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Coronary Angiographic Profile in Failed versus Successful Streptokinase Thrombolysis in Acute ST Elevation Myocardial Infarction: A Single-Centre Observational Study

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Abstract

Introduction: Failed thrombolysis is common in patients with acute ST elevation myocardial infarction (STEMI) treated with fibrinolytic therapy, particularly where primary percutaneous coronary intervention (PCI) is not available, and it carries a poor prognosis. The coronary angiographic correlates of failed streptokinase thrombolysis are incompletely described and hence this study compared the clinical and coronary angiographic profile of patients with failed and successful thrombolysis.

Material & methods: This single-centre, observational study included 200 patients with acute STEMI who received streptokinase (1.5 million units over 1 hour) at the Gandhi Medical College between January2024 and August 2025. Thrombolysis was considered successful when ST-segment elevation in the lead with maximal elevation resolved by more than 50% at 60 minutes, and failed otherwise or when chest pain persisted. All patients underwent coronary angiography after stabilisation.

Results: Thrombolysis failed in 78 patients (39%) and succeeded in 122 (61%). 162 patients were men; mean age was 50.9 ± 10.2 years. Failure was more frequent with anterior than inferior infarction ($p<0.001$), with longer delay to thrombolysis ($p=0.001$), diabetes ($p<0.001$) and hypertension ($p<0.001$), and was associated with lower left ventricular ejection fraction ($p<0.001$) and higher total cholesterol (178.7 vs 144.8 mg/dl, $p<0.001$). Age, sex, smoking and alcohol use were not associated with outcome. Significant coronary artery disease was present in 88.4% of the failed group

versus 22.1% of the successful group (p<0.001); multivessel disease in 38.4% vs 2.4% (p<0.001); left anterior descending (LAD) artery involvement in 51.2% vs 9.8% (p<0.001).

Conclusion: Failed streptokinase thrombolysis was associated with anterior infarction, late presentation, diabetes, hypertension and left ventricular dysfunction, and with a heavier burden of obstruction, multivessel and LAD disease. Patients without ST-segment resolution at 60 minutes should be promptly considered for rescue PCI and early coronary angiography.

Keywords: STEMI, failed thrombolysis, streptokinase, coronary angiography.

Introduction

Acute myocardial infarction remains one of the commonest causes of death and disability worldwide. Primary percutaneous coronary intervention (PCI) is the preferred reperfusion strategy in ST elevation myocardial infarction (STEMI), but it is not available to many patients because of the lack of catheterisation facilities, delayed presentation and cost. As a result, between 30% and 70% of STEMI patients worldwide still receive fibrinolysis as their initial reperfusion therapy, and it remains the most widely used strategy in much of India.[1]

Even with fibrinolysis, restoration of normal (TIMI grade 3) flow is far from universal. In the GUSTO angiographic substudy, streptokinase achieved TIMI 3 flow at 90 minutes in roughly 55–60% of patients.[2] Reported rates of failed thrombolysis range from about 25% to 45%, and an Indian series reported failure in about one-third of patients.[3,4] Failed reperfusion is associated with larger infarcts, heart failure and higher mortality, whereas an open infarct-related artery with TIMI 3 flow predicts a better outcome.[5,6]

Resolution of ST-segment elevation 60–90 minutes after the start of fibrinolysis is a simple bedside marker of reperfusion, and failure to achieve more than 50% resolution identifies patients who are unlikely to have a patent infarct artery.[7,8,9] Current guidelines recommend rescue PCI for such patients.[10,11] Several clinical features have been proposed as predictors of failure, including anterior infarction, delayed presentation and diabetes, but the underlying coronary anatomy of patients who fail streptokinase therapy has been less well characterised, particularly in Indian patients.[12,13]

We therefore studied the clinical and coronary angiographic profile of STEMI patients with failed streptokinase thrombolysis and compared it with that of patients with successful thrombolysis. Our objectives were (i) to compare demographic and clinical characteristics between the two groups; (ii) to compare angiographic lesion characteristics; (iii) to assess whether any infarct artery shows a predilection for successful or failed thrombolysis

Material and Methods

Study design and setting

This was a single-centre, observational study conducted in the Department of Cardiology, Gandhi Medical College, Bhopal (M.P), India. Patients admitted in the coronary care unit between January 2024 and August 2025 with acute STEMI who received thrombolytic therapy were enrolled. The institutional ethics committee approved the study and all patients gave written informed consent in a language they understood.

Study population

Patients with typical symptoms and electrocardiographic (ECG) evidence of acute ST elevation myocardial infarction were eligible. Exclusion criteria were: contraindication to thrombolysis, evolved myocardial

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infarction, history of previous myocardial infarction, left bundle branch block, death within 60 minutes of starting streptokinase; and chronic kidney disease precluding coronary angiography.

Thrombolysis and definitions

All patients received streptokinase 1.5 million units intravenously over 1 hour after contraindications had been excluded with continuous monitoring. A 12-lead ECG was recorded on arrival and repeated 60 minutes after the start of the infusion. ST-segment elevation was measured 80 ms after the J point in the lead showing maximal elevation at presentation. Thrombolysis was classified as successful if ST elevation in that lead had resolved by more than 50%, and as failed if resolution was 50% or less or if chest pain persisted. Infarct location was classified as anterior (ST elevation in the precordial leads) or inferior (leads II, III and aVF); right-sided and posterior leads were recorded in inferior infarction.

Clinical, laboratory and echocardiographic assessment

A structured history recorded the time from symptom onset to thrombolysis, diabetes mellitus, hypertension, smoking, alcohol use and family history. Time from symptom onset to thrombolysis was categorised as <3 h, 3–12 h and >12 h. Complete blood count, blood glucose, renal function and lipid profile were obtained on admission. Transthoracic echocardiography was performed before thrombolysis; left ventricular ejection fraction (LVEF) was calculated by the modified Simpson method and categorised as >55%, 40–54% and <40%.

Coronary angiography

All patients underwent coronary angiography after stabilisation, performed by a consultant cardiologist using the femoral approach (6F Judkins catheters). Patients in cardiogenic shock or with haemodynamic instability, contrast allergy, severe anaemia, acute renal failure or acute stroke were not taken up for angiography. Significant stenosis was defined as diameter stenosis of 50% or more. Patients were classified as having no significant disease or single-, double- or triple-vessel disease.

Statistical analysis

Categorical variables are presented as number (percentage) and continuous variables as mean ± standard deviation. Categorical variables were compared with Fisher's exact test for 2 × 2 tables and the chi-square test for larger tables; continuous variables were compared with Welch's t test, and LVEF categories were additionally compared with the Mann–Whitney U test. All tests were two-sided and $p<0.05$ was considered statistically significant. Statistical analysis was performed with SPSS (version 10.0).

Results

Study population and outcome of thrombolysis

A total of 200 patients were studied (162 men and 38 woman); mean age was 50.9 ± 10.2 years (range 28–70 years), and 135 patients (67.5%) were aged 40–60 years. 134 (67%) had anterior and 66 (33%) inferior infarction. Thrombolysis was successful in 122 patients (61%) and failed in 78 patients (39%).

Clinical profile

Baseline characteristics are shown in Table 1. Age and sex did not differ between groups. Failed thrombolysis was more frequent in anterior than in inferior infarction (47.7% vs 21.2%; $p<0.001$) . Delay in thrombolysis was strongly related to outcome: thrombolysis failed in 8 of 74 patients (10.8%) treated within 3 hours, 59 of 111 (53.1%) treated at 3–12 hours and 11 of 15 (73.3%)

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treated after 12 hours (p=0.001). Diabetes was present in 59 patients, of whom 39 (66.1%) had failed thrombolysis (p<0.001). Similarly, 31 of 46 hypertensive patients (67.3%) had failed thrombolysis (p<0.001). Smoking (103 patients) and alcohol use (68 patients) were not associated with outcome. Mean total cholesterol was higher in the failed group (178.7 ± 30.3 vs 144.8 ± 16.4 mg/dl; p<0.001).

LV systolic function was worse in the failed group (p<0.001; Table 1): 52 of 57 patients with LVEF >55% had successful thrombolysis. Chest pain had resolved within 2 hours in 110 of 122 patients (90.1%) with successful thrombolysis but in only 22 of 78 (28.2%) with failed thrombolysis (p<0.001)

Table 1: Clinical profile of patients with successful and failed thrombolysis

Characteristic	**Successful (n=122)**	**Failed (n=78)**	**p value**
Age, years (mean ± SD)	49.2 ± 11.0	52.8 ± 9.1	0.17
Male/Female	99/23	63/15	1.00
Infarct location			
Anterior wall MI	70(52.2%)	64(47.7%)	<0.001
Inferior wall MI	52(78.7%)	14(21.2%)	
Time from symptom onset to thrombolysis			
<3 h	66(89.1%)	8(10.8%)	0.001
3–12 h	52(46.8%)	59(53.1.%)	
>12 h	4(26.6%)	11(73.3%)	
Risk factors			
Diabetes mellitus	20(33.8%)	39(66.1%)	<0.001
Hypertension	15(32.6%)	31(67.3%)	<0.001
Smoking	70(57.3%)	33(42.3%)	0.78
Alcohol use	36(52.9%)	32(47%)	0.37
Total cholesterol, mg/dl (mean ± SD)	144.8 ± 16.4	178.7 ± 30.3	<0.001
Left ventricular ejection fraction			
>55%	52(91.2%)	5(8.8%)	<0.001
40–54%	63(57.2%)	47(42.7%)	
<40%	7(21.2%)	26(78.7%)	

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Characteristic	Successful (n=122)	Failed (n=78)	p value
Clinical response			
Chest pain relief within 2 h	110(90.1%)	22(28.2%)	<0.001

Coronary angiographic findings

Angiographic findings are summarised in Table 2. Significant coronary artery disease was present in 88.4% patients with failed thrombolysis but in only 22.1% with successful thrombolysis (p<0.001). Single-vessel disease was found in 63 patients (24 in successful vs 39 in failed), double-vessel disease in 19 (3 vs 16) and triple-vessel disease in 14, all in the failed group. Multivessel disease was therefore present in 38.4% patients with failed thrombolysis and 2.4 % with successful thrombolysis (p<0.001).

Lesions in the LAD were present in 51.2 % with failed thrombolysis and in 9.8% with successful thrombolysis (p<0.001). Left circumflex (LCx) artery lesions were also commoner in the failed group (p=0.01), whereas right coronary artery (RCA) lesions showed a non-significant trend (p=0.077).

Table 2: Angiographic profile of patients with successful and failed thrombolysis

Finding	Successful (n=122)	Failed (n=78)	p value
Extent of coronary artery disease			
No significant stenosis (<50%)	95(77.8%)	9(11.5%)	<0.001
Significant stenosis (≥50%) in ≥1 vessel	27(22.1%)	69(88.4%%)	
Single-vessel disease	24(19.6%%)	39(50%)	0.026
Double-vessel disease	3(2.4%)	16(20.5%)	0.045
Triple-vessel disease	0	14(17.9%)	<0.001
Multivessel disease (double + triple)	3(2.4%)	30(38.4%)	<0.001
Artery with lesion(s)			
Left anterior descending	12(9.8%%)	40(51.2%)	<0.001
Left circumflex	2(1.6%)	8(10.2%%)	0.01
Right coronary	13(10.6%)	21(26.9%)	0.077

Discussion

In this study of 200 STEMI patients treated with streptokinase, nearly 39% had failed thrombolysis by the 60-minute ECG criterion. Failure was associated with anterior infarction, late presentation, diabetes, hypertension, lower LVEF and higher total cholesterol, and was accompanied by a markedly heavier angiographic burden.

The failure rate in our series is at the upper end of the 25–45% range reported in the literature, including about one-third in an Indian series and 40–44% in streptokinase studies using ECG criteria.[3,9,14] A recent

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single-centre series from Jaipur, in which 35% of patients received tenecteplase and 31% streptokinase, reported a lower failure rate of 19%.[15] Several features of our study probably explain the higher rate: all patients received streptokinase, a non-fibrin-specific agent; only 70 of 200 patients (35%) were treated within 3 hours; two-thirds had anterior infarcts; and ST resolution was assessed at 60 minutes, which is earlier than the 60–90 minute window used by some investigator and patients who died early, or who were too unstable for angiography, were not included.

Delay to treatment was the strongest clinical determinant of failure. Failure rose from 10.8% when treatment was given within 3 hours to 53.1% at 3–12 hours and 73.3% beyond 12 hours. This is consistent with the progressive maturation of thrombus, which is more resistant to lysis, and with earlier reports in which failure was substantially more frequent after 6 hours.[12,13,15] The finding underlines the importance of shortening pre-hospital delay an where transfer to a PCI-capable centre is feasible, primary PCI should be done rather than late fibrinolysis.

In coronary angiography LAD involvement was seen in 51.2% of the failed group, which is in agreement with other angiographic series in which LAD lesions had the lowest success of fibrinolysis, although findings are not uniform.[15,16] Anterior infarcts are larger, produce greater ST elevation and may be more difficult to resolve by 50% within 60 minutes; the LAD also supplies a large myocardial territory, so persistent occlusion is more likely to be clinically manifest. The correspondingly lower LVEF in the failed group is in keeping with larger infarcts .[6,14]

Diabetes and hypertension were both associated with failed thrombolysis in our study, plausible mechanisms include endothelial dysfunction, a prothrombotic state, impaired microvascular perfusion and more diffuse atherosclerosis.

The angiographic burden between the groups was striking, 77.8% patients with successful thrombolysis had no significant coronary stenosis, which suggests that in many of them the occlusion was a thrombus-rich lesion in a mild diseased vessel that lysed readily or recanalised spontaneously. In contrast, 88.4 % patients with failed thrombolysis had significant fixed disease, failed fibrinolysis therefore appears to identify patients whose infarct arteries harbour substantial underlying atherosclerosis, in whom pharmacological recanalisation alone is unlikely to restore durable flow and who require mechanical revascularisation.

These findings have practical implications. In settings without primary PCI, a repeat ECG at 60–90 minutes is a simple and inexpensive way to identify patients who need urgent transfer for rescue PCI, which is recommended by current guidelines and has been shown to reduce adverse events compared with conservative management.[10,11] Patients with anterior infarction, late presentation, diabetes or hypertension warrant particular vigilance, and our data suggest that these groups are the most likely to have the high-risk anatomy described above.

Limitation

The main limitations are the small sample size, single-centre design and non-randomised, observational nature of the study. Only streptokinase was used, so the results may not apply to fibrin-specific agents. Failure was defined by a single ECG at 60 minutes, and ST-segment resolution is dynamic; continuous ST monitoring or a later reassessment could classify some patients differently, and patients who were unstable, died early or

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had contraindications to angiography were excluded, introducing selection and survivor bias. Door-to-needle time, Killip class and TIMI risk score were not analysed. Finally, no in-hospital or long-term outcomes were assessed.

Conclusion

In this series, failed streptokinase thrombolysis was associated with anterior infarction, delayed presentation, diabetes, hypertension and reduced LV function, and was characterised angiographically by a high prevalence of significant, multivessel, LAD-predominant disease with poor infarct-artery flow. Successful thrombolysis was largely confined to patients with mild or no obstructive disease. Patients without ≥50% ST-segment resolution at 60 minutes should be identified early and referred promptly for rescue PCI and coronary angiography.

References

1. Guha S, Sethi R, Ray S, et al. Cardiological Society of India: position statement for the management of ST elevation myocardial infarction in India. Indian Heart J. 2017;69(Suppl 1):S63–S97.
2. GUSTO Angiographic Investigators. The effects of tissue plasminogen activator, streptokinase, or both on coronary-artery patency, ventricular function, and survival after acute myocardial infarction. N Engl J Med. 1993;329:1615–22.
3. Katyal VK, Siwach SB, Jagadish, Sharma P, Batra M. Failed thrombolysis and its impact after acute MI. J Assoc Physicians India. 2002;51:1149–50.
4. de Belder MA. Acute myocardial infarction: failed thrombolysis. Heart. 2001;85:104–12.
5. Anderson JL, Karagounis LA, Califf RM. Metaanalysis of five reported studies on the relation of early coronary patency grades with mortality and outcomes after acute myocardial infarction. Am J Cardiol. 1996;78:1–8.
6. Puma JA, Sketch MH Jr, Thompson TD, et al. Support for the open-artery hypothesis in survivors of acute myocardial infarction: analysis of 11,228 patients treated with thrombolytic therapy. Am J Cardiol. 1999;83:482–7.
7. Schröder R, Wegscheider K, Schröder K, Dissmann R, Meyer-Sabellek W. Extent of early ST segment elevation resolution: a strong predictor of outcome in patients with acute myocardial infarction and a sensitive measure to compare thrombolytic regimens. A substudy of the International Joint Efficacy Comparison of Thrombolytics (INJECT) trial. J Am Coll Cardiol. 1995;26:1657–64.
8. Purcell IF, Newall N, Farrer M. Change in ST segment elevation 60 minutes after thrombolytic initiation predicts clinical outcome as accurately as later electrocardiographic changes. Heart. 1997;78:465–71.
9. Sutton AGC, Campbell PG, Price DJA, et al. Failure of thrombolysis by streptokinase: detection with a simple electrocardiographic method. Heart. 2000;84:149–56.
10. Ibanez B, James S, Agewall S, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J. 2018;39:119–77.
11. Byrne RA, Rossello X, Coughlan JJ, et al. 2023 ESC Guidelines for the management of acute coronary syndromes. Eur Heart J. 2023;44:3720–826.
12. Lee YY, Tee MH, Zurkurnai Y, Than W, Sapawi M, Suhairi I. Thrombolytic failure with streptokinase in acute myocardial infarction using

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electrocardiogram criteria. Singapore Med J. 2008;49:304–10.

13. Mishra A, Prajapati J, Dubey G, et al. Characteristics of ST elevation myocardial infarction with failed thrombolysis. Asian Cardiovasc Thorac Ann. 2020;28:266–72.
14. Richardson SG, Morton P, Murtagh JG, Scott ME, O'Keeffe B. Relation of coronary arterial patency and left ventricular function to electrocardiographic changes after streptokinase treatment during acute myocardial infarction. Am J Cardiol. 1988;61:961–5.
15. Jain P, Pachar BS, Pachar A, Nahata J, Agrawal VV, Rohilla A, et al. Clinical and coronary angiographic profile in failed versus successful thrombolysis in acute ST elevation myocardial infarction patients. Eur J Cardiovasc Med. 2024;14(6):750–4.
16. Durdana S, Malik MA, Hasan A, Rabbani MU. Angiographic outcomes in STEMI patients receiving fibrinolysis with guideline directed optimal antithrombotic therapy. Indian Heart J. 2021;73:125–8.

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