction (MI) remains one of the leading causes of mortality and morbidity worldwide, primarily resulting from atherosclerotic disease of the coronary arteries (1). The burden of this life-threatening condition continues to rise in both developed and developing nations, including Pakistan, where a significant proportion of the middle-aged population—particularly those between 46 and 55 years—faces a heightened risk of developing MI (2). Among the numerous contributing factors, diabetes mellitus stands out as a major comorbidity that not only predisposes individuals to myocardial infarction but also worsens its outcomes due to increased platelet reactivity and reduced responsiveness to antiplatelet therapy (3). In addition, well-established cardiovascular risk factors such as smoking, hypertension, dyslipidemia, and a prior history of ischemic heart disease further compound the likelihood of myocardial infarction (4). The electrocardiogram (ECG) continues to be the gold standard diagnostic tool for identifying acute ST-segment elevation myocardial infarction (STEMI), allowing clinicians to rapidly assess the extent of myocardial ischemia and guide timely therapeutic intervention (5). During the acute stage of MI, prompt restoration of coronary blood flow through thrombolytic therapy—most commonly with streptokinase—remains the cornerstone of treatment aimed at salvaging viable myocardium (6). The resolution of ST-segment elevation following thrombolysis serves as a key indicator of successful myocardial reperfusion and has been associated with improved clinical outcomes (7,8). Importantly, assessing ST-segment resolution provides a cost-effective and clinically meaningful method for evaluating reperfusion success, particularly in settings where access to coronary angiography is limited (9).

Despite the proven efficacy of thrombolytic therapy, diabetic patients continue to experience significantly higher rates of morbidity and mortality after myocardial infarction compared to non-diabetic individuals (10). This disparity is likely attributed to underlying microvascular dysfunction in diabetics, which compromises myocardial perfusion and may contribute to inadequate ST-segment resolution and poorer prognosis (11). Given these considerations, the present study was designed to evaluate the efficacy of thrombolysis with streptokinase in diabetic and non-diabetic patients, using ECG as a cost-effective and non-invasive marker of reperfusion. Furthermore, the study aims to assess the association between diabetes status and short-term major adverse cardiac events—including heart failure, arrhythmia, and mortality—within the first 24 hours following thrombolysis. The objective of this research is to determine whether diabetes mellitus influences the success of reperfusion therapy and early clinical outcomes in patients presenting with acute myocardial infarction, thereby providing insights that could guide more tailored management strategies for this high-risk population.

METHODS

This prospective cohort study was conducted in the Department of Cardiology, Federal Government Polyclinic Hospital, Islamabad, over a five-month period from January 1, 2025, to May 31, 2025. A total of 115 patients diagnosed with ST-elevation myocardial infarction (STEMI) were enrolled. The diagnosis of STEMI in symptomatic patients was confirmed using standard electrocardiographic (ECG) criteria, defined as new ST-segment elevation in at least two contiguous leads—greater than 2 mm in men and 1.5 mm in women in leads V2–V3, and/or greater than 1 mm in other contiguous chest or limb leads. Patients were categorized into two groups based on diabetic status. Those with a previous diagnosis of diabetes mellitus and receiving either insulin or oral hypoglycemic agents were classified as diabetic, while the remaining patients were considered non-diabetic. Eligible participants included patients presenting with acute STEMI and chest pain of less than 12 hours' duration who received thrombolytic therapy with streptokinase upon arrival. Patients were excluded if they presented beyond 12 hours after symptom onset, had Q-waves suggestive of previous myocardial infarction, or had contraindications to thrombolytic therapy. These contraindications included a known allergy to streptokinase, history of cerebrovascular accident or major surgery within the previous six weeks, ongoing warfarin therapy, active peptic ulcer disease, bleeding disorders, uncontrolled hypertension, or pregnancy. Time from onset of chest pain to thrombolysis was recorded based on patient history. A baseline ECG was obtained immediately upon presentation to identify the site of infarction, categorized as anterior, inferior, lateral, or posterior. Cardiac biomarkers, including troponin I and CK-MB levels, were measured to confirm myocardial injury. The degree of initial ST-segment elevation was recorded in millimeters from the lead demonstrating the maximum elevation.

Follow-up ECG was performed 90 minutes after the administration of streptokinase to assess reperfusion efficacy. ST-segment resolution was evaluated in the same lead showing maximum elevation at presentation and categorized as complete (>70% reduction), partial (30–70% reduction), or poor (<30% reduction) resolution. The degree of chest pain relief after thrombolysis was similarly classified as complete, partial, or no relief. Patients were continuously monitored for 24 hours post-thrombolysis to observe for complications such as arrhythmias, heart failure, re-infarction, major bleeding, stroke, and cardiogenic shock. Vital signs were recorded throughout this period, with hemodynamic stability defined as a systolic blood pressure greater than 90 mmHg and a pulse rate between 60–100 beats per minute. Rescue percutaneous coronary intervention (PCI) was considered in cases of thrombolysis failure or clinical deterioration. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0 for Windows. Continuous variables were expressed as mean ± standard deviation, while categorical data were summarized as frequencies and percentages. The Chi-square test was applied to evaluate associations between categorical variables, and a p-value of less than 0.05 was considered statistically significant. Ethical approval for this study was obtained from the Institutional Review Board (IRB) of the Federal Government Polyclinic Hospital, Islamabad. Informed written consent was obtained from all participants prior to enrollment, ensuring voluntary participation and confidentiality of data in accordance with the Declaration of Helsinki.

RESULTS

A total of 115 patients diagnosed with ST-elevation myocardial infarction (STEMI) were included in the study, comprising 48 (41.7%) diabetic and 67 (58.3%) non-diabetic individuals. The mean age of diabetic patients was 57.75 ± 11.08 years, whereas non-diabetic patients had a mean age of 56.0 ± 12.86 years. Among diabetic patients, 29 (60.4%) were male and 19 (39.6%) were female, while in the non-diabetic group, 48 (71.6%) were male and 19 (28.4%) were female. The most prevalent comorbidity was hypertension, observed in 62 (53.9%) patients, followed by smoking in 43 (37.4%), dyslipidemia in 7 (6.1%), and previous stroke in 3 (2.6%) patients. Based on ECG findings at presentation, 47 (40.9%) patients had anterior wall myocardial infarction, 55 (47.8%) had inferior wall infarction, 12 (10.4%) had lateral wall involvement, and only 1 (0.9%) had a posterior wall infarction. The mean duration from symptom onset to thrombolysis was 4.11 ± 2.3 hours. The mean initial ST-segment elevation was 5.08 ± 1.5 mm, while mean troponin I and CK-MB levels were 6.9 ± 4.89 ng/mL and 183.45 ± 169.17 ng/mL, respectively. Post-thrombolysis assessment revealed that complete resolution of chest pain occurred in 18 (37.5%) diabetic and 42 (56.2%) non-diabetic patients, while partial resolution was seen in 23 (47.9%) diabetic and 21 (31.3%) non-diabetic patients. No relief was reported in 7 (14.6%) diabetic and 4 (6.0%) non-diabetic individuals. The difference between the two groups was statistically significant ($\chi^2 = 7.58$, $p = 0.023$).

Regarding ST-segment resolution at 90 minutes, >70% reduction was observed in 15 (31.3%) diabetic and 31 (46.3%) non-diabetic patients, 30–70% reduction in 25 (52.1%) diabetic and 32 (47.8%) non-diabetic patients, and <30% reduction in 8 (16.7%) diabetic and 4 (6.0%) non-diabetic individuals. Although non-diabetic patients demonstrated better reperfusion outcomes, the difference did not reach statistical significance ($\chi^2 = 4.75$, $p = 0.093$). Within 24 hours post-thrombolysis, arrhythmias occurred in 5 (10.4%) diabetic and 4 (5.9%) non-diabetic patients, with no significant association ($p = 0.60$). Heart failure developed in 29 (60.4%) diabetic and 21 (31.3%) non-diabetic patients, showing a statistically significant relationship between diabetes and post-thrombolytic heart failure ($\chi^2 = 10.36$, $p = 0.006$). Cardiogenic shock occurred in 11 (22.9%) diabetic versus 3 (4.4%) non-diabetic patients, while major bleeding was observed in 2 (3.0%) non-diabetic individuals only. Vital instability within 24 hours of thrombolysis was documented in 14 (29.2%) diabetic and 10 (14.9%) non-diabetic patients. Of these, 13 (27.1%) diabetic and 5 (7.5%) non-diabetic individuals required rescue percutaneous coronary intervention (PCI).

Additional analysis of the dataset revealed further insights into early mortality, reperfusion timing, and biochemical markers. Within the first 24 hours post-thrombolysis, one death (0.9%) was recorded, occurring in a non-diabetic patient, with no early mortality among diabetic participants. Evaluation of cardiac function based on the Killip classification demonstrated that 19 diabetic patients exhibited no signs of heart failure, while 21, 6, and 2 patients were classified as Killip class II, III, and IV, respectively. Among non-diabetic patients, 46 exhibited no heart failure, 18 were

in Killip class II, and 3 were in class III, with none in class IV, suggesting that diabetic individuals experienced a more severe functional decline. The mean time from symptom onset to thrombolysis was slightly longer in diabetic patients (4.49 ± 2.25 hours) compared to non-diabetics (3.84 ± 2.39 hours), indicating a possible delay in presentation or treatment initiation among diabetics, which could contribute to poorer reperfusion outcomes. Mean troponin I levels at presentation were also higher in diabetic patients (7.62 ± 5.45 ng/mL) compared to non-diabetics (6.39 ± 4.42 ng/mL), while mean CK-MB levels were similar between the two groups (184.08 ± 178.21 ng/mL vs. 183.00 ± 163.76 ng/mL), reflecting a comparable degree of myocardial injury.

Table 1: Baseline Demographic and Clinical Characteristics of Study Population (n = 115)

Variable	Total (n=115)	Diabetic (n=48)	Non-Diabetic (n=67)	p-value
Age (years, mean ± SD)	56.8 ± 12.0	57.75 ± 11.08	56.00 ± 12.86	0.48
Gender				
Male	77 (67.0%)	29 (60.4%)	48 (71.6%)	0.21
Female	38 (33.0%)	19 (39.6%)	19 (28.4%)	
Hypertension	62 (53.9%)	34 (70.8%)	28 (41.8%)	0.003*
Smoking	43 (37.4%)	21 (43.8%)	22 (32.8%)	0.24
Dyslipidemia	7 (6.1%)	3 (6.3%)	4 (6.0%)	0.95
Previous Stroke	3 (2.6%)	1 (2.1%)	2 (3.0%)	0.80
Site of Infarction				
Anterior MI	47 (40.9%)	20 (41.7%)	27 (40.3%)	0.88
Inferior MI	55 (47.8%)	23 (47.9%)	32 (47.8%)	
Lateral MI	12 (10.4%)	5 (10.4%)	7 (10.4%)	
Posterior MI	1 (0.9%)	0 (0%)	1 (1.5%)	
Time from onset to thrombolysis (hours, mean ± SD)	4.11 ± 2.3	4.49 ± 2.25	3.84 ± 2.39	0.27

*Statistically significant ($p < 0.05$)

Table 2: Post-Thrombolysis Chest Pain Resolution between Diabetic and Non-Diabetic Patients

Chest Pain Resolution (90 mins)	Diabetic (n=48)	Non-Diabetic (n=67)	Total (n=115)	p-value (χ^2)
Complete relief	18 (37.5%)	42 (56.2%)	60 (52.2%)	0.023*
Partial relief	23 (47.9%)	21 (31.3%)	44 (38.3%)	
No relief	7 (14.6%)	4 (6.0%)	11 (9.5%)	

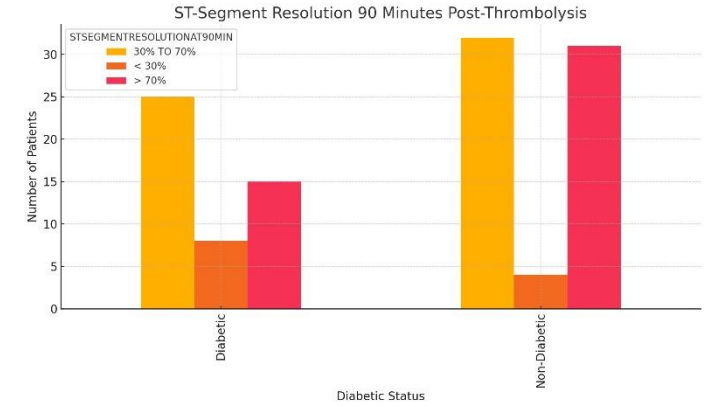
Table 3: ST-Segment Resolution and Reperfusion Success at 90 Minutes

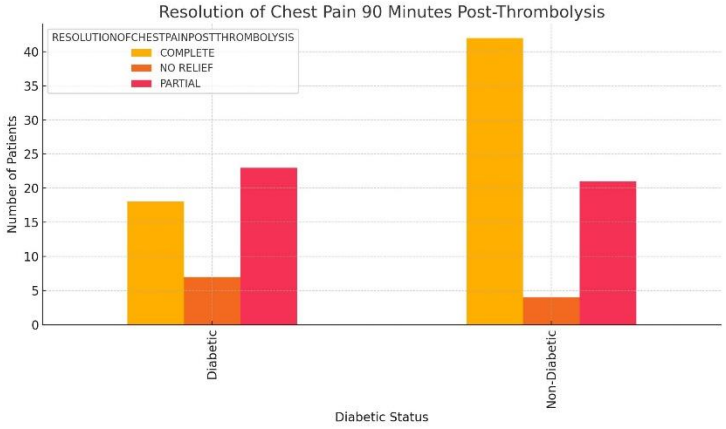
ST-Segment Resolution	Diabetic (n=48)	Non-Diabetic (n=67)	Total (n=115)	p-value (χ^2)
>70% (Complete)	15 (31.3%)	31 (46.3%)	46 (40.0%)	0.093
30–70% (Partial)	25 (52.1%)	32 (47.8%)	57 (49.6%)	
<30% (Poor/No Resolution)	8 (16.7%)	4 (6.0%)	12 (10.4%)	

Table 4: In-Hospital Adverse Outcomes within 24 Hours Post-Thrombolysis

Complication	Diabetic (n=48)	Non-Diabetic (n=67)	Total (n=115)	p-value (χ^2)
Arrhythmia	5 (10.4%)	4 (5.9%)	9 (7.8%)	0.60
Heart failure	29 (60.4%)	21 (31.3%)	50 (43.5%)	0.006*
Cardiogenic shock	11 (22.9%)	3 (4.4%)	14 (12.2%)	0.012*
Major bleeding	0 (0%)	2 (3.0%)	2 (1.7%)	0.28
Death (within 24 hours)	0 (0%)	1 (1.5%)	1 (0.9%)	0.39
Vital instability	14 (29.2%)	10 (14.9%)	24 (20.9%)	0.08
Need for rescue PCI	13 (27.1%)	5 (7.5%)	18 (15.7%)	0.009*

*Statistically significant ($p < 0.05$)





DISCUSSION

Diabetes mellitus is a well-established major risk factor contributing to the development and progression of cardiovascular diseases (11). It significantly worsens the prognosis in patients presenting with ST-elevation myocardial infarction (STEMI), regardless of the therapeutic intervention employed (12,13). Thrombolytic therapy with agents such as streptokinase remains an essential and effective reperfusion strategy, particularly in resource-limited settings where primary percutaneous coronary intervention (PCI) may not be immediately available (14). The present study demonstrated that diabetic patients exhibited lower rates of both chest pain resolution and ST-segment resolution following thrombolysis with streptokinase when compared to non-diabetic individuals, indicating a reduced efficacy of thrombolytic therapy in this high-risk group. Similar observations have been reported in previous research, which highlighted impaired thrombolytic response among diabetics, likely due to altered fibrinolytic activity and endothelial dysfunction (15,16). The findings also revealed that diabetic patients experienced a higher incidence of post-thrombolysis complications, including arrhythmia, heart failure, cardiogenic shock, and the need for rescue PCI within the first 24 hours. This is consistent with prior studies that have shown diabetes to be strongly associated with increased morbidity and adverse cardiac events following thrombolytic treatment (17). The underlying mechanisms are multifactorial, involving diffuse and accelerated atherosclerosis, microvascular disease, impaired coronary collateral circulation, reduced myocardial contractile reserve, and the presence of diabetic cardiomyopathy, all of which contribute to compromised myocardial perfusion and recovery (18). Furthermore, the delayed presentation to hospital and longer time-to-thrombolysis observed among diabetics in this study may have further limited the effectiveness of reperfusion therapy and negatively influenced clinical outcomes. The clinical implications of these findings emphasize the importance of early recognition and prompt management of STEMI in diabetic patients, as well as the potential need for adjunctive or alternative reperfusion strategies in this subgroup (19,20). Optimization of pre-hospital systems to minimize treatment delays and tailored pharmacologic approaches targeting platelet reactivity and endothelial dysfunction may improve outcomes.

The strength of this study lies in its prospective cohort design and standardized post-thrombolysis monitoring using ECG-based assessment of reperfusion, which provides a cost-effective and practical method of evaluating therapeutic success. However, the study had several limitations that must be acknowledged. It was a single-center investigation with a relatively small sample size, which may limit generalizability. All participants were from a similar ethnic background, potentially reducing population diversity and external validity. The follow-up period was limited to 24 hours post-thrombolysis, which restricted evaluation of long-term outcomes such as reinfarction, late heart failure, and mortality. Additionally, echocardiographic parameters, such as ejection fraction and wall motion score index, were not included, which could have provided further insight into myocardial recovery and functional outcomes. Future research should focus on larger multicenter studies with longer follow-up durations to better delineate the prognostic differences between diabetic and non-diabetic patients following thrombolytic therapy. Incorporating advanced imaging modalities, biochemical markers of reperfusion, and comparisons with primary PCI outcomes would enhance the understanding of diabetes-related disparities in myocardial salvage and recovery (21,22). Overall, this study reinforces that diabetes mellitus adversely influences both the immediate reperfusion success and early clinical outcomes after thrombolysis with streptokinase in patients with STEMI. The findings underscore the need for targeted strategies to mitigate these risks and improve prognosis in this vulnerable population.

CONCLUSION

The findings of this study conclude that diabetic patients experience poorer immediate clinical outcomes following thrombolysis for ST-elevation myocardial infarction compared to non-diabetic individuals. Diabetes was associated with reduced resolution of symptoms and ST-segment

changes, along with a higher incidence of early complications such as heart failure, arrhythmia, and cardiogenic shock. These results highlight the adverse impact of diabetes on reperfusion success and short-term recovery after thrombolytic therapy, underscoring the need for prompt recognition, optimized management, and tailored therapeutic strategies to improve outcomes in this high-risk population.

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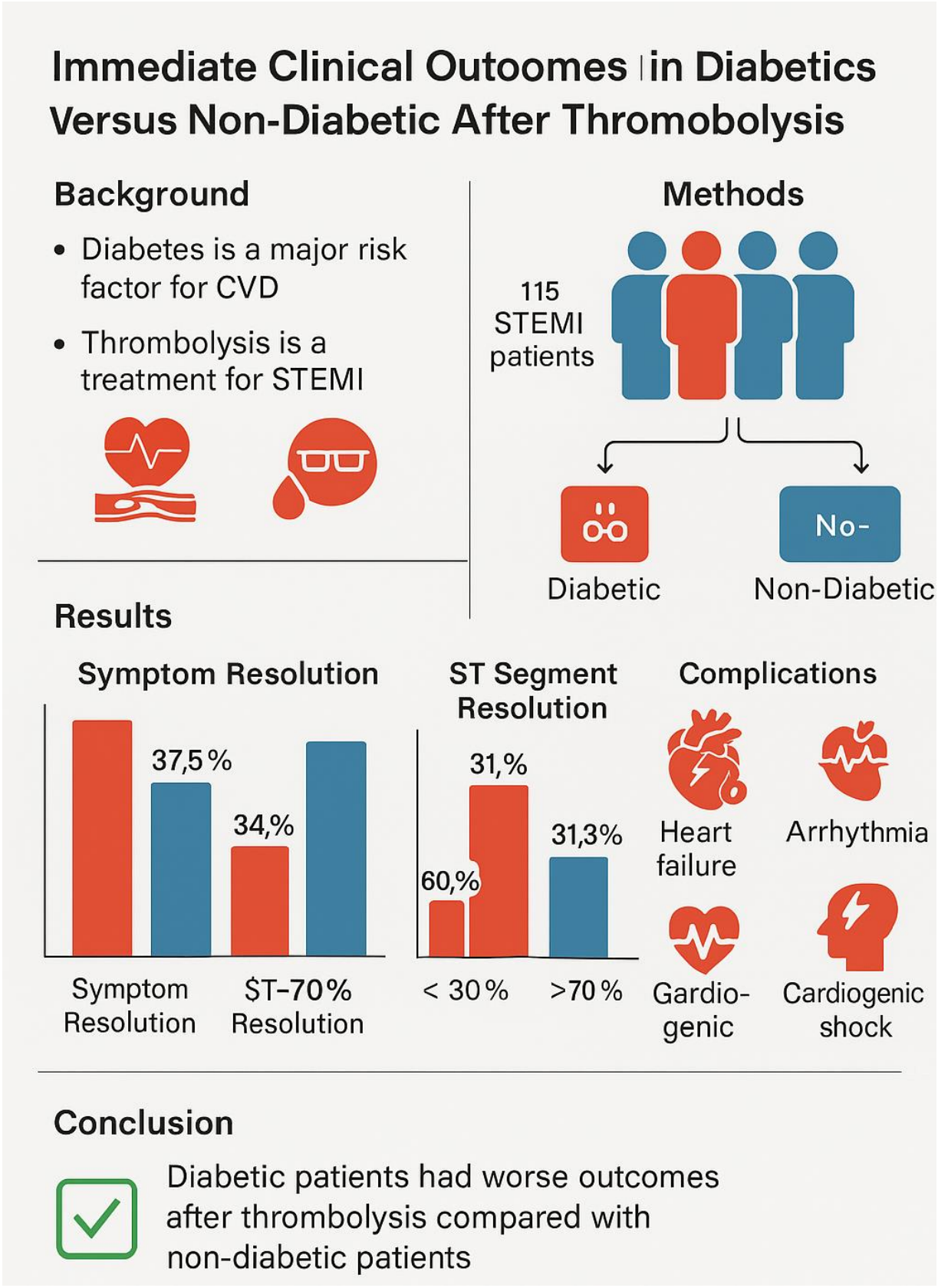

Figure 1 Graphical Abstract