

Assessment of ST Segment Resolution as a Predictor of Outcome in Acute Myocardial Infarction after Thrombolysis

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ABSTRACT

Introduction: Coronary heart disease (CHD) is a major cause of mortality and morbidity all over the world. This study was undertaken to assess the resolution of ST segment at 90 min of thrombolysis in ST segment elevation myocardial infarction as a predictor of short term outcome in terms of adverse events and mortality during hospital stay.

Material and methods: A total of 100 patients with first episode of ST elevation myocardial infarction without any conventional contraindication for thrombolysis were taken for the study. % of ST segment resolution after 90 min of thrombolysis was calculated and correlation with vital parameters like Killip class, ejection fraction, incidence of arrhythmias, prognosis in the patients with acute Myocardial Infarction.

Results: Out of 100 patients who were thrombolysed, 30% had failed thrombolysis. Patient who presented within 6 hours of chest pain had 7.7% failed thrombolysis which was significantly lower than patients who presented >6 hrs of chest pain with 44.5% failure rate, p value 0.0002. Failure of thrombolysis was higher in Diabetic patient (p value= 0.02) and hypertensive patient (p value= <0.0001). Risk factors like diabetes, hypertension significantly affect the outcome of thrombolysis. Mortality was seen in 10 patients, 80% had failed thrombolysis, p value< 0.001.

Conclusion: Patients with No resolution of ST segment at 90 min of thrombolysis had frequent adverse events and higher mortality when compared to patients with partial and complete ST segment resolution.

Keywords: Acute Coronary Syndrome (CAD), ECG, ST Segment Elevation MI, ST Segment Resolution, Thrombolysis.

INTRODUCTION

According to a report of World Health Organization (WHO) in 2005, cardiovascular disease (CVD) caused 17.5 million (30%) of the 58 million deaths that occurred worldwide.¹ While the prevalence and mortality due to CHD is declining in the developed nations.²

Current estimates from epidemiologic studies from various parts of the country indicate a prevalence of CHD to be between 7% and 13% in urban³⁻⁵ and 2% and 7% in rural^{6,7} populations. A study by Gajalakshmi et al during 1995–1997 showed that CVD deaths are the highest (38.6%) in urban Chennai.⁸ Similar data are published by Joshi et al from Andhra Pradesh.⁹ The Global Burden of Diseases Study reported that the disability-adjusted life years lost by CHD in India during 1990 was 5.6 million in men and 4.5 million in women; the projected figures for 2020 were 14.4 million and 7.7 million in men and women respectively.¹⁰

Acute myocardial infarction is one of the most common diagnoses in hospitalised patients in industrialized countries.¹¹ Despite the impressive strides in diagnosis and management over the past three decades, acute myocardial infarction continues to be a major health problem in industrialized world and is becoming and increasingly important problem in developing countries.¹²

The thrombolytic therapy is the main mode of reperfusion in developing countries like India.¹³

The present study is aimed at defining the extent of failed thrombolysis and assessing its demographic and clinical predictors in our hospital. Though the study was done some years back the demographic and clinical picture are still the same, hence the results are much relevant.

The acute coronary syndromes include unstable angina, ST segment elevation myocardial infarction (STEMI), non-ST segment elevation myocardial infarction (NSTEMI).¹⁴

Characteristic ST segment elevation in the 12-lead electrocardiogram (ECG) accompanied by clinical symptoms of chest pain provide the most rapid way to diagnose those patients who should receive thrombolysis to help dissolve thrombus and restore blood flow. Thrombolysis has been the cornerstone of treatment for patients having STEMI by improving outcomes and preserving left ventricular function¹⁵ Analysis of ST segment resolution on ECG, after fibrinolytic therapy, in cases of STEMI offers an attractive and cost-effective solution to assess coronary reperfusion.¹⁶ Patients with AMI experience sudden cardiac death due to ventricular tachycardia and fibrillation (VT/VF). These complications occur more in patients with failed thrombolysis in STEMI. ST segment changes reflect myocardial rather than epicardial flow and hence yield prognostic information beyond that provided by coronary angiogram alone.¹⁷ For this reason an attempt has been made in this study to determine the failure rate of thrombolysis in Acute Myocardial Infarction using

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ECG criteria.

MATERIAL AND METHODS

100 cases of acute ST elevation Myocardial infarction were taken for the study admitted between March 2015 to May 2016. Patients were taken from ICCU of department of medicine S.S. Medical College and S.G.M. Hospital Rewa (M.P.).

Selection criteria

Inclusion criteria

1. Symptoms of acute myocardial infarction within 6 h of onset of chest pain
2. STEMI, is defined as new ST elevation at the J point in at least 2 contiguous leads of ≥ 2 mm (0.2 mV) or more in men > 45 years or ≥ 0.25 mV in men < 45 years or ≥ 1.5 mm (0.15 mV) in women in leads V2-V3 and/or 1 mm (0.1 mV) or more in other contiguous limb leads
3. Age ≥ 18 years.

Exclusion Criteria

1. Late thrombolysis (> 12 hrs from onset of pain)
2. Recurrent MI
3. Presence of left bundle branch block
4. Development of pericarditis
5. Age < 18 years
6. Patients with conventional contraindications for thrombolytic therapy.
7. Patients with previous history of valvular heart disease, cardiomyopathy and congenital heart disease.
8. If patient dies before 90 minutes after thrombolytic therapy
9. Other causes of ST segment elevation.

In patients with acute MI after considering inclusion and exclusion criteria, history and clinical examination done.

Baselineserial ECG at 1hr, 2 hr and other investigations (RBS, Lipid Profile, RFT, cardiac enzymes- troponin T, CBC) were done.

Patients are assigned to successful/ failed thrombolysis is based on ECG taken 90 minutes after thrombolysis. Failed thrombolysis is considered if there is less than 50% ST segment resolution in the single lead showing maximum ST segment at baseline ECG.

STATISTICAL ANALYSIS

Continuous data were expressed as mean \pm SD and median and analyzed by unpaired t test. Categorical data are presented as numbers and percentages, were analyzed by chi-square test.

p value of 0.05 or less was considered as statistically significant.

RESULTS

Above table reveals that among males, maximum patients were in the age group 51-60 yrs followed by 41- 50 yrs. Among females, maximum patients were in the age group 61 – 70 yrs, followed by 51 – 60 yrs (table-1, figure-1).

Table-2 shows that out of 79 males, 54 (77.14%) had successful thrombolysis and 25(83.3%) had failed

thrombolysis. Out of 21 females, 16 (22.8%) had successful thrombolysis and 5 (16.67%) had failed thrombolysis.

Table-3 shows that patients who were thrombolysed within 6 hrshad 7.7% failed thrombolysis as compared to patients who were thrombolysed > 6 hrs who had 44.3% failed thrombolysis.

Table-4 shows that 57 patients were AWTMI, 40 were having IWMI, 3 were having LWMI.

Age Groups (years)	Males	%	Females	%	Total
21-30	1	1.2	1	4.7	1
31-40	4	5.0	1	4.7	5
41-50	19	24	3	14.2	21
51-60	29	36.7	4	19	33
61-70	15	18.9	8	38	23
71-80	8	10.1	3	19	12
> 80	3	3.7	1	4.7	4
Total	79		21		100

$\chi^2 = 6.237$, P value 0.3972

Table-1: Distribution of cases according to Age

Sex	Successful thrombolysis (70)	Failed thrombolysis (30)
Male	54(77.14%)	25(83.3%)
Female	16(22.8%)	5(16.67%)

P value= 0.6682 (non significant)

Table-2: Sex distribution

	Successful thrombolysis (n=70)	Failed thrombolysis (n=30)	No.	%
	No.	%		
Time to thrombolysed < 6 hrs	36	92.3	3	7.7
Time to thrombolysed > 6 hrs	34	55.7	27	44.3

$\chi^2 = 13.459$, P value 0.0002 (highly significant)

Table-3: Thrombolysis in relation to time of onset of MI (n=100)

	Successful thrombolysis (n=70)		Failed Thrombolysis (n=30)	
	No.	%	No.	%
Survivors	68	75.5%	22	24.5%
Mortality	2	20%	8	80%

$\chi^2 = 10.714$, P value 0.0011(significant)

Table-5: Mortality in failed thrombolysis

Killips class	No. of Cases	Percentage
I	82	82%
II	12	12%
III	02	2%
IV	03	3%
Total	100	100.0

Table-6: Distribution According to Killip's Class

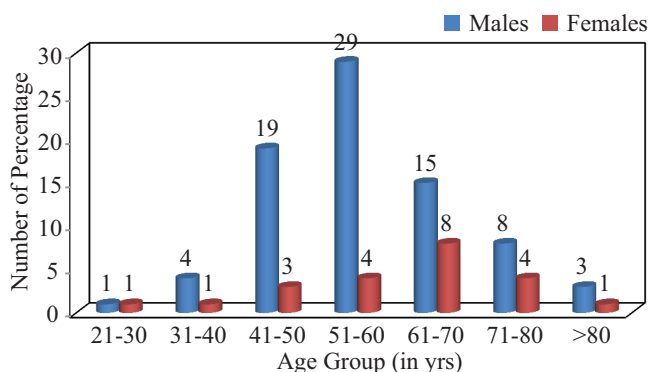


Figure-1: Distribution of cases according to Age and sex

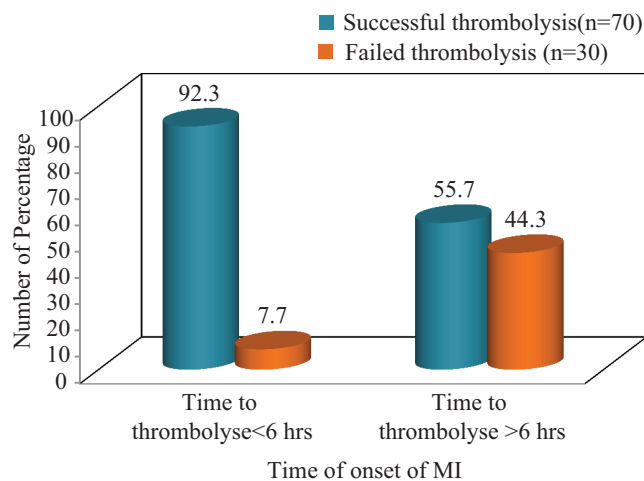


Figure-2: Thrombolysis in relation to time of onset of MI

Type of arrhythmia	Successful thrombolysis (70)		Failed thrombolysis (30)	
	No.	%	No.	%
VPCs	10	14.2%	3	10%
AIVR	14	20%	3	10%
AF	1	1.4%	-	-
VT	2	2.8%	3	10%
Sinus bradycardia	5	7.1%	1	3.3%
AV BLOCK	1	1.4%	1	3.3%
BBB	3	4.2%	1	3.3%
CHB	1	1.4%	-	-

Table-7: Arrhythmias in acute STEMI patients (n=100)

Table-5 shows that among patients who survived, 75.5% had successful thrombolysis and 24.5% had failed thrombolysis. Among patients who died after thrombolysis, 20% had successful thrombolysis and 80% had failed thrombolysis Table-6 shows that 82% were having Killips class I, 12% were having Killips class II, 2% were having Killips class III, 3% were having Killips class IV. Table-7 shows that among successfully thrombolysed patients, 14,2% had VPCs, 20% had AIVR, 1.4% had AF, 2.8% had VT, 7.1% had sinus bradycardia,1.4% had AV Block, 4.2% had RBBB and 1.4% had CHB. Among failed thrombolysed patients, 10% had VPCs, 10% had AIVR, 10% had VT, 3.3% had sinus bradycardia, 3.3% had AV Block.

DISCUSSION

This study entitled “ST segment resolution after thrombolysis in acute myocardial infarction – as predictor of outcome” carried out on 100 patients admitted in ICCU of Department of Medicine, S.S. Medical College and S.G.M. Hospital, Rewa from March 2015 to May 2016.

We have studied the extent of failed thrombolysis and successful thrombolysis. It depends on the ECG criteria used for failed thrombolysis, drug used and inclusion and exclusion criteria used in a particular study.

In present study failed thrombolysis was observed in 30% patients using $\leq 50\%$ maximum ST segment resolution at 90 min post thrombolysis as criteria.

Purcell et al (1997)¹⁸ who used 120min ECG post thrombolysis with streptokinase and Katyal et al (2003)¹⁹ who used $< 30\%$ at 90min as criteria observed 34% failed thrombolysis.

Age and sex distribution

In the present study, maximum incidence of MI was in the age group 51-60 years. Mean age in failed group was 61.76 ± 16.60 yrs and 57.45 ± 13.72 yrs in successful group. Though higher age was associated with failed thrombolysis it was statistically significant.

Gabriel et al (1990).²⁰ But Sezer et al(2004)²¹, Shah et al (2004)²² observed higher age in successful group. Among males, mean age was significantly higher in group with failed thrombolysis (62.24 ± 17.7371) p value < 0.0001 whereas in females, it was significantly higher in group with successful thrombolysis (62.87 ± 20.4678) p value < 0.0001 .

In the present study, among females, higher percentage of females were in the age group 61-70 years i.e. in the post menopausal age group as compared to premenopausal women

Diabetes is one of the important risk factors for CHD. Only 22% were diabetic patients in the present study. 54.5% of the diabetic patients did not achieve successful thrombolysis as compared to non-diabetic in whom failure was seen in 25.7% (p=0.02). Angeja et al (2002),²³ showed similar significant association of diabetes with failed thrombolysis.

Hypertension was seen in 90.4% of patients with failed and 9.5% of patients with successful thrombolysis which was significant, as shown in the Framingham study(1994).²⁵

This is in concordance with the observation of Lee et al (2008), who reported failure in 66.2% of patients with hypertension in comparison to 51.2% in normotensive patients.²⁶

In the present study, among patients with dyslipidemia, 62.3% and 37.7% had successful and failed thrombolysis respectively.

In present study, among smokers, 66.6% and 33.4% of patients have successful and failed thrombolysis. Sezer et al. (2004)²⁶ showed that smoking was significantly associated with successful thrombolysis and lower.

Time of maximum chest pain

Out of 100 patients in this study, 40% patients have maximum chest pain 12:00AM to 6:00 AM, 35% have chest pain was

during 6:01 AM to 12:00 Noon.

Time from onset of symptoms to thrombolysis

In the present study, 39 patients came to hospital within 6 hours from the onset of chest pain, out of which 36 (92.3%) patients have successful thrombolysis and 3 (7.7%) have failed thrombolysis. 61 patients came to hospital after 6 hours, out of which 34 (55.7%) patients were successfully thrombolysed and 27 (44.3%) patients have failed thrombolysis, p value 0.0002.

Keeley et al.(2003) 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.²⁷

Thrombolytic agent

In the present study, 91 patients were thrombolysed with Streptokinase, 4 with Urokinase and 5 with Tenecteplase. Among the patients who were thrombolysed with streptokinase 33.70% have failed thrombolysis p value 0.0934. All the patients who were thrombolysed with tenecteplase and urokinase have successful thrombolysis. Lee et al (2008),²⁸ showed streptokinase had a failure rate (56.8%)

Site of MI

57 patients had AAMI and 40 had IWMI. Among successful thrombolysis (70) group, 64.9% (38 patients) had AAMI and 44.2% (31 patients) had IWMI. Among failed thrombolysis, 63.3% (19 patients) had AAMI and 30% (9 patients) had IWMI.

In a similar study done by Jose et al²⁹(2004), over 1320 patients anterior wall infarction was present in 752 patients (57%), 517 (39.1%) patients had inferior wall infarction and 51 (3.9%) patients had antero-inferior infarction.

Killips class at presentation

Mean Killips class in successfully thrombolysed patients was 1.231 ± 0.5835 and failed group was 1.46 ± 0.9685 . In this study, there is 10% (10 patients) mortality in which Mean Killips class was 1.7 ± 1.3375 .

In AAMI patients, Mean Killips class was 1.263 ± 0.554 and 1.473 ± 1.0173 in successfully and failed thrombolysis patients. There was 10.5% (6 patients) mortality who had Mean Killips class 1.66 ± 1.3784

In IWMI patients, Mean Killips class was 1.0833 ± 0.3586 and 1 ± 0.3333 in successfully and failed thrombolysis patients. There was 10% (4 patients) mortality who had Mean Killip class 2 ± 1.4121 .

Arrhythmia in MI

In the present study, among 100 patients 14% had VPCs, 17% had AIVR, 6% had Sinus Bradycardia, 4% had RBBB, 5% had VT, 1% had AF.

Ventricular tachycardia was in 5% of the patients.

Accelerated idioventricular rhythm was present in 17% of the patients whereas according to Libby and Wagner (2007), it is seen in up to 20% of the patients.³⁰

CONCLUSION

The present study on the ST segment resolution after 90 min

of thrombolysis conveys useful

information regarding the outcome of patient with acute STEMI. Our study showed that patient with complete ST segment resolution (>70%) had a lesser adverse events and mortality whereas patients with no ST segment resolution (<30%) were associated with more frequent adverse events and mortality.

On the basis of our study, early and complete ST segment resolution predicts reperfusion of the ischemic myocardial tissue and its salvage. Early recognition and timely thrombolysis with appropriate agent predicts early reperfusion and will help in decreasing significantly the increased morbidity and mortality that is prevalent today because of acute myocardial infarction. Hence, ECG taken one at admission and second ECG after 90 min of thrombolysis is a simple, noninvasive and early marker of prognosis. It can be used in all patients at any hospital, including rural hospitals with limited infrastructure. It would guide for timely triage of patients to appropriate therapeutic intervention.

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