Section: Cardiology

Original Research Article

A COMPARATIVE ANALYSIS OF CLINICAL, ANGIOGRAPHIC PROFILE AND MANAGEMENT TRENDS IN STEMI PATIENTS WITH FAILED THROMBOLYSIS

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Abstract

Background: Failed thrombolysis for acute myocardial infarction is common and indicates a poor prognosis. Failed thrombolysis was defined as <50% ST-segment resolution 180 minutes after the start of thrombolytic treatment. AIM: main objective of the study was to investigate the clinical characteristics, angiographic profiles, and management outcomes in patients with failed thrombolysis following pharmacological reperfusion therapy for ST-elevation myocardial infarction (STEMI). **Materials and Methods**: observational cross-sectional study conducted at Coimbatore medical college hospital, department of Cardiology from May 2023 to May 2024.Statistical analysis was done using Chi-square test or Student's t-test for categorical and continuous variables. **Results**: smoking is observed to be most common associated factor in patients with failed thrombolysis (78.3%) with statistical significance. Diabetes (71.7%), dyslipidaemia (65%) are associated with failed thrombolysis. Late thrombolysis of >12 hrs also a risk factor leading to failed thrombolysis with statistical significance. **Conclusion**: appropriate management of comorbidities and early initiation of thrombolytic therapy should be the strategy for better outcome in ACS patients.

INTRODUCTION

Coronary Artery disease (CAD) is the primary cause of morbidity and mortality globally. Advancements in medical sciences and technology have led to a significant rise in life expectancy over the last few decades. The increased frequency of cardiovascular disease (CVD) has resulted in a significant impact. Specifically, those aged 75 years and beyond account for almost 60% of all fatalities caused by cardiovascular conditions. Acute coronary syndromes (ACS) have a substantial impact on health and are the leading cause of mortality in older persons. The process of ageing itself leads to an increased risk of cardiovascular disease (CVD) via many physiological processes. These include heightened stiffness in the arteries and ventricles, disrupted regulation of blood pressure, elevated levels of oxidative stress and inflammation, high cholesterol levels, and impaired glucose metabolism. Primary percutaneous coronary intervention (PCI) is widely recognised as superior to thrombolysis in the treatment of ST-elevation myocardial infarction (STEMI), leading to the widespread availability of PCI-capable hospitals in industrialised nations. Nevertheless, in low- to medium-income countries where there is a shortage of facilities capable of performing percutaneous coronary intervention (PCI), the major approach for restoring blood flow using medication is by the use of a thrombolytic agent.

Failed thrombolysis (FT) is a troublesome cause in the pharmacological reperfusion method for ST-elevation myocardial infarction (STEMI) since it is linked to mobidity and mortality. Global studies have shown varying rates of failed thrombolysis (FT) in ST-elevation myocardial infarction (STEMI), with percentages ranging from 10 to 56.8%. These rates apply to both fibrin-specific (alteplase, Tenecteplase) and non-fibrin-specific (streptokinase) thrombolytic drugs. Several researchers have discovered the predictors of FT, mostly focusing on streptokinase. The patient has an anterior location ST-elevation myocardial infarction (STEMI), a higher Killip class, a longer door-to-needle time, pre-existing diabetes and hypertension, a higher total white cell count, a

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longer symptoms-onset-to-thrombolysis duration, hyperglycemia, and a higher thrombolysis in myocardial infarction (TIMI) score.

FT represents a significant clinical setback, often leading to adverse outcomes such as increased mortality, ventricular dysfunction, and heightened risks of arrhythmias. The variability in FT rates reported globally highlights the multifactorial nature of this phenomenon, influenced by factors ranging from patient demographics to treatment protocols and healthcare infrastructures. Despite efforts to optimize thrombolytic strategies, including the use of both fibrin-specific and non-fibrin-specific agents, the predictors and clinical implications of FT remain a focal point of research interest.

Objective:

The main objective of the study was to investigate the clinical characteristics, angiographic profiles, and management outcomes in patients with failed thrombolysis following pharmacological reperfusion therapy for ST-elevation myocardial infarction (STEMI).

MATERIALS AND METHODS

Study Design

This study employed an observational cross-sectional design to investigate the clinical, angiographic profile, and management trends in patients with failed thrombolysis following acute ST-elevation myocardial infarction (STEMI).

Study Setting

The study was conducted at Coimbatore medical college Hospital (CMCH), department of Cardiology.

Duration of Study

The study spanned one year, from May 2023 to May 2024

Study Population

The study population consisted of patients presenting with acute STEMI to CMCH during the study period.

Inclusion Criteria

- Inpatients diagnosed with acute myocardial infarction based on electrocardiographic evidence.
- Patients categorized into successful thrombolysis if there was greater than 50% resolution of ST segment in the lead with maximum ST elevation within 90 minutes post-thrombolysis, along with resolution of chest pain.
- Patients classified into failed thrombolysis if ST segment resolution was less than 50% in the lead with maximum ST elevation 60 minutes after thrombolysis and persistence of chest pain.

Exclusion Criteria

- Patients with contraindications for thrombolysis.
- Patients with evolved myocardial infarction.
- Patients with a history of old myocardial infarction.
- Patients presenting with associated left bundle branch block and myocardial infarction.
- Patients who expired within 60 minutes of streptokinase therapy.
- Patients with acute myocardial infarction and chronic kidney disease unable to undergo coronary angiogram.

Sample Size

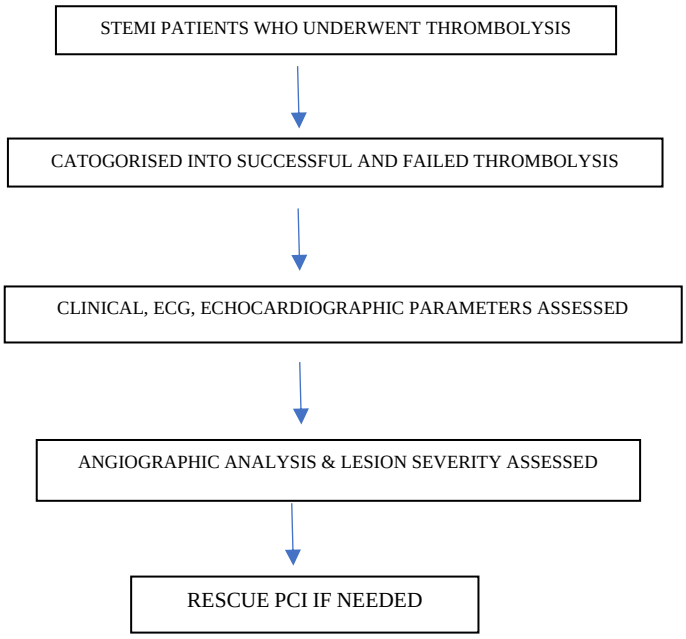
A total of 150 patients were included in the study.

Methodology

Patients underwent thrombolysis with streptokinase, categorized based on risk factors including age, sex, region of myocardial infarction, time to lysis, diabetes mellitus, systemic hypertension, dyslipidemia, smoking, and alcoholism. All the patients were assessed based on clinical and electrocardiographic parameters and then proceeded with angiographic assessment to determine number of coronary arteries involved, percentage of stenosis and characteristics of coronary lesions in both the groups (successful thrombolysis vs failed thrombolysis groups).

Statistical Analysis:

Descriptive statistics were used to summarize demographic and clinical characteristics. Comparisons between groups (successful vs. failed thrombolysis) were made using appropriate statistical tests such as Chi-square test or Student's t-test for categorical and continuous variables, respectively.



RESULTS

Out of the 150 patients who underwent thrombolysis, 60 had failed thrombolysis (40%)

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Table 1: Profile of the study participants.

Variable	Successful thrombolysis		Failed thrombolysis		P value
	N	%	N	%	
Age (years)					0.685
<40	19	21.2	16	26.7	
41 – 60	46	51.5	27	45	
>61	25	27.8	17	28.3	
Gender					0.679
Male	88	97.8	58	96.7	
Female	2	2.2	2	3.3	
Smoking					**<0.001**
Yes	25	27.8	47	78.3	
No	65	72.2	13	21.7	
Alcohol consumption					**<0.001**
Yes	18	20	48	80	
No	72	80	12	20	
Diabetes Mellitus					**<0.001**
Yes	17	18.9	43	71.7	
No	73	81.1	17	28.3	
Dyslipidaemia					**<0.001**
Yes	26	28.9	39	65	
No	64	71.1	21	35	

Table 2: ECHO findings

Variable	Successful thrombolysis		Failed thrombolysis		P value
	N	%	N	%	
Vessel involvement					**<0.001**
Normal	70	77.8	12	20	
Single vessel	19	21.1	22	36.7	
Multiple vessel	1	1.1	26	43.3	
Ejection fraction					**0.003**
>55%	40	44.4	18	30	
45 – 54%	38	42.2	19	31.7	
35 – 44%	12	13.3	21	35	
<35%	0	0	2	3.3	

Table 3: Type of MI and time to thrombolysis:

Variable	Successful thrombolysis		Failed thrombolysis		P value
	N	%	N	%	
Type					0.676
Anterior wall MI	57	63.3	40	66.7	
Inferior wall MI	33	36.7	20	33.3	
Time to thrombolysis (hours)					**<0.001**
<3					
4 – 12	60	66.7	13	21.7	
>13	29	32.2	19	31.7	
	1	1.1	28	46.7	

Table 4: Coronary Angiogram findings

Type of lesion	Successful thrombolysis		Failed thrombolysis		P value
	N	%	N	%	
Type A	27	30	24	40	0.068
Type B	29	32.2	24	40	
Type C	34	37.8	12	20	

DISCUSSION

Throughout the world, 30%–70% of patients with STEMI receive thrombolysis as the initial reperfusion therapy.[1] In India, thrombolysis remains the most common mode of reperfusion due to various constraints on primary PCI. Our study consisted of 150 STEMI patients who received fibrinolytic therapy as the primary reperfusion strategy. Streptokinase was used in 98.76% of STEMI patients and the two groups were compared based on demographic variables, underlying risk factors, hemodynamic variables, angiographic variables, and outcomes. We found that 40% of patients had failed thrombolysis, in agreement with Western data.[4] There was no gender predominance, comparable to other studies.[5-7] Various series of STEMI from India have reported that more than 90% of patients present with classic chest pain, which is similar to our study.8,9 The total ischemic time (from symptom onset to reperfusion therapy) is the most important factor in achieving the best possible outcomes in STEMI.[2] The mean time from onset of symptoms to first medical contact was <3 hours in patients in the successful thrombolysis group, whereas it was > 6 hours in patients in the failed thrombolysis group. In India, various registries have shown trends towards late presentation (4–10.8 h) due to various reasons.1

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In a study by Saleem and colleagues,[10] 71.08% of patients had thrombolysis within 12 h of onset of chest pain, and 28.92% received thrombolytics after 12 h, of which only 72.88% had complete resolution of ST elevation on ECG. The conventional risk factors such as diabetes mellitus, dyslipidemia, and obesity were widely prevalent in the failed thrombolysis group, consistent with earlier studies.[11,12] Cindy and colleagues13 reported similar patency rates in smokers and non-smokers at 90 min (73% versus 74%), comparable to our study results. Pinto and colleagues,[14] observed that most hemodynamically unstable patients, particularly the cardiogenic shock and Killip class III and IV subsets, had total thrombotic occlusion of the artery (failed thrombolysis), similar to our results. There was no correlation between heart rate at presentation and outcome of thrombolysis, as observed by Rao and colleagues.[15] Anderson and colleagues,[16] observed that patients in the successful thrombolysis group had better ejection fractions and fewer adverse outcomes. However, the correlation of left ventricular ejection fraction between the two groups failed to reach the level of significance in our study. In the GISSI-2 trial, it was observed that the higher the Killip class the more failed thrombolysis.[6] Sch€omig and colleagues,[17] observed that patients in cardiogenic shock (Killip class IV) exhibited total thrombotic occlusion of the infarct-related artery along with loss of 40% or more of the left ventricular myocardium, similar to our study. This indicates that patients in cardiogenic shock are better candidates for PCI. Anterior wall myocardial infarction was the most common territory of infarction, and the left anterior descending artery the most common infarct-related artery, based on the ECG at presentation. In our study, 77.8% patients in the successful thrombolysis group had nonobstructive coronary artery disease, whereas the occurrence of single & triple vessel disease in the failed thrombolysis group was 36.7% & 43.3 % respectively. In a study by Ross and colleagues,[18] multivessel coronary disease was present in 40.9% patients in the rescue PCI arm. In the failed thrombolysis group, the occurrence of TIMI flow grade 0, 1, 2, and 3 was 69.15%, 4.25%, 20.21%, and 6.38%, respectively, similar to the findings of Balachandran and colleagues.[19] In our study, the thrombolytic regimen failed to achieve TIMI flow grade 3 in 40.56% of the overall study population, with results comparable to those in the GUSTO trial. In our study,70 patients (46 %) of patients in the successful thrombolysis group continued on optimal medical management without the need for any form revascularization, whereas 48 patients (32 %) of patients in the failed thrombolysis group underwent rescue PCI. The mean TIMI risk score was higher in the failed thrombolysis group, with overall mortality of 5.2%. The incidence of early mortality in our study may have been partially curbed due to the strategy of rescue PCI in as many as 32 % of patients, with the exclusion of the subset of patients with hospital mortality prior to coronary angiography. Balachandran and colleagues,[19] reported that 83% of patients remained event-free for the endpoints, with reinfarction rates (due to stent thrombosis) in 4.58% patients at a mean follow-up of 30 months. The predictors of failed thrombolysis on multivariate analysis were prolonged ischemic time (delayed presentation), dyspnoea at presentation, higher Killip class (>I), and blood pressure, particularly cardiogenic shock, along with risk factors such as diabetes mellitus, dyslipidemia, and obesity (body mass index 23.5kgm 2). In a study by Rao and colleagues, a long symptom-to-needle time was an important predictor of failed thrombolysis, as well as old age, diabetes, and dyslipidemia. The main limitation of this study was small sample size because subjects without angiographic data were excluded. Also, there was a lack of long-term followup, and the long-term outcomes remain unknown. We concluded that non-resolution of presenting symptoms and ST-segment changes on ECG at 90min post-thrombolysis served as the simplest and earliest indicators of failed thrombolysis and TIMI grade 0/1 flow in the infarct-related artery, with frequent need for rescue PCI. The clinical variables such as prolonged ischemic time, dyspnoea at presentation, baseline Killip class>I, cardiogenic shock, TIMI score, and conventional risk factors including diabetes mellitus, dyslipidemia, and obesity represented a cluster of predictors for failed thrombolysis. Prompt angiography and revascularization should be strongly considered in patients with failed thrombolysis, to improve clinical outcomes.

CONCLUSION

The effect of myocardial reperfusion depends on mechanical, rheological, metabolic and hematological factors. Mechanical factors include initial stenosis and complexity of residual stenosis after reperfusion and extent of embolization of platelet aggregates and thrombotic and atheromatous debris. metabolic factors like reperfusion injury and hematological factors includes type as well as extent of thrombus and hemodynamic status of the patient.t-PA and r-PA achieves vessel patency at 60-90 minutes when compared to streptokinase. Rescue angioplasty is beneficial if delivered within 6-8 hours of onset of angina. Several meta-analysis of randomized trials lends support to the use of rescue PCI for failed fibrinolytic therapy in patients with STEMI

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