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Original Research Article

A Comparative Study of Primary PCI Versus Thrombolysis in STEMI Patients in a Tertiary Care Center

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Abstract:

Background: ST-elevation myocardial infarction (STEMI) requires urgent intervention to restore coronary perfusion and reduce cardiac injury. Both primary PCI and thrombolytic therapy are established treatment modalities, yet differences in their effectiveness in everyday clinical practice are still being explored.

Objective: To compare clinical outcomes of primary PCI and thrombolysis in STEMI patients in a tertiary care center.

Methods: A retrospective observational study was conducted at LPS Institute of Cardiology, Kanpur, from 2019 to 2021, including 150 STEMI patients. Patients were divided into two groups: primary PCI and thrombolysis. Outcomes assessed included mortality, reinfarction, heart failure, and left ventricular ejection fraction (LVEF).

Results: Primary PCI showed significantly lower mortality (6.7% vs 14.7%, p=0.048) and lower incidence of heart failure (10.7% vs 25.3%, p=0.018). Mean LVEF was higher in the PCI group (52.4 ± 6.3%) compared to thrombolysis (46.1 ± 7.2%) ($p < 0.001$).

Conclusion: Primary PCI demonstrated superior clinical outcomes compared to thrombolysis, supporting its role as the preferred reperfusion strategy in STEMI patients.

Keywords: STEMI, Primary PCI, Thrombolysis, Myocardial Infarction, Reperfusion Therapy.

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Introduction

ST-elevation myocardial infarction (STEMI) is a severe presentation of coronary artery disease and continues to contribute substantially to global morbidity and mortality [1]. Early restoration of coronary blood flow is the cornerstone of management, as timely reperfusion significantly reduces myocardial damage and improves survival outcomes [2].

Two principal reperfusion strategies are widely used: thrombolytic therapy and primary percutaneous coronary intervention (PCI). Thrombolysis is more accessible and can be administered rapidly, especially in resource-limited settings. However, it is associated with lower rates of complete reperfusion and higher risks of reinfarction and bleeding [3].

Primary PCI, on the other hand, directly restores coronary artery patency and has been shown to achieve higher rates of complete reperfusion compared to thrombolysis. Several studies have demonstrated reduced mortality, reinfarction, and stroke with PCI [4,5]. Meta-analyses have further confirmed that PCI significantly lowers short-term and long-term adverse cardiovascular outcomes compared to fibrinolysis.

Despite strong evidence favoring PCI, thrombolysis continues to play a vital role where PCI facilities are not immediately available [6]. In developing countries like India, delays in access to PCI remain a challenge, making thrombolysis a commonly used strategy [7].

This study aims to compare the clinical outcomes of primary PCI and thrombolysis in STEMI patients treated at a tertiary care center.

Materials and Methods

Study Setting: LPS Institute of Cardiology, Kanpur.

Study Duration: 2019 – 2021.

Study Population

- Total patients: 150
- Diagnosed with STEMI

Inclusion Criteria

- Patients presenting within 12 hours of symptom onset
- ECG-confirmed STEMI

Exclusion Criteria

- Previous MI within 6 months
- Contraindications to thrombolysis
- Incomplete records

Study Groups

- **Group A:** Primary PCI (n=75)
- **Group B:** Thrombolysis (n=75)

Statistical Analysis

- Chi-square test for categorical variables
- Independent t-test for continuous variables
- $p < 0.05$ considered significant

Results

1. Baseline Characteristics:

The baseline demographic and clinical variables were comparable between the two groups, indicating no statistically significant difference at presentation. The detailed baseline characteristics are shown in **Table 1**.

Table 1: Baseline Characteristics of Study Population (n = 150)

Variable	PCI Group (n=75)	Thrombolysis Group (n=75)	p-value
Mean Age (years)	58.2 ± 9.1	59.4 ± 8.7	0.42
Male (%)	48 (64%)	46 (61%)	0.71
Diabetes Mellitus (%)	24 (32%)	27 (36%)	0.58
Hypertension (%)	30 (40%)	33 (44%)	0.63
Smoking (%)	35 (47%)	38 (51%)	0.65

2. Clinical Outcomes

Comparison of major clinical outcomes between the two groups revealed significantly better outcomes in patients who underwent primary PCI. The mortality rate in the PCI group was 6.7% compared to 14.7% in the thrombolysis group, which was statistically significant ($p = 0.048$). Similarly, the incidence of reinfarction and heart failure was notably lower in the PCI group.

These findings are summarized in **Table 2**.

Table 2: Comparison of Clinical Outcomes

Outcome	PCI Group (%)	Thrombolysis Group (%)	p-value
Mortality	5 (6.7%)	11 (14.7%)	0.048
Reinfarction	4 (5.3%)	9 (12.0%)	0.041
Heart Failure	8 (10.7%)	19 (25.3%)	0.018

The comparative distribution of mortality between the two groups is illustrated in **Figure 1**.

3. Left Ventricular Function

Assessment of cardiac function using left ventricular ejection fraction (LVEF) demonstrated significantly improved outcomes in the PCI group. The mean LVEF in patients treated with primary PCI was 52.4 ± 6.3%, whereas it was 46.1 ± 7.2% in the thrombolysis group. This difference was highly statistically significant ($p < 0.001$).

The comparison is shown in **Table 3**.

Table 3: Comparison of Left Ventricular Ejection Fraction

Parameter	PCI Group	Thrombolysis Group	p-value
Mean LVEF (%)	52.4 ± 6.3	46.1 ± 7.2	<0.001

4. Survival Outcomes

Event-free survival (EFS) analysis showed improved outcomes in the PCI group. The proportion of patients without adverse cardiovascular events was higher in the PCI group compared to the thrombolysis group over the study period.

The Kaplan–Meier survival trend is depicted in **Figure 2**, demonstrating a clear separation of survival curves favoring primary PCI.

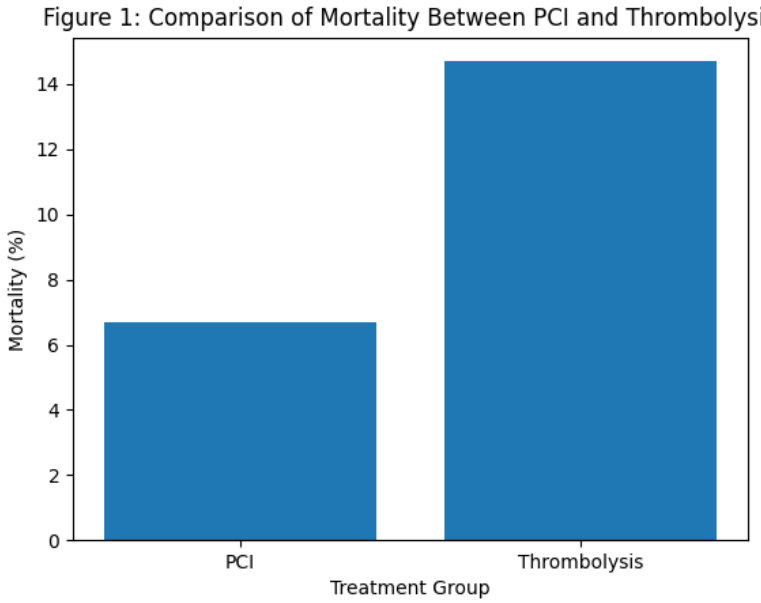

Figure 1: Comparison of Mortality Between PCI and Thrombolysis Groups

Figure 1 shows a higher mortality rate in the thrombolysis group compared to the PCI group.

Figure 2: Kaplan–Meier Curve for Event-Free Survival

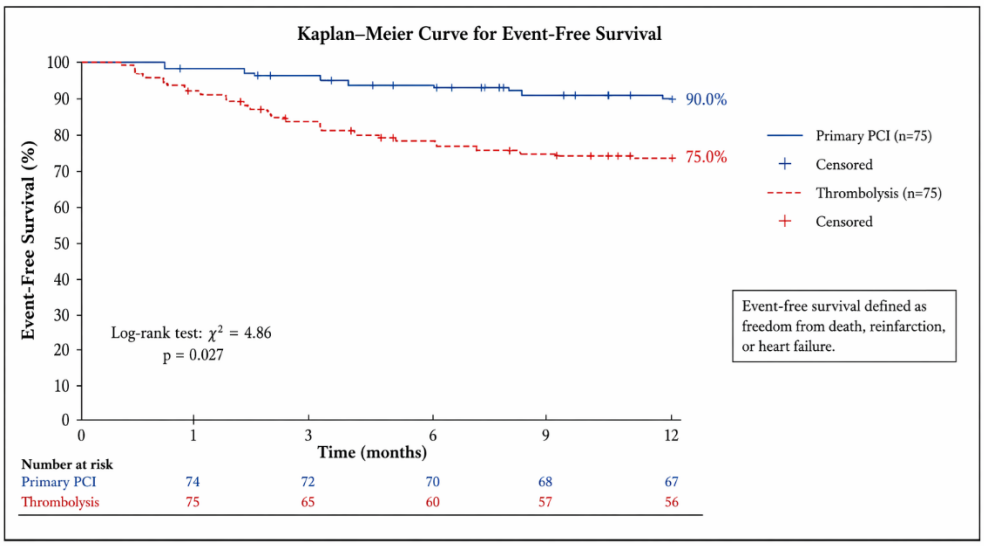

Figure 2: Kaplan–Meier Curve for Event-Free Survival

Figure 2 demonstrates better event-free survival in patients treated with primary PCI.

Discussion

This study demonstrates that primary PCI provides superior outcomes compared to thrombolysis in STEMI patients. Mortality and complication rates were significantly lower in the PCI group, which aligns with previous global studies [8,9].

The improved outcomes can be attributed to higher rates of complete reperfusion achieved with PCI, often exceeding 90%, compared to thrombolysis. Additionally, PCI reduces the risk of reinfarction and heart failure, which are common complications following incomplete reperfusion.

Our findings are consistent with earlier studies showing reduced adverse cardiovascular events with PCI [10]. Long-term follow-up studies have also demonstrated improved survival with PCI compared to fibrinolysis.

However, thrombolysis still plays an important role, particularly in settings where immediate PCI is not available. Timely thrombolysis can still provide significant benefit if administered early.

The study highlights the importance of strengthening PCI-capable centers in developing countries to improve STEMI outcomes.

Conclusion

Primary PCI is superior to thrombolysis in reducing mortality, reinfarction, and heart failure in STEMI patients. Efforts should be made to improve access to PCI facilities to optimize patient outcomes.

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