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Original Research Article

An Observational Study on Failure of Thrombolysis with Streptokinase in Acute Myocardial Infarction using ECG Criteria

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Abstract:

Background: Globally, coronary heart disease (CHD) is a leading cause of both mortality and morbidity. In developed nations, acute myocardial infarction is among the most frequently diagnosed conditions among hospitalized patients. This study aims to determine if thrombolysis with streptokinase fails in cases of acute myocardial infarction based on ECG criteria.

Methods: This prospective study was conducted from January 2021 to June 2021 on patients who presented with acute myocardial infarction at the Sri Krishna Medical College and Hospital in Muzaffarpur, Bihar. The study included 220 patients in all who had an acute myocardial infarction.

Results: 193 (87.7%) males and 27 (12.3%) females out of 220 patients took part in the study. Streptokinase was used to perform thrombolysis on each subject. Of the 220 patients undergoing streptokinase thrombolysis, the majority (97; 41.1%) belonged to the 56–65 age range. 121 patients (or 55%) out of the 220 patients who had thrombolysis experienced thrombolytic failure. The age group of 56–65 years old had a much greater failure rate (88; 72.7%). Patients with diabetes (65.2%) had a significantly higher prevalence of thrombolytic failure with streptokinase than non-diabetics (52.3%).

Conclusion: We came to the conclusion in this study that among patients with acute myocardial infarction, a lengthy symptom to needle time is a significant predictor of unsuccessful thrombolysis. Therefore, it's critical to inform the public about the importance of quickly recognizing symptoms and obtaining medical attention. Individuals who suffer from diabetes, hypertension, dyslipidemia, or advanced age should have close monitoring and intensive care.

Keywords: Thrombolysis, Streptokinase, Acute Myocardial Infarction.

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Introduction

Unstable angina, ST segment elevation myocardial infarction (STEMI), and non-ST segment elevation myocardial infarction (NSTEMI) are among the acute coronary syndromes. [1] Every year, around 7 million myocardial infarctions occur worldwide. Approximately one-third of individuals suffering from acute myocardial infarction (AMI) pass away within the first hour of symptoms, typically as a result of a deadly arrhythmia.

When clinical symptoms of chest discomfort are combined with characteristic elevation of the ST segment in the 12-lead electrocardiogram (ECG), it is possible to diagnose patients most quickly and determine which ones need thrombolysis to help break up thrombus and restore blood flow.

As thrombolysis preserves left ventricular function and improves prognosis, it has been the cornerstone of treatment for patients with STEMI. [2] Assessing cardiac reperfusion in STEMI patients following fibrinolytic therapy can be done attractively and economically by analyzing the ST segment resolution on the ECG. [3]

While the epicardial vessel's successful recanalization is a prerequisite, the microvascular flow has the strongest correlation with the result. Ventricular fibrillation and tachycardia (VT/VF) cause abrupt cardiac mortality in patients with AMI. Those with failed thrombolysis in STEMI are more likely to experience these consequences.

ST segment alterations provide predictive information beyond that of a coronary angiography alone because they represent myocardial flow rather than epicardial flow. [4] This study was carried out to ascertain the failure rate of

thrombolysis with streptokinase in AMI using ECG criteria because there is a dearth of information on the use of streptokinase as a thrombolytic drug.

Material and Methods

From January 2021 to June 2021, a prospective study was carried out in the Department of Medicine at the Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar. All AMI cases diagnosed according to WHO criteria, meaning that at least two of the following conditions were present, were included: Acute myocardial infarction with symptoms lasting less than 12 hours is indicated by (i) chest pain; (ii) electrocardiogram changes, such as ST segment elevation > 0.2 mv in at least two contiguous chest leads or > 0.1 mv in at least two contiguous limb leads; (iii) left bundle branch block, either new or likely new, on the ECG; and (iv) elevated cardiac enzyme levels (CPK-MB more than double of the reference value or positive troponin I/T test).

Patients with non-ST elevation myocardial infarction (NSTEMI), those who were not given streptokinase because the therapy was contraindicated, those who received streptokinase from other hospitals, those who had previously used streptokinase (5 days to 2 years), those who had undergone primary angioplasty, and fully evolved cases with pathological Q wave were among the exclusion criteria.

A thorough medical history was obtained, including information on age, gender, employment, and other risk factors such as diabetes, hypertension, smoking, family history of ischemic heart disease, etc. When a patient first arrives at the emergency room, a thorough physical examination is performed, and vital signs such pulse, blood pressure, respiration rate, pallor, cyanosis, JVP, pedal edema, LAP, icterus, and clubbing are recorded. The history allowed for the timing of the patient's emergency room presentation and the beginning of their chest pain.

Before beginning streptokinase infusion, the first ECG was recorded, and the second ECG was recorded once the infusion was finished. This was completed within a span of two to four hours, however it took ninety minutes. Using a standard millimeter ruler, the vertical height of ST segment elevation in the lead with the maximum segment elevation (worst infarct lead) before and after streptokinase was assessed. The ST elevation peak, or J point, is 80 milliseconds away from where the ST segment was measured. The first turning point in the ST segment on the ECG was referred to as the J point. A reduction of 50% or less in ST segment elevation in the worst infarct lead without idioventricular rhythm after 90 minutes (a time frame of two to four hours) was considered failure of thrombolysis with streptokinase. Each patient received 1.5 million units of streptokinase intravenously over the course of an hour, diluted in 100 milliliters of normal saline.

All data was analyzed using the Statistical Package for Social Sciences (SPSS). Numerical data was recorded as mean and standard deviation, and categorical data as frequency and percentages. A p-value of <0.05 was considered significant association with thrombolysis failure using streptokinase. Univariate analysis using chi-square test for categorical data and student's t-test for numerical data was used to compare the association of variables.

Results

A total of 220 patients, 193 (87.7%) males and 27 (12.3%) females were included in the study. Most of the patients 97 (41.1%) were in the age group of 56-65 years, followed by 86 (39.1%) in the age group of 46-55 years, 25 (11.4%) in <45 years and 12 (5.4%) in the age group of 66-75 years. Thrombolytic failure rate was observed in 121 (55%) patients, significantly more in the age group of 56-65 years (88; 72.7%). Mean age (59.5 years) in thrombolytic failure group was 10 years higher than success group. Failure rate was more in females (18/27; 66.7%) compared with males (103/193; 53.4%). Relationship of thrombolytic failure with location of myocardial infarction, symptom-to-needle time, KILLIP class, smoking, diabetes mellitus and hypertension respectively is given in Table 1. Mean (± standard deviation) values of total leukocyte count (TLC), vital signs, duration of door-to-needle time in thrombolytic failure and success groups is given in Table 2. Medication used in thrombolytic failure and success groups is given in Table 3.

Table 1: Relationship of Thrombolytic Failure with Different Parameters

Parameters		Failure Group n (%)	Success Group n (%)	p-value
Location	Anterior Inferior	99(75) 22(25)	33(25) 66(75)	0.00
Symptom-to needle time	≤6 hours >6 hours	56(45.2) 65(67.7)	68(54.8) 31(32.3)	0.00
KILLIP class	Class I Class II-IV	65(56) 56(53.8)	51(44) 48(46.2)	0.74
Habit	Non-smoker Smoker	26(61.9) 95(53.4)	16(38.1) 83(46.6)	0.31

Diabetes status	Diabetic Non-diabetic	30(65.2) 91(52.3)	16(34.8) 83(47.7)	0.11
Hypertension status	Hypertensive Non-Hypertensive	55(64.7) 66(48.9)	30(35.3) 69(51.1)	0.02

Table 2: Mean (± Standard Deviation) values of Thrombolytic Failure and Success Groups

Parameters	Failure Group Mean (±SD)	Success Group Mean (±SD)
Total Leukocyte count (mm^3)	13.8 (±4.3)	13.3 (±3.7)
Heart Rate (bpm)	81 (±18.5)	74 (±16.6)
SBP (mmHg)	134.8 (±26.9)	125.1 (±23.2)
DBP (mmHg)	84.2 (±19.6)	76.5 (±14.3)
Door-to-needle time (minutes)	116 (±83.5)	91 (±47.5)

Table 3: Medication Used in Thrombolytic Failure and Success Groups

Medication	Failure Group n (%)	Success Group n (%)	Total n (%)	p-value
Beta Blocker	84(60)	56(40)	140(63.6)	0.33
ACE inhibitor	90(54.5)	75(45.5)	165(75)	

Discussion

Using the ECG criteria, the current investigation found that in STEMI patients, the failure rate for thrombolysis with streptokinase was 55%. These findings are consistent with the multicenter GUSTO-I trial, which examined several thrombolytic approaches and found that streptokinase, had an arterial patency rate of 54% after 90 minutes. [5]

In the current study, patients with anterior placement of infarct had a worse clinical result than those with inferior location. This was associated with a decreased future left ventricular ejection fraction [6] and a greater ultimate infarct size. The observation of large clinical trials, such as GUSTO-I, which demonstrated that thrombolysis with streptokinase was linked with lower mortality and morbidity in patients with anterior infarct, is in contrast to these results. [5] Our findings, however, are consistent with other research, such as INJECT, which shown that when administered a thrombolytic drug, patients with anterior infarcts had less success with reperfusion than those with inferior infarcts. [3] According to our research, anterior wall MI (75%) had a considerably greater rate of thrombolytic failure with streptokinase (p=0.00) than inferior wall MI (25%).

In the current investigation, the failure rate for thrombolysis with streptokinase was 45.2% in patients with symptom-to-needle times less than 6 hours, while 67.7% of patients with symptom-to-needle times greater than 6 hours had failed the procedure (p=0.00). This finding is consistent with Kharash et al. [7], who came to the conclusion that the better the outcomes, the shorter the interval between the onset of pain and treatment. Although the purpose of this study was not to investigate the reasons for extended symptom-to-needle times, a review of the medical records revealed several potential explanations, such as improper initial triage, transport delays, incorrect first diagnosis, and treatment start delays. History of diabetes mellitus was a powerful predictor of mortality and the future episode of cardiac event, acting as a "myocardial infarction equivalent". In a GUSTO-I trial, diabetes cohorts (n = 5,944) had a higher death rate at 30 days with OR 1.77, and this risk persisted after a year (5), as demonstrated by Mak et al. Despite making up just 20.9% of the research cohorts, 65.2% of the diabetic patients in this trial failed to achieve effective thrombolysis, compared to 52.3% of the non-diabetic patients (p=0.11). Our findings are consistent with those of Chowdhury et al., who found that among diabetes patients with STEMI, reperfusion failed in 67.2% of cases, compared to 19.8% in the non-diabetic group. [8] The reasons for the higher risk of failure were the diffuse and multiple small vessel diseases in diabetic patients, which did not respond well to streptokinase. Diabetic patients usually present to the hospital later, due to their impaired sensation in myocardial ischaemic pain.

In addition, diabetic patients have a lower ejection fraction. According to the Framingham study [9], hypertension is a documented risk factor for increased mortality in individuals with AMI and it is additive to other known risk factors. Extensive worldwide trials, such as GUSTO-I and GISSI [2,10] have demonstrated that hypertension was a significant predictor of mortality during the thrombolysis era. In our study, 38.6% of the patients had hypertension. Compared to individuals with normotension, who had a 48.9% failure rate, the majority of hypertension patients (64.7%) were unable to accomplish effective thrombolysis with streptokinase (p=0.02). This is consistent with the findings of Lee et al., who found that failure occurred in 66.2% of hypertension patients compared to 51.2% of patients with normotension. Poorly controlled hypertension, the high-risk character of hypertension, and potentially accelerated atherosclerosis linked to endothelial dysfunction were potential causes of the higher

failure rate. [11] The failure rate in the current study was greater in females (66.7%) than in males (53.4%) (p=0.19). The findings of Sultana et al. [12] indicate that there was a greater incidence of thrombolytic failure with streptokinase in males (39.3%) as opposed to females (36.8%).

Our findings contradict their findings. 80.9% of the patients in our study smoked. 53.4% of smokers and 61.9% of non-smokers experienced thrombolytic failure (p=0.31). This stands in contrast to the findings of Sultana et al. [12], who found that 61% of smokers experienced thrombolytic failure. In our study, mean age in thrombolytic failure group was 59.5 years as compared to 49.4 years in successful thrombolysis group.

Maximum patients were in the age group of 56-65 years (n=97; 44.1%), with thrombolytic failure being maximum in the same age group (n=88) (p=0.00). In our study, the failure rate of thrombolysis was higher in patients with Killip Class I (56%) as compared to patients with Killip Class II-IV (53.8%) (p=0.74). Streptokinase is the first generation thrombolytic agent. It acts by complexing with plasminogen and it is not fibrin specific. Eventually there is depletion of plasminogen, known as "plasminogen steal", which will limit the fibrinolytic action accounting partly for the thrombolysis failure [13]. Late presentation is an important risk factor for failed thrombolysis in AMI. Persistence of chest pain and non-resolution of reciprocal ST depression are significantly associated with failed thrombolysis [14].

Conclusion

Other reperfusion techniques should be taken into consideration, especially in high-risk patients, since streptokinase has a significant failure rate of thrombolysis in AMI patients. Tissue plasminogen activators (tPA) such as alteplase and reteplase are among the more recent generation of thrombolytic drugs. When compared to streptokinase, these are linked to a superior outcome for thrombolysis. These agents are pricey, though, and they're not always accessible in places with limited resources. PCI is an additional tactic that has demonstrated superior mortality outcomes over thrombolytic drugs in numerous prospective trials.

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