Original Article

Factors influencing ihe outcome of thrombolysis in acute st-segment elevated myocardial infarction based on ECG criteria

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Objective: The aim of our study was to find out the overall success rate of thrombolysis in acute STEMI based on electrocardiography (ECG) criteria, and to assess the effect and correlation of various parameters such as age, sex, pre-infarction angina, smoking status, history of hypertension, history of diabetes mellitus, time interval between onset of pain and initiation of thrombolytic agent, killip's class and territory of MI on outcome of thrombolysis.

Material and Methods: A total of 100 randomly selected STEMI patients satisfying the inclusion criteria were studied at New Hospital Medical College, Kota. All patients underwent thrombolysis with streptokinase. ST-segment elevation on ECG was assessed before and after 90 minutes of completion of thrombolytic therapy.

Results: A total of 57 patients (57%) show successful thrombolysis using streptokinase. The success rate is significantly higher in patients presenting within 3 hours of index chest pain (P<0.05) and who have inferior wall MI than any other wall MI (P<0.05). The patients presenting with higher Killip class had less success rate (P<0.05). Other risk parameters (age, sex, pre-infarction angina, diabetes, smoking and hypertension) did not affect outcome significantly (P>0.05).

Conclusion: The overall success rate of thrombolysis with streptokinase was 57%. The earlier presentation, inferior wall infarction and Killip class-1, are associated with statistically significant higher rate of successful thrombolysis.

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Key words **: Myocardial Infarction, Thrombolysis, ECG criteia.**

The cardiovascular disease (CVD) is the leading cause of death worldwide, including India[1]. Ischemic heart disease (IHD) and stroke being the predominant causes are responsible for >80% of CVD deaths in India, with IHD most predominant cause[2]. Ischemic heart disease (IHD) or coronary artery disease typically occurs when there is an imbalance between myocardial oxygen supply and demand. The most common cause of myocardial ischemia is atherosclerotic disease of an epicardial coronary artery (or arteries)[3].

The current definitive treatment modalities for acute STEMI includes thrombolysis and percutaneous coronary intervention (PCI). The preferred reperfusion option for patients with STEMI is timely primary PCI. Many people suggest that fibrinolysis have no place in the era of primary PCI whereas others believe fibrinolysis is needed because primary PCI cannot be delivered to all patients with STEMI within the evidence-based time frames needed for full effectiveness[4].

The principal goal of fibrinolysis is prompt restoration of full coronary arterial patency. Coronary angiography is the gold standard to determine coronary artery patency after reperfusion therapy but it is an expensive, invasive and not always readily available modality. Therefore, bedside noninvasive markers are more attractive options. Among these, ECG has good predictive value and sensitivity which is an easily available and cheaper option. Sutton *et al*[5]. showed that patients with less than 50% resolution of ST-Segment elevation in the worst lead have 87% chance (positive predictive value) of <TIMI-3 flow in infarct

Editor's Comment :

- **Success rate of thrombolysis with streptokinase is significantly associated with certain determinants like earlier presentation killip class and inferior wall infarction.**
- **Knolwledge about these factors will help in proper management.**

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related vessel with sensitivity of 81% and specificity of 88%.

Along with this it is well recognized that thrombolytic therapy can fail in a significant proportion. We need to identify the risk factors that are responsible for failure of thrombolysis. With this background, we decided to conduct a study in a subgroup of ACS patients who receive thrombolysis for STEMI as an option of reperfusion and not PCI due to some or the other reason.

Material and Method

An observational prospective cohort study of randomly selected 100 patients receiving thrombolytic therapy for acute STEMI were studied at New Hospital Medical College, Kota, from 01 January 2019 to 31 December 2019.

Inclusion criteria: Presence of typical chest pain suggestive of acute myocardial infarction and/or ischemic angina equivalents without typical chest pain along with ECG evidence of STEMI undergoing thrombolytic therapy.

ECG criteria for diagnosis of STEMI: New ST-elevation at the J-point in two contiguous leads with the cut point ≥1 mm in all leads except leads v_2 and v_3 where the cut-points are: ≥2mm in men ≥40 years and ≥2.5 mm in men < 40 years, or ≥1.5 mm in women regardless of age[6].

Exclusion criteria: Recurrent STEMI and Presence of left bundle branch block.

Criteria for successful thrombolysis: Electrocardiographically:- ≥50% ST-segment resolution in a lead which show maximum ST elevation initially.

Data Collection and analysis: The data was collected from all eligible patients after taking written consent. A detailed clinical history, complete physical examination, routine investigation and ECG on admission and after 90 minutes of completion of thrombolytic therapy were noted.

A detailed standard statistical analysis by "Pearson's Chi-squared test" was be carried out at the end of study to conclude the results.

Observations and Results

A total of 100 patients are studied out of which 75 are males (75%) and 25 females (25%). The mean age of patients is 57 years (range from 32 to 82 years). Overall success rate of thrombolysis is 57%. The outcome of thrombolysis in sex and age group wise is shown in Table 1. The success rate is higher in younger age (Age ≤40 years) group than elderly but statistically it is not significant with χ^2=0.6528 and p value >0.05. The successful thrombolysis is seen in 57% of males and 56% of females but statistically it is not significant with χ^2=0.0136 and p value >0.05. Comparison of window (time) period, location of MI and hemodynamic killip class with outcome of thrombolysis is shown in Table 2. Those patients who received thrombolytic therapy within 0-3 hours have highest success rate (75%) than those who received it later with statistically significant values (χ^2=9.5122 and p value <0.05). Inferior wall infarction shows higher (72.5%) success rate compared to other location MI, values are statistically significant with χ^2=9.5437 and p < 0.05. Patients with killip class-1 have higher (64%) success rate compared to killip class-2, 3 and 4 with a statistically significant values (χ^2=6.3658 and p <0.05). The presence of risk factors and outcome of thrombolysis are shown in Table 3. 52 patients are smokers (52%), 17 are hypertensive (17%), 7 are diabetic (7%) and 13 patients experienced pre-infarction angina (13%). These factors (pre-infarction angina, diabetes, smoking and hypertension) did not affect thrombolysis outcome significantly (P>0.05).

Table 1 — *Outcome of thrombolysis in different age groups and sex*

Age/Sex	Number of Patient	Success	Failure	Chi square (χ^2) test and P value
Age ≤40 years	17	11 (65%)	6 (35%)	χ^2=0.6528, P= 0.88 Not significant
Age 41-60 years	60	33 (55%)	27 (45%)	
Age 61-70 years	17	10 (59%)	7 (41%)	
Age ≥70 years	6	3 (50%)	3 (50%)	
Male	75	43 (57%)	32 (43%)	χ^2=0.0136, P= 0.91 Not significant
Female	25	14 (56%)	11 (44%)	

Table 2 — *Comparision of time window period, location of MI and killip class with outcome of thrombolysis*

Window period :	Number of Patient	Success	Failure	Chi square (χ^2) test and P value
0–3 hour	20	15 (75%)	5 (25%)	χ^2=9.5122, P= 0.0232 Significant
4–6 hour	28	18 (64%)	10 (36%)	
7-9 hour	25	15 (60%)	10 (40%)	
10–12 hour	27	9 (33%)	18 (67%)	
AWMI	48	25 (52%)	23 (48%)	χ^2=9.5437, P= 0.048 Significant
IWMI	40	29 (72.5%)	11 (27.5%)	
ALWMI	5	1 (20%)	4 (80%)	
IPWMI	4	1 (25%)	3 (75%)	
LWMI	3	1 (33%)	2 (67%)	
Killip class-1	84	54 (64%)	30 (36%)	χ^2=6.3658, P= 0.0414 Significant
Killip class-2	10	3 (30%)	7 (70%)	
Killip class-3	4	1 (25%)	3 (75%)	
Killip class-4	2	0 (0%)	2 (100%)	

Table 3 — *Effect of various risk factors on outcome of thrombolysis*

Risk Factor	Number of Patient	Success	Failure	Chi square (χ^2) test and P value
Pre-infarction angina (PIA)	13	7 (54%)	6 (46%)	χ^2=0.0606, P= 0.80
No PIA	87	50 (57.5%)	37 (42.5%)	Not significant
Smokers	52	32 (61.5%)	20 (38.5%)	χ^2=0.9104 , P= 0.34
Non-smoker	48	25 (52%)	23 (48%)	Not significant
Hypertensive	17	10 (59%)	7 (41%)	χ^2=0.0278 , P= 0.87
Non-hypertensive	83	47 (57%)	36 (43%)	Not significant
Diabetic	7	3 (43%)	4 (57%)	χ^2=0.6143, P= 0.43
Non-diabetic	93	54 (58%)	39 (42%)	Not significant

Discussion

In this study, the overall success rate of thrombolysis with streptokinase is 57%, based on ECG criteria. Our results are almost similar as obtained by Girish Ronad *et al.*[7] and Abhishek Chaudhary *et al.*[8] where overall success rate of thrombolysis with streptokinase was 61.9% and 64% respectively. In our study success rate is high in comparison to a study done by Lee YY *et al.*[9] where it was 43.2%.

In this study, patients with age ≤40 years achieved higher (65%) success rate compared to higher age groups but statistically it is not significant. In our study, statistically significant difference is not found based on the gender.

In present study, patients with inferior wall infarction are found to have higher (72.5%) success rate compared to other MI. Our results are in concordance with study done by Girish Ronad *et al.*[7] and Lee YY *et al*[9]. The reason for this differential response is evident as we look into the physiology of coronary circulation in the left coronary arteries. Blood flow in the right coronary artery is relatively independent of the phase of cardiac cycle being present in both systole and diastole. Whereas flow in the left coronary artery is almost absent during systole and may even be reversed in conditions of heightened micro-vascular tone and left ventricular hypertrophy[10]. Gibson, Murphy and Braunwald *et al.* (TIMI subgroup) found that TIMI grade III flow rates were lower for left coronary and circumflex artery (LAD and LCx) compared to right coronary artery after thrombolytic therapy[11].

In this study, success rate is higher (75%) in patients who were thrombolysed early (within 3 hours from the onset of symptoms) than presenting later. Our results are in concordance with Girish Ronad *et al.* (7) who concluded that those presenting within 0-4 hours of symptoms onset had higher success rate compared to those presenting later (P < 0.01). Our results are also in concordance with study done by Lee YY *et al.*[9] in which a longer door-to-needle time was significantly associated with failure of thromboolysis using streptokinase (PP%0.02). The study of S.S. Iyengar, T. Nair *et al.*[12] has shown that delayed administration of tenecteplase (>6 hours of onset of symptoms) gives lower success rates (85.38%; P < 0.0001), as against those patients who received tenecteplase within 3 hours of onset of symptoms (96.54%; P P% 0.006).

In our study, killip class has significantly affected the outcome of thrombolysis indicating that higher the killip class, higher will be the failure rate. The results are in concordance with Girish Ronad *et al.*[7] who concluded that patients with higher killip class had high failure rate (p < 0.05). Our results are also in concordance with study done by S.S. Iyengar, T. Nair *et al.* (12) which showed that patients with killip class 1 & 2 had a higher thrombolysis success rate with tenecteplase than killip class 3 & 4.

In this study, there is no significant difference in outcome of thrombolysis among groups with or without pre-infarction angina (P >0.05). Felicita Andreotti, Vincenzo Pasceri, Attilio Maseri *et al.*[13] in there study observed that patients with AMI who have intermittent infarct related pain or unstable angina in the seven days preceding the infarction have faster coronary artery perfusion and smaller infarcts after thrombolytic therapy (t-PA) than patients without pre-infarction angina. In our study thrombolytic agent used is streptokinase, t-PA is a better thrombolytic agent as has been shown in various studies. Moreover we observed only 90 minutes ECG and have not correlated it angiographically to demonstrate TIMI flow which is definitely a better assessor.

In present study, there is no significant difference in outcome of thrombolysis in relation to history of hypertension (P >0.05). Lee YY *et al.*[9] reported that the success rate of thrombolysis is lesser in hypertensive patients (33.8%) than normotensive (48.8%) but statistically it is not significant. In our study success rate of thrombolysis is almost equal in hypertensive versus normotensive patients (59% v/s 57% respectively). The possible reason for this difference could be because of more number of hypertensive cases in their cohort (37%) while in our study it is only 17%.

In our study, smokers shows higher success rate

than non-smokers (61.5% v/s 52%) but is statistically insignificant. The possible reasons attributed by them were that they were of relatively younger age, without diabetes and hypertension and more often consuming alcohol.

In present study, the success rate of thrombolysis is lesser in diabetic patients than non-diabetic patients (57% v/s 42%) but statistically it is not significant. Our results are concordance with Lee YY *et al.*[9] where 64.9% of the diabetic patients did not achieve successful thrombolysis using streptokinase with three times risk of failure in compare to non-diabetic.

Limitation of Study :

There are few limitations of our study:

- The criteria for successful thrombolysis is based solely on ECG, and achievement of TIMI grade flow is not confirmed with coronary angiography, which is the gold standard.
- We have used streptokinase instead of recombinant tissue-type plasminogen activator (t-PA) because it is cheap and easily available in our setting.
- Pre and post thrombolysis echocardiography and further follow up was not done in any patients.

Conclusion

The effect and correlation of various factors which influence the outcome of thrombolysis in acute STEMI in the present study are:

- The overall success rate of thrombolysis is 57%.
- Time window period significantly ($P<0.05$) influence the outcome of thrombolysis as those with short window period have a better success rate.
- Killip class significantly ($P<0.05$) affects outcome of thrombolysis as failure rate is more with higher killip class.
- Inferior wall myocardial infarction has statistically significant better success rate than anterior wall myocardial infarctions and lateral wall infarction or in combination.
- Age and gender are not found to influence the success rate of thrombolysis.
- Pre-infarction angina has statistically insignificant effect on the success rate of thrombolysis.
- Smokers have a better success rate than non smokers but it is statistically insignificant.
- There is no difference in the success rate between hypertensives and normotensive patients.
- Non-diabetic patients have better success rate than diabetic patients but it is statistically insignificant.

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Conflict of Interest : None

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