

A Comparative Study of Primary Angioplasty and Thrombolytic Therapy Outcomes for Acute Myocardial Infarction

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Abstract:

Background: Acute myocardial infarction (AMI) requires prompt reperfusion to minimize myocardial damage and improve survival. Primary angioplasty and thrombolytic therapy are the two principal reperfusion strategies, but their comparative effectiveness remains clinically important. This study compared the outcomes of both treatment modalities in patients with AMI.

Methods: A retrospective comparative study was conducted at tertiary care hospital from February 2024 to February 2025. Medical records of 164 patients with AMI treated with either primary angioplasty or thrombolytic therapy were reviewed. Clinical outcomes and follow-up data were analyzed using appropriate statistical tests, with $p < 0.05$ considered statistically significant.

Results: Among the 164 patients included in the study, the primary angioplasty group demonstrated significantly higher infarct-related artery patency and better preservation of left ventricular ejection fraction than the thrombolytic therapy group. Non-fatal reinfarction, the composite outcome of death or reinfarction, and the requirement for repeat percutaneous coronary intervention within 30 days were significantly lower following primary angioplasty. Although early and late mortality were numerically lower in the angioplasty group, the differences were not statistically significant. At the 6-month follow-up, the requirement for coronary artery bypass grafting and the use of cardiovascular medications were comparable between the two groups.

Conclusion: Primary angioplasty demonstrated superior efficacy in reducing recurrent ischemic events and the need for repeat revascularization while preserving ventricular function, supporting its role as the preferred reperfusion strategy for eligible patients with acute myocardial infarction.

Keywords: Acute Myocardial Infarction; Primary Angioplasty; Percutaneous Coronary Intervention; Thrombolytic Therapy.

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Introduction

Acute myocardial infarction (AMI), commonly known as a heart attack, is a life-threatening cardiovascular emergency resulting from the sudden interruption of blood flow through a coronary artery, leading to myocardial ischemia and necrosis if reperfusion is delayed [1]. Ischemic heart disease remains the leading cause of death worldwide, accounting for nearly 9 million deaths annually, while cardiovascular diseases contribute to approximately one-fourth of all deaths in India [2,3]. Prompt restoration of coronary perfusion is therefore the cornerstone of AMI management, as early reperfusion limits infarct size, preserves ventricular function, and improves survival [4]. Intravenous thrombolytic therapy has been shown to reduce early mortality by approximately 20–30% when administered within the recommended time window [5].

The two principal reperfusion strategies for ST-segment elevation myocardial infarction (STEMI) are primary percutaneous coronary intervention (PCI), also known as primary angioplasty, and thrombolytic (fibrinolytic) therapy [6]. Primary angioplasty restores blood flow mechanically by dilating the occluded coronary artery and, in most cases, placing a stent to maintain vessel patency. In contrast, thrombolytic therapy employs fibrinolytic agents to dissolve the intracoronary thrombus and re-establish coronary perfusion [7,8]. Although both modalities aim to salvage ischemic myocardium and improve clinical outcomes, they differ in efficacy, safety profile, treatment delay, and resource requirements.

Several landmark studies have compared these reperfusion strategies. The DANAMI-2 trial demonstrated that primary angioplasty was superior to thrombolytic therapy in reducing mortality,

reinfarction, and stroke among patients with AMI [9]. Similarly, the CAPTIM trial reported comparable efficacy when treatment was administered promptly, emphasizing the importance of minimizing reperfusion delays [10]. These findings are further supported by large observational registries such as the GRACE study, which reported lower mortality among patients undergoing primary PCI [11].

Despite the established benefits of primary angioplasty, thrombolytic therapy remains widely used in resource-limited settings where immediate access to PCI facilities is unavailable. Consequently, evaluating the comparative outcomes of these treatment modalities remains clinically important, particularly in developing countries. The present study was undertaken to compare the outcomes of primary angioplasty and thrombolytic therapy in patients with acute myocardial infarction, thereby assessing their relative effectiveness and safety in routine clinical practice.

Methods

Study Design and Setting: This retrospective comparative study was conducted at a tertiary care hospital over one year from February 2024 to February 2025. The study evaluated the outcomes of primary angioplasty and thrombolytic therapy among patients diagnosed with acute myocardial infarction (AMI). Clinical and treatment-related data were obtained through a retrospective review of hospital medical records.

Study Population: A total of 164 patients with AMI who met the eligibility criteria were included in the study. Patients were categorized into two treatment groups based on the reperfusion strategy received: primary angioplasty (primary percutaneous coronary intervention [PCI]) or thrombolytic therapy. All patients received standard medical management, including aspirin and heparin. Patients in the thrombolysis group were treated with intravenous streptokinase according to the institutional protocol, while those in the angioplasty group underwent primary PCI using standard catheterization techniques.

Eligibility Criteria: Patients presenting with symptoms of acute myocardial infarction lasting more than 30 minutes, ST-segment elevation of ≥ 1 mm in two or more contiguous electrocardiographic leads, ongoing ischemia within 6–24 hours of symptom onset, and no contraindications to thrombolytic therapy were included. Patients younger than 40 years of age, pregnant women, those who did not satisfy the eligibility criteria, and

patients lost to follow-up were excluded from the study.

Data Collection: Clinical data were retrospectively extracted from the electronic medical records of eligible patients admitted between February 2024 and February 2025. Information collected included demographic characteristics, cardiovascular risk factors, symptom onset, electrocardiographic findings, laboratory parameters, reperfusion strategy (primary angioplasty or thrombolytic therapy), angiographic findings, left ventricular ejection fraction, in-hospital complications, repeat revascularization, discharge medications, and mortality. Clinical outcomes were assessed during hospitalization and at 1-, 3-, and 6-month follow-up visits using outpatient records and hospital readmission data. All extracted information was entered into a standardized data collection proforma and verified before statistical analysis.

Study Variables: The primary independent variable was the reperfusion strategy received (primary angioplasty or thrombolytic therapy). Baseline variables included age, sex, cardiovascular risk factors, infarct location, previous myocardial infarction, and left ventricular ejection fraction. Outcome variables comprised infarct-related artery patency, all-cause mortality, non-fatal reinfarction, stroke, repeat revascularization procedures, and medication use during follow-up.

Outcome Measures and Statistical Analysis: The primary outcomes assessed were all-cause mortality and the composite outcome of death or non-fatal reinfarction. Data were analyzed according to the intention-to-treat principle. Continuous variables were compared using Student's t-test, while categorical variables were analyzed using the chi-square test, with a p-value of <0.05 was considered statistically significant.

Results

A total of 164 patients were included in the study, with 80 patients undergoing primary angioplasty and 84 receiving thrombolytic therapy. The baseline demographic and clinical characteristics were comparable between the two groups, with no significant differences in age, sex distribution, anterior wall myocardial infarction, previous myocardial infarction, or diabetes mellitus ($p > 0.05$). However, the angioplasty group demonstrated a significantly higher rate of patent infarct-related artery (90.0% vs. 67.9%; $p < 0.001$) and a greater proportion of patients with preserved left ventricular ejection fraction (75.0% vs. 57.1%; $p = 0.02$) (Table 1).

Table 1: Baseline Characteristics of the Study Population (N = 164)

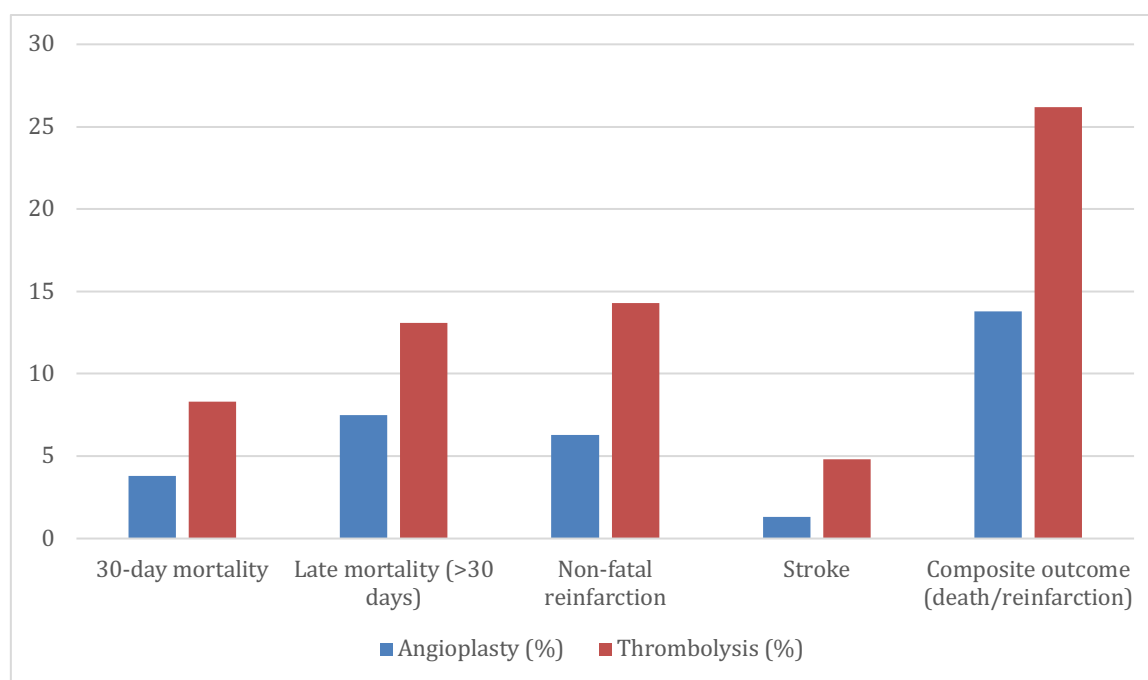
Characteristic	Angioplasty (n=80)	Thrombolysis (n=84)	P-value
Age (years), mean $\pm$ SD	57.4 $\pm$ 8.2	58.1 $\pm$ 8.5	0.58
Male, n (%)	60 (75.0)	61 (72.6)	0.72
Anterior wall MI, n (%)	32 (40.0)	31 (36.9)	0.68
Previous MI, n (%)	15 (18.8)	13 (15.5)	0.57
Diabetes mellitus, n (%)	16 (20.0)	14 (16.7)	0.58
Patent infarct-related artery after treatment, n (%)	72 (90.0)	57 (67.9)	<0.001
Left ventricular ejection fraction $\geq$ 50%, n (%)	60 (75.0)	48 (57.1)	0.02

Patients treated with primary angioplasty exhibited more favorable clinical outcomes than those receiving thrombolytic therapy. Although 30-day mortality and late mortality were lower in the angioplasty group, these differences were not statistically significant ($p > 0.05$). However, the

incidence of non-fatal reinfarction was significantly lower following angioplasty (6.3% vs. 14.3%; $p = 0.04$). Likewise, the composite endpoint of death or reinfarction occurred significantly less frequently in the angioplasty group compared with the thrombolysis group (Table 2).

Table 2: Primary Clinical Outcomes Following Reperfusion Therapy (N = 164)

Outcome	Angioplasty (n=80)	Thrombolysis (n=84)	P-value
30-day mortality, n (%)	3 (3.8)	7 (8.3)	0.18
Late mortality (>30 days), n (%)	6 (7.5)	11 (13.1)	0.24
Non-fatal reinfarction, n (%)	5 (6.3)	12 (14.3)	0.04
Stroke, n (%)	1 (1.3)	4 (4.8)	0.19
Composite outcome (death/reinfarction), n (%)	11 (13.8)	22 (26.2)	0.047

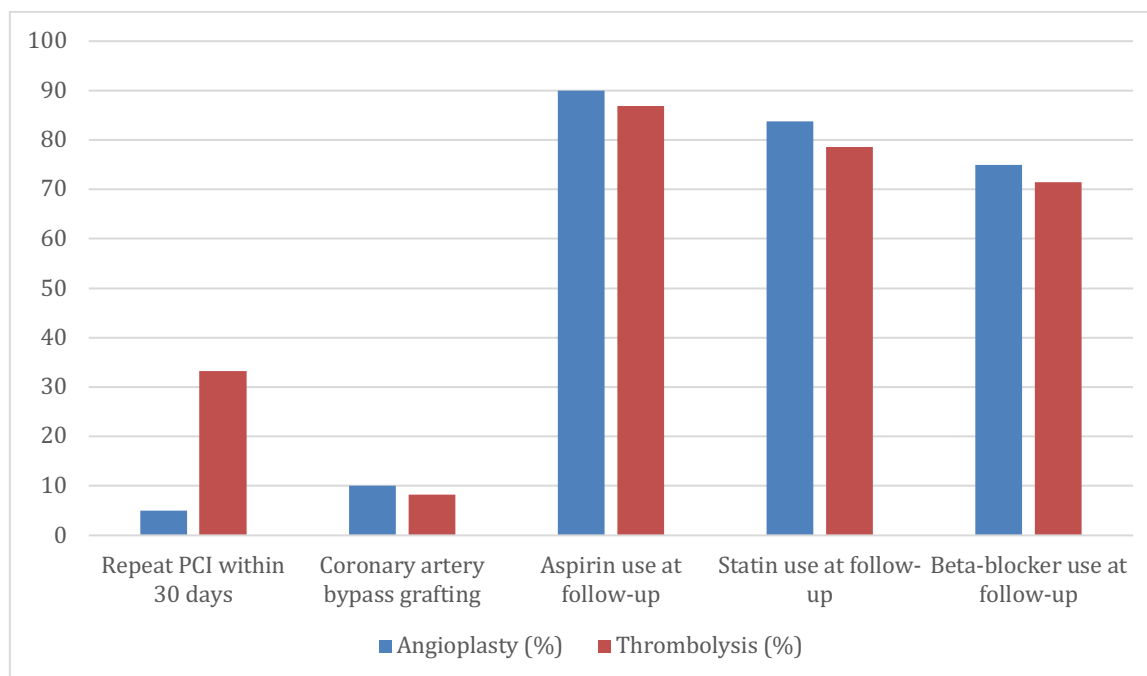
**Figure 1: Clinical Outcomes Following Primary Angioplasty and Thrombolytic Therapy.**

During follow-up, the need for repeat percutaneous coronary intervention (PCI) within 30 days was significantly lower among patients treated with primary angioplasty than those who received thrombolytic therapy (5.0% vs. 33.3%; $p < 0.001$). At the 6-month follow-up, the requirement for coronary artery bypass grafting and the use of guideline-directed medical therapy, including

aspirin, statins, and beta-blockers, were comparable between the two groups, with no statistically significant differences ($p > 0.05$). These findings indicate a reduced need for additional revascularization following primary angioplasty while maintaining similar long-term medical management (Table 3).

Table 3: Secondary Outcomes and Six-month Follow-up Characteristics (N = 164)

Outcome	Angioplasty (n=80)	Thrombolysis (n=84)	P-value
Repeat PCI within 30 days, n (%)	4 (5.0)	28 (33.3)	<0.001
Coronary artery bypass grafting, n (%)	8 (10.0)	7 (8.3)	0.71
Aspirin use at follow-up, n (%)	72 (90.0)	73 (86.9)	0.54
Statin use at follow-up, n (%)	67 (83.8)	66 (78.6)	0.39
Beta-blocker use at follow-up, n (%)	60 (75.0)	60 (71.4)	0.61

**Figure 2: Secondary Clinical Outcomes and Follow-up Characteristics of the Study Population**

Discussion

The present study compared the clinical outcomes of primary angioplasty and thrombolytic therapy in 164 patients with acute myocardial infarction (AMI). Patients who underwent primary angioplasty demonstrated better clinical outcomes than those treated with thrombolytic therapy, with lower rates of reinfarction, composite adverse events, and repeat revascularization. Although differences in mortality were not statistically significant, the angioplasty group showed a consistent trend toward lower early and late mortality. These findings support the established role of timely reperfusion in limiting myocardial damage and improving patient outcomes. Restoration of early and sustained coronary blood flow remains the principal objective of reperfusion therapy, and previous studies have shown that primary angioplasty achieves higher rates of complete coronary patency than thrombolytic therapy, translating into improved myocardial salvage and survival [12-14].

A notable finding of the present study was the significantly higher proportion of patients with a patent infarct-related artery and preserved left ventricular ejection fraction following primary angioplasty. Effective reperfusion minimizes infarct size, preserves ventricular function, and reduces

adverse left ventricular remodeling, thereby lowering the risk of subsequent cardiac complications. Earlier studies have similarly reported that successful primary angioplasty is associated with improved coronary patency, reduced re-occlusion, and better long-term ventricular function compared with fibrinolytic therapy [15,16]. The lower incidence of non-fatal reinfarction observed in the angioplasty group in the present study further supports the superior efficacy of mechanical reperfusion in maintaining vessel patency and preventing recurrent ischemic events [12,17].

The requirement for repeat percutaneous coronary intervention within 30 days was significantly lower among patients undergoing primary angioplasty, indicating more durable reperfusion and reduced need for additional interventions. Although the use of secondary prevention medications at follow-up was comparable between the two groups, patients receiving thrombolytic therapy required slightly greater use of supportive medications, which may reflect poorer ventricular function and a higher burden of residual ischemia. Similar observations have been reported in previous studies, where primary angioplasty reduced recurrent ischemia, hospital readmissions, and the need for repeat

revascularization, ultimately contributing to improved long-term clinical outcomes [18-20].

Overall, the findings of the present study are consistent with evidence from previous randomized trials and observational studies demonstrating the superiority of primary angioplasty over thrombolytic therapy for the management of acute myocardial infarction. While thrombolytic therapy remains an important reperfusion option in settings where immediate PCI is not feasible, primary angioplasty offers better preservation of myocardial function, fewer recurrent ischemic events, and a lower requirement for repeat revascularization when performed promptly. These findings reinforce current recommendations advocating primary angioplasty as the preferred reperfusion strategy whenever timely access to PCI facilities is available.

Conclusion

Primary angioplasty demonstrated superior clinical outcomes compared with thrombolytic therapy in patients with acute myocardial infarction. Patients undergoing primary angioplasty had significantly higher infarct-related artery patency, better preservation of left ventricular function, lower rates of reinfarction, reduced need for repeat revascularization, and fewer composite adverse cardiovascular events. Although mortality was lower in the angioplasty group, the difference was not statistically significant. These findings support primary angioplasty as the preferred reperfusion strategy whenever timely PCI facilities are available.

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