

Systematic Review

Comparative clinical effectiveness of thrombolytic agents streptokinase versus alteplase versus tenecteplase in the management of ST-segment elevation myocardial infarction: a systematic review and meta-analysis

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Received: 09 December 2025

Revised: 15 April 2026

Accepted: 18 April 2026

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ABSTRACT

ST-segment elevation myocardial infarction (STEMI) remains a leading cause of mortality worldwide, particularly in LMICs where access to primary percutaneous coronary intervention is limited. Thrombolytic therapy continues to be the cornerstone of reperfusion in such settings. This study aimed to assess the clinical effectiveness of fibrinolytic agents Streptokinase (SK), Alteplase (tPA), and Tenecteplase (TNK) in management of STEMI. This SRMA was conducted in accordance with the PRISMA guidelines. A literature search was performed across PubMed, Web of Science, and Embase using predefined keywords. Two independent reviewers screened titles, abstracts, and full texts. Data were extracted in predetermined way and assessed for quality using appropriate critical appraisal tools. Meta-analyses were performed using a random-effects model to compare the clinical outcomes. Total of 12 studies were selected out of 1280, 158 duplicates and 1048 studies were removed based on title and abstract screening, 59 studies were excluded on full text screening. Of all 9 evaluated vessel reperfusion based on TIMI grades, 8 evaluated 30-day mortality, 6 studies reported major bleeding events, 5 reported minor bleeding and 7 reported MACE. Meta-analysis showed significant improvement in reperfusion with fibrinolytic therapy (62.80%; 95% CI: 53.98–71.62%). TNK demonstrated higher reperfusion success and lower 30-day mortality (3.46%; 95% CI: 0.00– 7.85) compared to SK (5.15%; 95% CI 2.27–8.04%). TNK exhibited the lowest bleeding risk (0.92; 95% CI: 0.03– 1.80%) and favourable MACE outcomes (11.04%, 95% CI: 3.44–18.64). Fibrin-specific thrombolytic i.e. TNK, demonstrate superior efficacy and safety in the management of STEMI.

Keywords: Thrombolytic agent, Fibrinolytics, Clot lysis, Streptokinase, Alteplase, Tenecteplase

INTRODUCTION

Globally cardiovascular diseases are the leading cause of death, taking an estimated 17.9 million lives (32%) each year. Heart attacks and strokes account for 85% of these deaths.¹ Acute coronary syndrome (ACS) is a group of conditions characterized by a sudden decrease in myocardial perfusion, which includes ST-segment

elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI), or unstable angina. STEMI represents about 30% of all ACS cases, and is marked by transmural myocardial ischemia resulting in myocardial injury.² Common feature of myocardial ischemia is chest pain-equivalent symptoms which includes dyspnoea, epigastric pain, and pain in the left arm. In STEMI, the pain tends to be more persistent

and heavier. For patients presenting with ACS, electrocardiography should be performed immediately (within 10 minutes of presentation) to distinguish between STEMI and non-ST-segment elevation.^{1,3,4}

STEMI results in myocardial injury or necrosis and remains a major cause morbidity and mortality worldwide. While Primary percutaneous coronary intervention (PCI) is preferred reperfusion therapy, due to its limitations, fibrinolytic therapy is often preferred. The treatment of MI includes, aspirin tablets, to dissolve arterial blockage injection of thrombolytics (tissue plasminogen activator) streptokinase or urokinase in blood within 3 hours of the onset of a heart attack and painkillers.⁵ The management of patients with STEMI and NSTEMI has evolved considerably over decades, with better understanding early reperfusion needs and protocol based pharmacotherapy.^{6,7} Thrombolytic therapy plays an important role in management of STEMI. Depending on the location of such thrombi and emboli, they may manifest themselves in the form of varied thromboembolic disorders like stroke, pulmonary embolism, deep vein thrombosis, arterial thrombosis, acute myocardial infarction (AMI) and retinal artery occlusion.⁸ When electrocardiography suggests STEMI, rapid reperfusion with primary percutaneous coronary intervention (PCI) within 120 minutes reduces mortality from 9% to 7%. If PCI within 120 minutes is not possible, fibrinolytic therapy with alteplase, reteplase, or tenecteplase at full dose should be administered for patients younger than 75 years without contraindications and at half dose for patients 75 years or older (or streptokinase at full dose if cost is a consideration), followed by transfer to a facility with the goal of PCI within the next 24 hours.³ Alteplase showed better reperfusion than Streptokinase, also accelerated alteplase infusion showed better patient outcome than non-accelerated infusion.⁹ According to many studies a fibrin-specific agent should be preferred. Single-bolus weight-adjusted tenecteplase is equivalent to accelerated tPA in reducing 30-day mortality, and is safer in various aspects.^{10,11} A 30-day post-discharge health-related quality of life (HRQoL) among patients with acute myocardial infarction (AMI), using the Seattle Angina questionnaire (SAQ) was conducted in India, 44% experienced angina within 30 days. Physical limitation was 58.3% (IQR: 41.7–77.8). Patient satisfaction and quality of life 81.3% and 66.7 respectively.¹²

This study intends to provide evidence-based insights to physicians at rural settings, and healthcare policymakers, by comparing interventions across key outcome parameters such as effectiveness, efficacy, safety, adverse events, and treatment success.

This review will also emphasize the broader significance of selecting appropriate fibrinolytic agents, particularly in resource-limited settings where cost-effectiveness, drug availability, and patient safety are crucial considerations.

Objectives

The objectives of the study were: to systematically review the published literature and identify reperfusion success with fibrinolytic agents i.e. streptokinase, alteplase and tenecteplase in management of ST-segment elevation myocardial infarction, and to compare the clinical efficacy, safety, and humanistic outcomes of the fibrinolytic therapy in patients with ST-segment elevation myocardial infarction.

METHODS

The systematic review was registered in The International Prospective Register of Systematic Reviews (PROSPERO) CRD420251072502. The study is reported according to the preferred reporting items for systematic reviews and meta-analysis extension (PRISMA).

Inclusion criteria

Types of studies

Studies that included patients with severe chest pain diagnosed with ST elevation myocardial infarction with ECG showing more than 1 mm elevation in 2 contiguous leads. Eligible studies assessed the reperfusion, efficacy and/or safety of TNK versus TPA versus SK in managing MI. Studies that didn't mention TNK, TPA and/or SK in the title but mentioned fibrinolytics or thrombolytics were selected for full-text screening, if a conclusion could not be reached on abstract screening.

No restriction was placed on the publication date, follow-up duration, and sample size. Besides systematic reviews, case study and case report no other restriction was placed on the study design.

Types of participants

Studies where patients (≥ 40 years of age) with severe chest pain and reaching CHC/SDH or DH within 12 hours and diagnosed with ST elevation myocardial infarction with ECG showing more than 1 mm elevation in 2 contiguous leads. In female, leads V2 and V3 showing more than 1.5 mm of elevation. In male < 40 years of age, leads V2 and V3 showing more than 2.5 mm of elevation and in male > 40 years of age showing more than 2 mm of elevation.

Outcome measures

The studies that reported reperfusion rate of the fibrinolytic agents, mortality, adverse cardiovascular events, bleeding complication, incidents of reinfarction and health related quality of life.

Exclusion criteria

Type of study

Overlapping/repetitive studies, systematic reviews, non-English studies and conference abstracts were excluded.

Search strategy

A comprehensive literature search was conducted on PubMed, web of science and Embase. We developed the search terms for "STEMI", "fibrinolytic agents" and "outcomes". For the clinical condition STEMI, we developed the search terms as "Myocardial Infarction", "ST-segment Elevation Myocardial Infarction" "ST elevation myocardial infarction" and "STEMI". For fibrinolytic agents, the search teams developed were "Thrombolytic Therapy", "fibrinolysis", "reperfusion therapy", "reperfusion", "Streptokinase", "alteplase", "tenecteplase", "tPA", "T-Plasminogen Activator", "TNK", "Fibrinolysis", "lysis", "clot dissolve" and "Fibrinolytic Agents". For outcomes the search terms used were "management", "efficacy", "effectiveness", "Adverse effects", "adverse events" "complication" and "mortality". Boolean operators "AND" and "OR" were used along with truncation to refine the search. The reference list of recognized studies will be further explored to search for additional papers. Furthermore, an extensive search of grey literature will be conducted in accordance with the specified timelines.

Selection of studies

Firstly, all the studies were uploaded on Rayyan software, the included study in the review was screened and duplicates were removed. The two reviewers ZA and TR independently screened title/abstract of the studies. Those that fit the inclusion criteria was considered for the next stage of screening and the rest was excluded.

All the eligible studies full texts were retrieved, and both reviewers independently assessed the full papers for their eligibility for final inclusion and data extraction. In-case of disagreement, issue was resolved by discussion.

The selection process of the studies is depicted in the flow diagram following the PRISMA guidelines.

Study characteristics

Selection of studies

A total of 1280 studies were selected and were uploaded on Rayyan software, the included study in the review was screened and 158 duplicates were removed. The two reviewers ZA and TR independently screened title/abstract of the 1122 studies. Those that fit the inclusion criteria was considered for the next stage of screening and the 1048 were excluded. All the eligible studies (n=74) full texts were retrieved, and both reviewers independently assessed

the full papers for their eligibility for final inclusion and data extraction. Studies were excluded based on different outcome of interest, different drugs or combinations, full text unavailability, different population, different study design and foreign languages. In-case of disagreement, issue was resolved by discussion. We narrowed to a total of 15 studies. The selection process of the studies is depicted in the flow diagram following the PRISMA guidelines.

Data extraction and quality assessment

Two investigators (ZA and TR) independently extracted data from text, tables and figures. Any discrepancies were resolved by discussion and consensus with a third reviewer (NAY). For each of the included trials, the following data were extracted: publication year, drugs used, number of patient in each group and treatment details (reperfusion, 30 days' mortality, major and minor bleeding, major adverse cardiovascular events and recurrence). Study quality and risk of bias were critically appraised using the updated Cochrane collaboration risk-of-bias tool V.2, Newcastle-Ottawa for cohort studies, JBI critical appraisal tools for the analytical cross-sectional studies and quasi-experimental study.

Outcome

The predetermined primary outcome was reperfusion followed by 30 days' mortality, major and minor bleeding and major adverse cardiovascular events. Table 1 shows study characteristics such as author and year of publication, sample size, study setting and design and outcome. From these studies Table 2 was extracted showing summary of various events occurring for the given fibrinolytics.

RESULTS

A total of 1280 unique records were identified through electronic searches using four online databases, from which 158 duplicates were removed. Of these, 1048 were excluded based on title and abstract alone. After screening the full text of the remaining 74 articles, 12 studies were found to meet the inclusion criteria, as summarised on the PRISMA flow diagram (Figure 1).²⁵ The risk of bias assessment was done using ROB2, JBI and New Ottawa checklist for each study according to their study design and 9 studies showed low risk and 2 showed high risk.

Clinical outcomes

A total of two studies compared Streptokinase versus Alteplase and 10 studies compared Streptokinase vs Tenecteplase. Out of all, 9 studies evaluated vessel reperfusion based on TIMI grades. The overall pooled proportion demonstrated a significant improvement in reperfusion with thrombolytic therapy 62.80%; 95% CI: 53.98-71.62%.

Table 1: Study characteristics.

Author/year	Sample size	Study design/setting	Outcomes
Chesebro et al 1987¹³	SK=159, TPA=157	RCT	rt-PA elicited reperfusion in twice as many occluded infarct-related arteries as compared with SK
The GUSTO Investigators 1993¹⁴	SK=10,410, TPA=10,396	RCT	Survival benefit favours t-PA, especially in patients with higher mortality risk
Panduranga et al 2012¹⁵	SK=674, TNK=164	Cross-sectional, analytical	Use of newer thrombolytic agents in high risk patients was appropriate. Newer thrombolytic agents were associated with significantly lower mortality at 1-month and 1-year compared to the older agent, streptokinase
Ayça et al 2015¹⁶	SK=89, TNK=140	Cohort study	Fibrin specific regime should be preferred
Xavier et al 2016¹⁷	SK=30, TNK=30	Cross-sectional, analytical	Tenecteplase and Streptokinase had equal ST resolution (83%), but Tenecteplase had fewer adverse effects than Streptokinase.
Aherrao et al 2018¹⁸	SK=30, TNK=30	RCT	Efficacy and safety of Streptokinase and Tenecteplase are similar when administered in correct timelines for STEMI treatment.
Bawaskar et al 2019¹⁹	SK=162, TNK=47	Cros-sectional, analytical	Thrombolysis of STEMI within golden hours improved the reperfusion. However, 1-year fatality is significance with streptokinase as compared with tenecteplase
Singh et al 2019²⁰	SK=104, TNK=42	Cohort study	Tenecteplase is associated with faster ST resolution compared to Streptokinase. Both drugs have a comparable safety profile. Streptokinase had higher allergic reactions.
Neela et al 2020²¹	SK=50, TNK=50	RCT	Streptokinase (SK) was the least effective and had the highest rate of adverse events (bleeding, hypotension, anaphylaxis)
Shah et al 2021²²	SK=54, TNK=44	Non-randomised quasi-experimental	TNK trends better than SK for reperfusion
Koh et al 2022²³	SK=349, TNK=349	Cross-sectional, analytical	Streptokinase and tenecteplase are fibrinolytic agents with similar efficacy and safety in STEMI reperfusion therapy in our Asian population.
Sahu et al 2022²⁴	SK=100, TNK=100	Cros-sectional, analytical	Numerically, TNK had the lowest 30-day mortality (5%) and highest survival (94.5%).

Table 2: Summary of studies investigating various events thrombolysis for patients with STEMI.

Author/year	Groups	Reperfusion of vessels	Major bleeding	Minor bleeding	MACE	30 days mortality
Chesebro et al 1987¹³	SK=159, TPA=157	√	√	√	√	√
The GUSTO Investigators 1993¹⁴	SK=10,410, TPA=10,396	NR	√	NR	√	√
Panduranga et al 2012¹⁵	SK=674, TNK=164	NR	NR	NR	NR	√
Ayça et al 2015¹⁶	SK=89, TNK=140	√	NR	NR	NR	NR
Xavier et al 2016¹⁷	SK=30, TNK=30	√	NR	√	√	√
Aherrao et al 2018¹⁸	SK=30, TNK=30	√	NR	√	NR	√
Bawaskar et al 2019¹⁹	SK=162, TNK=47	√	√	√	√	√
Singh et al 2019²⁰	SK=104, TNK=42	√	√	NR	√	NR
Neela et al 2020²¹	SK=50, TNK=50	√	√	NR	√	NR
Shah et al 2021²²	SK=54, TNK=44	√	NR	NR	NR	NR
Koh et al 2022²³	SK=349, TNK=349	NR	√	√	√	√
Sahu et al 2022²⁴	SK=100, TNK=100	√	NR	NR	NR	√

The subgroup analysis revealed that streptokinase was associated with a significant improvement in vessel reperfusion by 56.57%; 95% CI: 41.67-71.47%. Similarly, tenecteplase demonstrated a significant reperfusion by 71.29%, 95% CI: 63.08-79.41%.

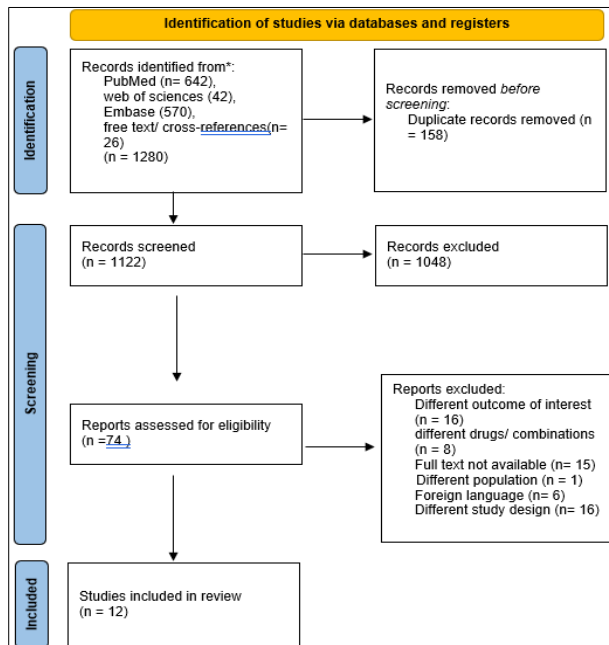


Figure 1: PRISMA diagram.

Eight studies evaluated 30-day mortality following thrombolytic therapy. The overall pooled analysis demonstrated a significant reduction in 30-day mortality with thrombolytic use 4.05%; 95% CI: 2.68-6.48%. In the subgroup analysis, Streptokinase was associated with a 6% mortality rate 95% CI: 2.27-8.04%, while tenecteplase demonstrated a significantly lower pooled mortality 3.64%; 95% CI: 0-7.84%.

Of all, six studies reported major bleeding events following thrombolytic therapy. The overall pooled analysis demonstrated low risk of major bleeding i.e. 3.77%; 95% CI: 0.84-6.70%; $I^2=86.9\%$; $p<0.0001$). In the subgroup analysis, streptokinase was associated with a pooled major bleeding risk of 4.39% (95% CI: 0.00-8.9). Tenecteplase showed a comparatively lower bleeding risk of 0.92% (95% CI: 0.03-1.80%), whereas alteplase demonstrated a slightly higher risk of 7.52% (95% CI: 0.00-22.20%).

Five out of 12 studies reported minor bleeding. The overall pooled analysis demonstrated a 6.50% risk of minor bleeding 95% CI: 2.80-10.21%, with high heterogeneity ($I^2=85.1\%$). In the subgroup analysis, streptokinase was significantly associated with 8.39% risk of minor bleeding risk (95% CI: 2.91-13.88%; $I^2=86\%$), whereas tenecteplase showed a comparatively lower risk of 3.52% (95% CI: 0.00-7.44%; $I^2=60.1\%$). And 7 studies reported MACE, the overall pooled analysis demonstrated MACE rate of 11.34% (95% CI: 7.60-15.08%, $I^2=91.2\%$). In the subgroup analysis, streptokinase demonstrated significant

MACE risk of 11.27% (95% CI: 5.56-16.47%; $I^2=90.8\%$), while tenecteplase demonstrated a significant risk of 11.04% (95% CI: 3.44-18.64; $I^2=90.8\%$). Alteplase exhibited a slightly higher MACE risk of 11.87% (95% CI: 6.92-16.82; $I^2=70\%$). The Overall outcome suggested that fibrin-specific thrombolytic i.e. Tenecteplase is superior than non-fibrin-specific thrombolytics i.e. Streptokinase in terms of reperfusion, 30-days mortality and major and minor bleeding and MACEs.

DISCUSSION

This systematic review and meta-analysis comprehensively compared the clinical efficacy and safety of different thrombolytic agent streptokinase, alteplase, and tenecteplase in the management of STEMI. Early revascularisation remains the cornerstone of successful management of patients with STEM. The pooled evidence from 15 studies demonstrates that thrombolytic therapy significantly improves reperfusion and reduces short-term mortality in STEMI patients, with notable variations in outcomes among different agents. Our findings reaffirm that fibrin-specific agents (alteplase and tenecteplase) offer superior clinical efficacy compared to the non-fibrin-specific streptokinase. In terms of reperfusion success, both alteplase and tenecteplase achieved higher rates of TIMI grade 3 flow restoration, reflecting better microvascular perfusion.^{17,19} The reduction in 30-day mortality was also most evident with tenecteplase, followed by alteplase, while streptokinase though still effective showed a comparatively higher mortality risk. These results align with previous large-scale trials such as GUSTO and ASSENT, which established the mortality and reperfusion benefits of fibrin-specific agents over older thrombolytics.²⁶

An important implication of these findings is the clinical and operational advantage of tenecteplase. Its single-bolus administration simplifies logistics, shortens door-to-needle time, and reduces the need for continuous infusion monitoring. These properties make TNK particularly suitable for pre-hospital or peripheral healthcare settings, where infrastructure for PCI or prolonged infusion may be limited. Tenecteplase yielded the lowest pooled mortality (RR=0.04; 95% CI: 0.02–0.08; $I^2=89.5\%$; $p<0.0001$), followed closely by alteplase (RR=0.06; 95% CI: 0.06–0.06; $I^2=0\%$; $p=0.4195$), whereas streptokinase though effective showed comparatively higher mortality risk (RR=0.06; 95% CI: 0.03–0.08; $I^2=96.5\%$; $p<0.0001$), possibly reflecting its lower fibrin specificity and higher immunogenic potential. Overall, this systematic review underscores that tenecteplase and alteplase outperform streptokinase in terms of reperfusion efficacy, mortality reduction, and safety, supporting their preferential use in the management of STEMI. Streptokinase, though widely used, may be less efficient and associated with greater heterogeneity in clinical outcomes. Thus, this analysis supports the preferential use of fibrin-specific agents in the thrombolytic management of STEMI.

CONCLUSION

This systematic review concludes that fibrin-specific thrombolytics, particularly tenecteplase and alteplase, demonstrate superior efficacy and safety compared to streptokinase in the management of STEMI. Both agents significantly improve reperfusion success and reduce 30-day mortality with a lower incidence of bleeding complications. Among them, tenecteplase offers added operational advantages due to its single-bolus administration and favourable safety profile, making it a practical choice in resource-limited settings where timely PCI is not feasible.

Funding: HTAIn Regional Resource Hub Hyderabad, Department of Health Research MoHFW. Government of India

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Antman AM, Anbe DT, Armstrong PW, Bates ER, Green LA, Hand M, et al. ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction—Executive Summary. *Circulation*. 2004;110:5.
2. Akbar H, Sharma S. Acute ST-Segment Elevation Myocardial Infarction (STEMI). StatPearls. Treasure Island (FL): StatPearls Publishing; 2024.
3. Bhatt DL, Lopes RD, Harrington RA. Diagnosis and Treatment of Acute Coronary Syndromes: A Review. *JAMA*. 2022;327(7):662-75.
4. Mitsis A, Gragnano F. Myocardial Infarction with and without ST-segment Elevation: a Contemporary Reappraisal of Similarities and Differences. *Curr Cardiol Rev*. 2021;17(4):e230421189013.
5. Lu L, Liu M, Sun R, Zheng Y, Zhang P. Myocardial Infarction: Symptoms and Treatments. *Cell Biochem Biophys*. 2015;72(3):865-7.
6. Jamal M, Roohafza H, Soleimani A, Massoumi G, Mirmohammadsadeghi A, Dorostkar N, et al. Predictors of Mortality for Patients with ST-Elevation Myocardial Infarction after 2-Year Follow-Up: A ST-Elevation Myocardial Infarction Cohort in Isfahan Study. *Adv Biomed Res*. 2022;11:116.
7. Guha S, Sethi R, Ray S, Bahl VK, Shanmugasundaram S, Kerkar P, et al. Cardiological Society of India: Position statement for the management of ST elevation myocardial infarction in India. *Indian Heart J*. 2017;69(1):S63-97.
8. Adivitiya, Khansa YP. The evolution of recombinant thrombolytics: Current status and future directions. *Bioengineered*. 2017;8(4):331-58.
9. Jinatongthai P, Kongwatharapong J, Foo CY, Phrommintikul A, Nathisuwan S, Thakkinstant A, et al. Comparative efficacy and safety of reperfusion therapy with fibrinolytic agents in patients with ST-segment elevation myocardial infarction: a systematic review and network meta-analysis. *Lancet*. 2017;390(10096):747-59.
10. Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). *Eur Heart J*. 2018;39(2):119-77.
11. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2013;127(4):e362-425.
12. Huffman MD, Mohanan PP, Devarajan R, Baldridge AS, Kondal D, Zhao L, et al. Health-Related Quality of Life at 30 Days Among Indian Patients With Acute Myocardial Infarction. *Circ Cardiovasc Qual Outcomes*. 2019;12(2):e004980.
13. Chesebro JH, Knatterud G, Roberts R, Borer J, Cohen LS, Dalen J, et al. Thrombolysis in Myocardial Infarction (TIMI) Trial, Phase I: A comparison between intravenous tissue plasminogen activator and intravenous streptokinase. Clinical findings through hospital discharge. *Circulation*. 1987;76(1):142-54.
14. NEJM Group - Massachusetts Medical Society. The New England Journal of Medicine. Available at: nejm.org. Accessed on 15 June 2026.
15. Panduranga P, Al-Zakwani I, Sulaiman K, Al-Habib K, Al Suwaidi J, Al-Motarreb A, et al. Clinical Profile and Mortality of ST-Segment Elevation Myocardial Infarction Patients Receiving Thrombolytic Therapy in the Middle East. *Heart Views*. 2012;13(2):35-41.
16. Ayça B, Conkbayır C, Katkat F, Gulsen K, Akin F, Okuyan E, et al. The relationship between grade of ischemia, success of reperfusion, and type of thrombolytic regimen. *Med Sci Monit*. 2015;21:716-21.
17. Xavier AA, Chandana R, Sarwar A, Dhanapal CK, Sudarshan S. A Comparative Study of Thrombolytics Used for The Treatment of STEMI in a Research in Pharmacy and Health Sciences. A comparative study of thrombolytics used for the treatment of stemi in a South Indian tertiary care hospital. *Res Pharm Health Sci*. 2016;2(3):160-2.
18. Yang HT, Xiu WJ, Zheng YY, Liu F, Gao Y, Ma X, et al. Invasive reperfusion after 12 hours of the symptom onset remains beneficial in patients with ST-segment elevation myocardial infarction: Evidence from a meta-analysis of published data. *Cardiol J*. 2019;26(4):333-42.
19. Koh HP, Redzuan A, Mohd S, Jivanraj S, Noel RN, Ross T. The outcomes of reperfusion therapy with streptokinase versus tenecteplase in ST - elevation myocardial infarction (STEMI): a propensity -

- matched retrospective analysis in an Asian population. *Int J Clin Pharm*. 2022;44(3):641-50.
20. Singh AK, Sharma R, Saklani NR. A comparative analysis of efficacy of thrombolytics in acute st elevation MI and its variation with circadian rhythm. *Cardiology*. 2019;8(1):124-7.
 21. Neela B, Gunreddy VR, Chandupatla MR, Eggadi V, Sharvana S, Bandaru B. Safety and Efficacy of Streptokinase, Tenecteplase, and Reteplase in Patients Diagnosed with ST - Elevation Myocardial Infarction: A Comparative Study. *J Indian Coll Cardiol*. 2020;10(3):134-8.
 22. Shah S, Sukhwani K, Prajapati V, Sahasranam KV. Clinical evaluation of reperfusion in ST elevation myocardial infarction with non-invasive markers following thrombolysis with streptokinase versus tenecteplase. *Int J Sci Res*. 2021;10(2):35-8.
 23. Koh HP, Md Redzuan A, Mohd Saffian S, Nagarajah JR, Ross NT, Hassan H. The outcomes of reperfusion therapy with streptokinase versus tenecteplase in ST-elevation myocardial infarction (STEMI): a propensity-matched retrospective analysis in an Asian population. *Int J Clin Pharm*. 2022;44(3):641-50.
 24. Sahu L, Mohanty NK, Goutam S, Swain TR. Comparative Efficacy between Streptokinase, Tenecteplase and Reteplase in ST Elevated Myocardial Infarction among Patients Attending Tertiary Care Hospital of Odisha. *J Clin Diagnost Res*. 2022;16(12):FC01-5.
 25. Cochrane library. PRISMA 2020 Checklist. Available at: <https://www.prisma-statement.org/prisma-2020-checklist>. Accessed on 15 May 2026.
 26. Kent DM, Hayward RA, Griffith JL, Vijan S, Beshansky JR, Califf RM, et al. An independently derived and validated predictive model for selecting patients with myocardial infarction who are likely to benefit from tissue plasminogen activator compared with streptokinase. *Am J Med*. 2002;113(2):104-11.

Cite this article as: Afnan Z, Reddy T, Pathak S, Vani M, Ramani VN, Nirupama AY, et al. Comparative clinical effectiveness of thrombolytic agents streptokinase versus alteplase versus tenecteplase in the management of ST-segment elevation myocardial infarction: a systematic review and meta-analysis. *Int J Community Med Public Health* 2026;13:6066-72.