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Md. Suhail Alam
Assistant Professor, Department of Cardiology, Jalalabad Ragib-Rabeya Medical College Hospital, Sylhet, Bangladesh

Saleh Ahmad Tahlil
Assistant Professor, Department of Cardiology, Jalalabad Ragib-Rabeya Medical College Hospital, Sylhet, Bangladesh

Ayesha Rafiq Chowdhury
Professor, Department of Cardiology, Jalalabad Ragib-Rabeya Medical College Hospital, Sylhet, Bangladesh

Shah Jamal Hussain
Professor, Department of Cardiology, Jalalabad Ragib-Rabeya Medical College Hospital, Sylhet, Bangladesh

Md Atiqur Rahman
Registrar, Department of Cardiology, Jalalabad Ragib-Rabeya Medical College Hospital, Sylhet, Bangladesh

Tafhema Tarin
Junior Consultant, Department of Paediatrics, Sylhet Women's Medical College & Hospital, Sylhet, Bangladesh

Corresponding Author:
Md. Suhail Alam
Assistant Professor, Department of Cardiology, Jalalabad Ragib-Rabeya Medical College Hospital, Sylhet, Bangladesh

Comparison of in Hospital Outcome of Acute ST Elevated Myocardial Infarction Patients Treated with Tenecteplase and Streptokinase in a Tertiary Medical College Hospital, Sylhet, Bangladesh

Md. Suhail Alam, Saleh Ahmad Tahlil, Ayesha Rafiq Chowdhury, Shah Jamal Hussain, Md. Atiqur Rahman and Tafhema Tarin

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Abstract
Introduction: ST Elevation Myocardial Infarction (STEMI) is one of the most fatal emergencies contributing to significant morbidity and mortality due to coronary artery disease. Reperfusion is the mainstay of management of STEMI and it is done in a time-dependent manner. Primary PCI is the gold standard management protocol which is scarcely available in developing countries. Thrombolytics like Streptokinase (SK) and Tenecteplase (TNK) by far remains the only option in such critical situation. Successful reperfusion therapy mainly depends upon time of presentation, type of agent used and underlying co-morbidities.
Aim: To compare the in hospital outcome in terms of efficacy & safety profile of streptokinase and Tenecteplase in patients admitted with acute ST Elevated Myocardial Infarction (STEMI) within a given time frame in terms of resolution of ST-segment elevation after 60 minutes of thrombolytic administration and to compare the in hospital complications and mortality during index hospitalization of therapy.
Methods: This is a prospective, single-center; observational study which was conducted in the Department of Cardiology of Jalalabad Ragib Rabeya Medical College Hospital, Sylhet from January 2024 to December 2024. About 100 patients were included and were divided into two groups (50 in each group) who are diagnosed as STEMI and who received either Streptokinase or Tenecteplase as thrombolytic agent. A reduction of ≥50% of the initial ST elevation was considered as successful thrombolysis. The efficacy of the thrombolysis with these agents were assessed based on the extent of ST segment resolution in Electrocardiogram (ECG) after 60 minutes of post thrombolytic administration and observing the complications and mortality during index hospitalized period.
Results: There was no statistically significant difference between the two groups with respect to ST segment resolution. After 60 minutes of thrombolysis, 82% of patients who received Streptokinase showed ST segment reduction and 86% patient who received Tenecteplase showed significant ST segment reduction, respectively. In hospital complications were similar in both the groups. Major bleeding was seen 3(6%) in Streptokinase group & 1 (2%) among group who received Tenecteplase. Hypotension was seen more among group receiving Streptokinase 10(20%) compared to Tenecteplase, 3 (6%), re-infarction was seen in 4 (8%) patient in Streptokinase group and 2 (4%) in Tenecteplase group respectively. In hospital death was also similar in both groups, 3(6%) in Streptokinase group and 2(4%) in Tenecteplase group respectively.
Conclusion: Streptokinase and Tenecteplase were found equally efficacious as thrombolytic agent in terms of ST segment resolution. Also both the agents were comparable in terms of in-hospital complications and mortality.

Keywords: Acute coronary syndrome, Cardiology, Fibrinolytic agents, Streptokinase, Tenecteplase, STEMI, Mortality, Thrombolysis

Introduction
Myocardial infarction is a major cause of mortality and morbidity worldwide. ST Segment Elevated Myocardial Infarction (STEMI) is a medical emergency condition [1]. About 17.9 million deaths were recorded worldwide in 2019 due to cardio vascular diseases (CVD), accounting for 32% of all fatalities, according to a report issued by World Health

Organization (WHO) on June 11, 2021. Myocardial Infarction (MI) accounts for 85% of these fatalities & among them three quarters occurs in low & middle-income nations [2]. Reperfusion therapy like Primary Percutaneous Coronary Intervention (PPCI) remains the gold standard for early management of STEMI, which is practically not feasible in low & middle-income nations and hence thrombolytic remain the sole agent for reperfusion therapy [3]. Thrombolytic agents are the most effective agents for the management of STEMI. When administered within 12 hours of symptom onset, they can achieve reperfusion and restore blood flow to the infarcted region [4], restore normal cardiac function and can save lives. Fibrinolytic therapy administered within the golden hour can abort Myocardial Infarction and dramatically reduce mortality. Thrombolytic agents available to treat STEMI include Streptokinase (SK), Alteplase (rt-PA), Reteplase (t-PA) and Tenecteplase (TNK-tPA). Streptokinase is one of the earliest, safer, cheaper and widely used drugs but being a bacterial extract, it may induce hypotension and anaphylaxis [5]. Thus it should not be used again after four days of administration [6]. Subsequent episodes of thrombotic events are treated with recombinant tissue Plasminogen Activators (rt-PA) such as Alteplase, Tenecteplase & Reteplase [7]. Tenecteplase is administered as a single bolus intravenous injection within 5 to 10 seconds. It is highly efficacious but is very expensive, particularly in developing countries where expense and availability is a big challenge [8]. The aim of this study was to compare the in-hospital outcome in terms of safety, efficacy, complications and in hospital mortality of Streptokinase which is relatively cheaper and easily available compared to Tenecteplase, which is highly efficacious, safer but comparatively expensive and less available in treating patients presenting with ST segment elevated myocardial infarction.

Materials and Methods

- **Study Design and Study Period:** The present study was a prospective, observational, single centered hospital-based study, conducted in the department of cardiology of Jalalabad Ragib Rabeya Medical College & Hospital from January 2024 to December 2024.
- **Source of Data:** All the data were collected in a previously designed data collection form. The data required for the observational study was collected on daily basis over a period of one year in the department of cardiology of a tertiary care teaching hospital.
- **Sample size calculation:** A total of 100 patients were included, 50 in each group.

Inclusion criteria

Patients were selected who fulfilled the following criteria. Both male and female aged > 18 years who were diagnosed with ST segment Elevated Myocardial Infarction and presented within 12 hours of symptom onset and treated with either Streptokinase or Tenecteplase in the coronary care unit.

Exclusion criteria

The study excluded

- Prior intracranial hemorrhage,
- Stroke patients (within 3 months),
- Significant closed head trauma or facial trauma within 3 months,
- Intracranial or intra-spinal surgery within 2 months,
- Known malignant intracranial neoplasm,
- Major surgery,
- Non-compressible vascular punctures,
- Active bleeding or bleeding diathesis (excluding menses),
- History of internal bleeding in 2-4 weeks,
- Previous exposure within 6 months or history of hypersensitivity to streptokinase,
- Severe uncontrolled hypertension (unresponsive to emergency therapy),
- Pregnant women, lactating mothers,
- Active peptic ulcer,
- Current use of warfarin.

ECG was done immediately after admission with characteristic symptoms and those with ST segment and presented within 12 hours of symptoms onset were enrolled after obtaining consent. Patients were treated with either Streptokinase or Tenecteplase based on their financial capability.

Treatment Allocation & Study Procedure: All the eligible patients were assessed and based on clinician judgement & patients financial ability, eligible patients were either given Streptokinase or Tenecteplase. 50 patients received Streptokinase and 50 patients received Tenecteplase as thrombolytic agent. Streptokinase was administered as 1.5 million unit intravenous bolus infusion over 60 minute and Tenecteplase was given as single intravenous bolus based on patients body weight. The efficacy of the thrombolytic agents was based on the extent of ST segment resolution in ECG at 60 minutes after administration of thrombolytic.
A reduction of ≥ 50% of initial ST segment elevation was considered as successful thrombolysis. The patients were followed up on regular basis till index hospitalization. Any complications such as major bleeding, hypotension & reinfarction developed during the hospital stay were noted and all deaths were recorded.

Statistical Analysis: A total of 100 participants were selected, 50 patients in each group. T-test was utilized to compare the characteristics of patients. The analysis was performed using EXCEL version 2021.

Results

In the present study, a total of 100 patients were included who were admitted with ST segment Elevated Myocardial Infarction. Among them 50 patients were treated with streptokinase and another 50 patient's received Tenecteplase. Out of 100 patients, 80 (80%) were male patients and 20(20%) were female patients. Male were more prone to ST segment elevated MI when compared to female. Among the 100 patients majority 52(52%) were between the age group of 41 to 60 years and about 24 (24%) patients were between 61 to 80 years. Regarding symptom onset and time of presentation, only 21 (21%) patients presented within 6 hours of symptom onset, among them 9 (9%) patient received Streptokinase and 12(12%) patients received Tenecteplase. 79 (79%) patient presented between 6 to 12 hours of symptom onset and among them 41(41%) patients received Streptokinase and 38 (38%) received Tenecteplase. Regarding the various risk factors observed among the patients, 56(56%) were smokers, 45(45%) were tobacco chewers, 39(39%) had hypertension, 35(35%) were diabetic, 22(22%) had dyslipidaemia and only 1(1%) was diagnosed

with chronic kidney disease (CKD). ST elevated Myocardial Infarction is classified broadly depending upon the area of myocardium involved. Majority of the patients were Anterior STEMI, 78(78%) and the remaining 22(22%) were Inferior STEMI.

Efficacy Parameters: Among the 50 patients in each group, ST segment resolution ≥50% were found in 41(82%) patients treated with Streptokinase and 43(86%) patients treated with Tenecteplase, which represents that the resolution of ST segment was similar among the two groups. On the other hand, 9(18%) patients treated with Streptokinase & 7(14%) patients treated with Tenecteplase failed to show significant ST segment resolution after 60 minutes of administration of the drug. Regarding the complication of various thrombolytic agents during index hospitalization period, major bleeding was seen in 3(6%) patients treated with Streptokinase & 1(2%) patient treated with Tenecteplase. Hypotension, a common complication was seen among 10(20%) patients receiving Streptokinase & 3(6%) patient receiving Tenecteplase. Reinfarction was seen in 4 (8%) patients receiving Streptokinase & 2(4%) patient receiving Tenecteplase. In hospital mortality was almost similar in both the groups, 3(6%) patient died who received Streptokinase while 2(4%) patient died who received Tenecteplase.

Table 1: Demographic and clinical characteristics of the participants at baseline

Variables	Streptokinase (n=50)	Tenecteplase (n=50)	Total % (n=100)
Gender Distribution			
Male	38 (76%)	42 (84%)	80%
Female	12 (24%)	8 (16%)	20%
Age wise distribution (years)			
20-40	13 (26%)	10 (20%)	23%
41-60	25 (50%)	27 (54%)	52%
61-80	11 (22%)	13 (26%)	24%
>80	1 (2%)	0 (0%)	1%
Risk Factor Profile			
Smoking	30 (60%)	26 (52%)	56%
Tobacco chewing	25 (50%)	20 (40%)	45%
T2DM	20 (40%)	15 (30%)	35%
Hypertension	22 (44%)	17 (34%)	39%
Dyslipidemia	13 (26%)	9 (18%)	22%
CKD	1 (2%)	0 (0%)	1%

Table 2: Outcomes of the study

Parameters	Streptokinase (n=50)		Tenecteplase (n=50)		Total % (n=100)
Types of STEMI					
Anterior MI	41 (82%)		40 (80%)		81%
Inferior MI	9 (18%)		10 (20%)		19%
Window Period					
<6 Hours	9 (18%)		12 (24%)		21%
6-12 Hours	41 (82%)		38 (76%)		79%
ST-Segment Resolution at 6o Min					
	Anterior MI (38)	Inferior MI (12)	Anterior MI (40)	Inferior MI (10)	
Yes	32 (84.2%)	9 (75%)	34 (85%)	9 (90%)	84%
No	6 (15.8%)	3 (25%)	6 (15%)	1 (10%)	16%

Table 3: In Hospital Complications

Complications	Streptokinase (n=50)	Tenecteplase (n=50)	%
Major Bleeding	3 (6%)	1 (2%)	4%
Hypotension	10 (20%)	3 (6%)	13%
Re-infarction	4 (8%)	2 (4%)	6%
In Hospital Death	3 (6%)	2 (4%)	5%

Discussion

Fibrinolytic therapy remains one of the main stay of treatment for acute myocardial infarction till date especially in resource limited countries [9]. The present study was conducted to compare the in-hospital outcome in terms of efficacy, safety, complications and in hospital mortality of two commonly used fibrinolytics *viz*. Streptokinase and Tenecteplase used in the treatment of acute ST elevated myocardial infarction [10]. About 100 patients were selected in this study and were divided into two groups, 50 patients received streptokinase and another 50 received Tenecteplase as fibrinolytic agent. The purpose was to compare & evaluate their efficacy in terms of ST segment resolution ≥ 50% of initial ECG & the in-hospital complications and mortality of the two thrombolytic agents [11]. The present study found no significant difference in the various studied parameters among the two agents. The primary outcome was to assess the success of thrombolysis among the two agents, defined by ST segment resolution ≥ 50% of the initial rise. The end results were almost similar to a study conducted by Sahu et

al., [11]. On the other hand a study conducted by Chandra Babu. S. et al., [10] showed that Tenecteplase was more efficient thrombolytic agent when compared to streptokinase in treating ST segment Elevated Myocardial Infarction. In the present study, the most common site of infarction was in the anterior wall which was similar to a study conducted by Sahu et al., [11] and Mohammed OS et al., [12]. Studies conducted by Pandey R et al., [13] & Hashmi SF et al., [14] found inferior wall STEMI more common than anterior wall STEMI. In the present study only 21(21%) patients presented within 6 hours of symptom onset, majority of the patients, 79 (79%) presented between 6 to 12 hours of symptom onset. A study by Lakshmi NR et al., showed that earlier the thrombolysis, better the success rate it holds [15]. The overall efficacy of both the thrombolytics was 82% for Streptokinase and 86% for Tenecteplase respectively. It was almost similar to the study conducted by Sahu et al., [11] where there observation was 75% with Streptokinase and 76% with Tenecteplase respectively. A study by Girdher DR et al., done on 104 patients found a success rate of 67.3% with Streptokinase [16]. Another study by Srinivasan K., showed only 54% success rate with Streptokinase [17]. A study by Iyengar SS et al., done on 6000 patients revealed a success rate of 90.93% with Tenecteplase [18]. Another study done on 2162 patients showed a high rate of successful thrombolysis with Tenecteplase i.e. 83.9% [19].

In the present study, the incident of major bleeding was almost similar with both the agents, 3 (6%) among Streptokinase & 2 (4%) among Tenecteplase respectively. Hypotension was seen in 10(20%) patients receiving Streptokinase compared to 3(6%) among patient receiving Tenecteplase which was similar to a study done by Chandra Babu. S. et al., [10]. Reinfarction was seen in 4(8%) patients receiving Streptokinase and 2(4%) among patients receiving Tenecteplase. In overall hospital mortality during index hospitalization was almost similar among both the groups. 3 (6%) patient died during index hospital period who received Streptokinase compared to 2(4%) who received Tenecteplase. The study by Sahu at el., [11] showed a mortality of 9% among patients receiving Streptokinase and 5% patients receiving Tenecteplase. A meta-analysis showed that the use of thrombolytic agents significantly reduces the mortality at 30 days of thrombolysis [20]. In a study by Mega JL et al., showed that women undergoing fibrinolysis for ST elevated MI were at higher risk of short term mortality [21].

Limitations

In the present study, data were derived from a single tertiary care hospital in Bangladesh. The study sample was taken consecutively (non-randomly) which might have affected the outcome of the study. The study did not have the scope to include information on the patients of acute myocardial infarction who died on the way to the hospital, which must have resulted in an under estimation of the mortality rates among patients of acute MI. The study was aimed to evaluate the efficacy of these thrombolytic agents for an acute event; the safety profile could not be studied due to short hospital stay. Duration of co-morbidities was not taken into consideration which could have made a significant difference in the outcome.

Conclusion

The present study demonstrates that there were no significant differences between the efficacies, safety profile and in-hospital complications among patients of ST elevated Myocardial infarction who received either Streptokinase or Tenecteplase as thrombolytic agent. Both the agents were equally efficient in resolving ST-segments among ST segment elevated MI.

Recommendation

In light of the findings of the present study, the following recommendations are made. Considering the socio-economic condition & resource limited facilities, both streptokinase and Tenecteplase can be considered as agent for thrombolysis for managing acute ST Elevated Myocardial Infarction. Public awareness should be raised to minimize pre hospital delay after symptom onset of acute MI. However, a multicentre study involving a large sample is recommended for further evaluation.

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