Efficacy and Safety of Streptokinase and Tenecteplase in Patients with ST Elevation Myocardial Infarction

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Original Research Article

Efficacy and Safety of Streptokinase and Tenecteplase in Patients with ST Elevation Myocardial Infarction

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ABSTRACT

Objective: To investigate the efficacy and safety of Streptokinase (STK) and Tenecteplase (TNK) in ST elevation myocardial infarction patients.

Study Design: Randomized control trial.

Place and duration: Study was conducted at Ch Pervaiz Ellahi institute of cardiology hospital Multan from May 2022 to April 2023.

Methodology: Patients of ST elevation myocardial infarction presented within six hours of onset of symptoms were included in the study. Patients were divided into two equal groups (STK and TNK). Patients in STK group were thrombolysed with streptokinase and in TNK group were treated with Tenecteplase. SPSS version 23 was used for data analysis.

Results: ST-resolution Pre-PCI at 90 minutes in STK and TNK groups was observed as 68% and 80%, respectively. While post-PCI ST-resolution was found in 80% and 88% patients of STK and TNK groups, respectively. Major bleeding events were found in 8% patients of STK Group and in 4% patients of TNK Group. The differences were statistically insignificant, and no association was found.

Conclusion: Both drugs Streptokinase and Tenecteplase are equally effective when given in correct timeline in patients of ST segment myocardial infarction. Efficacy and safety of TNK is also like STK when administered in equal time frame.

Keywords: Streptokinase; Tenecteplase; STEMI; TIMI Flow

1. INTRODUCTION

Acute coronary syndrome is characterized by reduced blood flow in coronary arteries resulting in heart muscle damage and impaired function, is a critical condition that can lead to patient fatality (1). Typical symptoms include chest pain radiating to the jaw or shoulder, accompanied by nausea, vomiting, and palpitations (2). Main causes of acute coronary syndrome are non-ST elevation myocardial infarction, ST elevation myocardial infarction, and unstable angina, accounting for approximately 38% of cases (3).

The diagnosis of Myocardial infarction relies on electrographic, clinical, and biochemical criteria (4). Globally, it's understood as the death of heart muscle cells due to prolonged lack of blood flow. Electrocardiographic changes, such as ST and T alterations, indicate myocardial ischemia, while myocardial necrosis is evident in QRS patterns (5). ST elevation myocardial infarction poses a higher fatality risk compared to non-ST elevation myocardial infarction, which affects only a portion of heart muscle due to ischemia (6).

The benefits of thrombolytic therapy in myocardial infarction patients are widely acknowledged and extensively recorded, with timing being crucial (7). Optimal advantages are attained when treatment is administered within 3 to 4 hours of symptom onset. However, thrombolytic therapy can still be beneficial for patients presenting within 12 hours (8). Early intervention with thrombolytic therapy diminishes the extent of the infarct, restoring coronary flow, and potentially enhancing both short-term and long-term patient survival.

Restoring complete coronary blood flow is the primary objective of re-perfusion therapy, which can significantly enhance clinical outcomes and increase patients' chances of survival. Among re-perfusion options, intravenous administration of thrombolytic therapy is preferred due to its widespread availability and associated reduction in mortality rates (9). Streptokinase, a thrombolytic agent, is utilized to dissolve clots in instances of heart attacks, arterial thrombolism, and coronary embolism (10).

The objective of our study is to evaluate and compare the effectiveness and safety profiles of two thrombolytic agents, streptokinase and tenecteplase. The intravenous administration of streptokinase may lead to side effects such as low blood pressure, bleeding, allergic reactions, and nausea. In contrast, tenecteplase,

a plasminogen activator molecule, exhibits greater fibrin specificity, 14 times more than alteplase, slower plasma clearance, and a longer half-life (11).

2. METHODOLOGY

Randomized controlled trial was conducted at Ch Pervaiz Ellahi institute of cardiology hospital Multan from May 2022 to April 2023. Ethical approval was taken from the hospital ethical board. The study employed a non-probability convenience sampling method. It focused on patients with ST elevation myocardial infarction who presented within 6 hours of symptom onset and were subsequently admitted to the intensive care unit.

The patients were evenly divided into two groups: Group A received streptokinase treatment, while Group B received tenecteplase treatment. Detailed information, including patient age, BMI, time of symptom onset, admission time, type and dosage of thrombolytic agent administered, thrombolysis time, and thrombolysis-to-needle time, was recorded on a standardized form. Patients with a history of stroke, tumors, left bundle branch block, contraindications to thrombolytic agents, hypertension, or lactating women were excluded from the study. Electrocardiography and echocardiography were conducted for all participants. Drug dosages were adjusted according to patient body weight, and coronary angiography was performed 90 minutes after drug administration. Follow-up assessments were conducted at one week, one month, and 60 days post-treatment.

Data analysis was performed using SPSS version 23. Frequencies and percentages were calculated for categorical variables, while mean and standard deviation were computed for continuous variables. A p-value of less than or equal to 0.05 was considered statistically significant.

3. RESULTS

Fifty patients were included in this study. The patients were divided into two groups as n=25 (50%) in streptokinase (STK) Group and n=25 (50%) in tenecteplase (TNK) Group. The mean age and BMI of STK Group was 46.01±2.74 years and 29.68±3.19 kg/m^2, respectively. There was n=13 (52%) males and n=12 (48%) females. While the mean age and BMI of TNK Group was 45.64±3.18 years and 29.01±3.06 kg/m^2, respectively. There was n=14 (56%)

males and n=11 (44%) females. No difference was statistically significant. (Table 1).

Table 1: Demographic Characteristics of Both the Groups

Variable	STK n=25 (50%)	TNK n=25 (50%)	P-value
Age (years)	46.01±2.74	45.64±3.18	0.703
BMI (kg/m^2)	29.68±3.19	29.01±3.06	0.447
Gender			
Male	n=13 (52%)	n=14 (56%)	0.777
Female	n=12 (48%)	n=11 (44%)	

Source: Author's own.

TIMI III flow after 90 minutes CAG (Prior to PTCA) in STK and TNK Group observed inn=15 (60%) patients and n=20 (80%) patients, respectively. All the patients had TIMI III after PTCA of both the groups. The mortality was noted n=2 (8%) in STK Group and n=1 (4%) in TNK Group. ST-resolution Pre-PCI at 90 minutes in STK and TNK groups was observed as n=17 (68%) and n=20 (80%), respectively. While post-PCI ST-resolution was found in n=20 (80%) and n=22 (88%) patients of STK and TNK groups, respectively. Major bleeding events were found in n=2 (8%) patients of STK Group and in n=1 (4%) patients of TNK Group. The differences were statistically insignificant, and no association was found. (Table 2). P-value ≤0.05 considered as significant.

Table 2: Clinical Presentations of Both the Groups

Variable	STK n=25 (50%)	TNK n=25 (50%)	P-value
TIMI III flow after 90 minutes	n=15 (60%)	n=20 (80%)	0.123
TIMI III Flow after PTCA	n=25 (100%)	n=25 (100%)	--
Mortality	n=2 (8%)	n=1 (4%)	0.552
ST-resolution Pre-PCI (at 90 minutes)	n=17 (68%)	n=20 (80%)	0.333
ST-resolution Post-PCI	n=20 (80%)	n=22 (88%)	0.440
Major Bleeding events	n=2 (8%)	n=1 (4%)	0.552

Source: Author's own.

4. DISCUSSION

A study was conducted by Dundar et al. (11) in 2003 and reported that both streptokinase and tenecteplase are equally effective when administered at early and in time. In STEMI patients both these drugs show equal complication rate and mortality rate. A similar study was conducted by Aherrao et al. (12) and reported that efficacy and safety of STK and TNK is similar in STEMI patients when given at correct and equal time frame. We also concluded same findings that both drugs are equally effective when given in exact time and similar patients.

Another observation of our study was mortality rate at 30 days of thrombolysis, and we observed 8% mortality rate with STK and 4% morality rate with TNK. In a study conducted by Huikuri et al. (13) reported that mortality rate was observed in both groups and concluded that TNK is as safe as STK in STEMI patients regarding mortality and death complication.

ST resolution before PCI is another contributing variable of our study that can be compared with other studies, in our study in 68% of patients ST resolution was occurred before PCI in STK patients and 80% were relieved in TNK group. A study by Jason et al. (14) concluded that ST resolution was found in both groups STK and TNK. In STK group 73.3% and in TNK group 78.8% patients found resolved ST segment after administration of drug at 90 minutes.

Bleeding after drug exposure is also important factor that should be controlled and need to be vigilant, in our study we observed no major bleeding was seen. A study was conducted by Gurbel et al. (15) on comparison of STK and TNK and compare major bleeding factor and reported nil bleeding rate in both groups. Minor bleeding 6.6% was found in STK and 3.3% in TNK group.

When comparing all aspects of study cost effectiveness also matters, in a study conducted by Ting et al. (16) reported that STK is less expensive as compared to TNK, similarly another study by Bravo et al. (17) also reported that STK is less expensive and less costly when compared with TNK. In a study by Vergel et al. (18) reported that as compared to TNK availability of STK is easier and cheaper.

Chau et al. (19) conducted a study and reported that TNK is as safe as STK in STEMI patients when treated in acute phase of treatment, both drugs are equally effective and safe. TNK can be used in replacement of STK (20).

5. CONCLUSION

Both Streptokinase and Tenecteplase have demonstrated comparable effectiveness when administered within the appropriate timeframe to patients with ST segment myocardial infarction. Our study indicates that the efficacy and safety profiles of Tenecteplase are comparable to those of Streptokinase when administered within the same time frame.

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