Original Article
MVP Journal of Medical Sciences, *Vol 9(1), 24-29, January-June 2022*
ISSN (Print) : 2348–263X
ISSN (Online) : 2348-2648
DOI: 10.18311/mvpjms/2022/v9i1/294

Comparative Outcome Study between Resolved and Unresolved St Segment in St Segment Elevation Acutemyocardial Infarction (STEMI) after Thrombolytic Therapy

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Abstract

Background: To study the comparative outcome between resolved an unresolved ST segment in ST Segment Elevation Acute Myocardial Infarction (STEMI), after thrombolytic therapy. **Method:** A study was carried out on patients admitted with 1st episode of ST elevated myocardial infarction in MICU of a tertiary health care center of a teaching hospital. On admission detailed history was taken and a complete clinical examination was done. Thrombolysis was done using streptokinase, 2D ECHOs were performed before and after thrombolytic therapy. **Result:** Most of the study population in both the group (Unresolved STEMI and Successful thrombolysis), belonged to the age group of 41 to 50 years. Co-morbidities like hypertension were present in 83% of Unresolved STEMI and 53% of Resolved STEMI. Comorbidities like diabetes were present in 66.7% of Unresolved STEMI and 52.6% of Resolved STEMI. RWMA on 2D-Echo before thrombolysis was present in 58.3% of Unresolved STEMI and 47.4% of Resolved STEMI. RWMA on 2D-Echo after thrombolysis was present in 66.7% of Unresolved STEMI and 18.5% of Resolved STEMI. **Conclusion:** Symptom to needle time is an important predictor of whether thrombolysis will be successful or not in acute myocardial infarction patients. Hence it is important to educate the public about prompt recognition of symptoms and seeking medical help urgently. As the rate of unsuccessful thrombolysis is higher in patients with old age, diabetes, hypertension and dyslipidemia, such patients should be monitored and treated aggressively.

Keywords: Diabetes, Hypertension, RWMA - Regional Wall Motion Abnormalities, STEMI - ST Segment Elevation Myocardial Infarction, Thrombolysis

1. Introduction

Coronary Heart Disease (CHD) is a major cause of mortality and morbidity all over the world. 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 developed nations[2], the same cannot be held true for developing countries.

There has been an alarming increase over the past two decades in the prevalence of CHD and cardiovascular mortality in India and other south Asian countries. India is going through an epidemiologic transition whereby the burden of communicable diseases have declined slowly, but that of Non-Communicable Diseases (NCD) has risen rapidly, thus leading to a dual burden. There has been a 4-fold rise of CHD prevalence in India during the past 40 years.

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Current estimates from epidemiologic studies from various parts of the country indicate a prevalence of CHD to be between 7% and 13% in urban[3–5] and 2% and 7% in rural populations[6,7]. Epidemiologic studies have shown that there are at present over 30 million cases of CHD in this country. 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[8].

Acute myocardial infarction is one of the most common diagnosis in hospitalized patients in industrialized countries[9]. 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 an increasingly important problem in developing countries[10].

Because acute myocardial infarction strikes an individual during the most productive years, it can have profoundly deleterious psychological and economic ramifications[11]. The unequivocal demonstration of role of the thrombus in acute myocardial infarction quickly led to the systematic testing of thrombolytic strategies to abort myocardial infarctions[12]. Thrombolytic therapy is the main mode of reperfusion in developing countries like India[13].

The acute coronary syndromes include unstable angina, ST segment Elevation Myocardial Infarction (STEMI), Non-ST Segment Elevation Myocardial Infarction (NSTEMI)[14].

ST-segment elevation appears in ECG due to, transmural involvement of the myocardium, that is full thickness damage of the cardiac muscle. Therefore, STEMI is more severe type of myocardial infarction compared to NSTEMI (Non-ST Segment Elevation Myocardial Infarction) in which myocardium is partially damaged. 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 suffering from STEMI by improving outcomes and preserving left ventricular function[15]. 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]. Although successful recanalization of the epicardial vessel is a necessary condition, it is the microvascular flow that most strongly correlates with outcome. 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 ECG criteria.

Although 60 to 70% of treated patients can be successfully re-perfused, thrombolytic treatment fails in a substantial proportion. These non-responsive patients can have a significant high mortality and morbidity. Since alternative modes of coronary intervention are available, it is prudent to identify patients with failed thrombolysis so that they can be offered alternative modes of reperfusion[18]. 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 carried out in the past, demographic data and clinical picture were found to be similar hence the results are much more relevant as per trends of the current day and age.

2. Aims and Objectives

- To study the clinical profile of patients with first episode of ST elevated acute myocardial infarction.
- To study the changes in conventional 12 lead Electrocardiograms during acute myocardial infarction before and after 90 minutes of thrombolytic therapy.
- To study the extent of myocardial salvage after thrombolysis in patients of acute myocardial infarction by 2D Echo.

3. Materials and Methods

This prospective observational study was carried out on patients admitted with 1st episode of ST elevated myocardial infarction in MICU of a tertiary health care centre of a teaching hospital. Institutional ethics committee permission was taken.

3.1 Study Duration

August 2016 to December 2018.

3.2 Sample Size

Minimum sample size for this study is 91.

$n = Z^2 P(1-P)/e^2$

Z - Confidence interval

N - Sample size

e – Margin of error

3.3 Actual Sample Size Studied = 100 Patients

Those patients fulfilling the inclusion and exclusion criteria were included in the study. Only the patient giving valid informed consent was considered.

3.4 Eligibility Criteria

3.4.1 Inclusion Criteria

Patients of ≥18 years of age, belonging to either sexes, having 1st episode of ST Elevation Acute Myocardial Infarction (STEMI) presenting to healthcare facility within 12 hrs of onset of symptom.

[STEMI, is defined as new ST elevation at the J point in at least 2 contiguous leads of >2mm (0.2 mV) or more in men >45 years or >0.25mV 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]

3.4.2 Exclusion Criteria

- Patients coming after >12 hours after onset of pain.
- Patients with previous MI.
- Patients showing presence of left bundle branch block.
- Patient showing signs of pericarditis.
- Other contraindications of thrombolysis like bleeding disorder, previous history of hemorrhagic stroke, head trauma or brain surgery within last 6 months etc.

3.5 Methodology

- On admission detailed history was taken and a complete clinical examination was done.
- Thrombolysis was done using streptokinase.
- ECG, 2D ECHO was done before and after thrombolytic therapy.

4. Statistical Analysis

All the collected data was entered in Microsoft Excel sheet and then transferred to SPSS software ver. 17 for analysis. Qualitative data was presented as frequency and percentages and analyzed using chi-square test. P-value <0.05 was taken as level of significance.

5. Results

5.1 Demographic Profile

Table 1. Age group distribution amongst study population

Age group	TT		Total
	Unresolved STEMI	Resolved STEMI	
Less than 40 years	2 (8.30%)	3 (3.90%)	5 (5%)
41 to 50 years	10 (41.7%)	29 (38.1%)	39 (39%)
51 to 60 years	2 (8.30%)	16 (21.10%)	18 (18%)
More than 60 years	10 (41.7%)	28 (36.80%)	38 (38%)
Total	24 (100%)	76 (100%)	100 (100%)

As seen in the above Table 1, most of the study population in both the group (Unresolved STEMI and Successful thrombolysis), belongs to the age group of 41 to 50 years (41.70% vs, 36.80%) and more than 60 years (41.70% vs. 36.80%) and the difference was statistically insignificant.

Table 2. Hypertension amongst study population

Hypertension	TT		Total
	Unresolved STEMI	Resolved STEMI	
No	5(17%)	36(47%)	41(41%)
Yes	19(83%)	40(53%)	59(59%)
Total	24 (100%)	76 (100%)	100 (100%)

As seen in the above Table 2, Comorbidities like Hypertension was present in 83% of Unresolved STEMI and 53% of Resolved STEMI and the difference was statistically significant.

Table 3. Diabetes amongst study population

Diabetes	TT		Total
	Unresolved STEMI	Resolved STEMI	
No	8 (33.30%)	36 (47.40%)	44 (44%)
Yes	16 (66.70%)	40 (52.60%)	56 (56%)
Total	24 (100%)	76 (100%)	100 (100%)

As seen in the above Table (3), Comorbidities like Diabetes was present in 66.7% of Unresolved STEMI and 52.6% of Resolved STEMI and the difference was statistically significant.

Table 4. Time to thrombolysis amongst study population

Time to thrombolysis	TT		Total
	Unresolved STEMI	Resolved STEMI	
< 6 hrs	4 (16.7%)	54 (71.1%)	58 (58%)
> 6 hrs	20 (83.3%)	22 (28.9%)	42 (42%)
Total	24 (100%)	76 (100%)	100 (100%)

As seen in the above Table 4, >6 hrs of time to thrombolysis was present in 83.3% of Unresolved STEMI and 28.9% of Resolved STEMI and the difference was statistically significant.

Table 5. 2D-Echo RWMA before thrombolysis amongst study population

2D-Echo RWMA	TT		Total
	Unresolved STEMI	Resolved STEMI	
No	10 (41.7%)	40 (51.6%)	50 (50%)
Yes	14 (58.3%)	36 (47.4%)	50 (50%)
Total	24 (100%)	76 (100%)	100 (100%)

As seen in the above Table 5, RWMA on 2D-Echo before thrombolysis was present in 58.3% of Unresolved STEMI and 47.4% of Resolved STEMI and the difference was statistically insignificant.

Table 6. 2D-Echo RWMA after thrombolysis amongst study population

2D-Echo RWMA	TT		Total
	Unresolved STEMI	Resolved STEMI	
No	8 (33.3%)	62 (81.5%)	70 (70%)
Yes	16 (66.7%)	14 (18.5%)	30 (30%)
Total	24 (100%)	76 (100%)	100 (100%)

As seen in the above Table 6, RWMA on 2D-Echo after thrombolysis was present in 66.7% of Unresolved STEMI and 18.5% of Resolved STEMI and the difference was statistically significant.

6. Discussion

6.1 Age Group

In the present study, most of the study population in both the group (Unresolved STEMI and Resolved STEMI), belongs to the age group of 41 to 50 years (41.70% *vs.* 36.80%) and more than 60 years(41.70% *vs.* 36.80%) and the difference was statistically insignificant. Increasing age is considered the most significant risk factor for CAD. Individuals aged more than 45 years have an eight times greater risk for AMI[19]. The younger patients had a higher incidence of a family history of vascular disease, hypertriglyceridemia and smoking compared to middle-age and older patients, which is in agreement with previous reports on premature AMI in South Asian Indians[20,21].

6.2 Comorbidities

In the present study, Comorbidities like Hypertension was present in 83.3% of Unresolved STEMI and 52.6% of Resolved STEMI and the difference was statistically significant. A study conducted by Huma, 2006 showed hypertension as a risk factor[22]. Large international trials have shown that hypertension was an important predictor of mortality in the thrombolysis era, including GUSTO-I and GISSI-2 (1996)[23].

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. Possible reasons for the higher failure rate were poorly-controlled hypertension, high-risk nature of hypertension and possible accelerated atherosclerosis associated with endothelial dysfunction[24].

In the present study, Comorbidities like Diabetes were present in 41.7% of Unresolved STEMI and 52.6% of Resolved STEMI and the difference was statistically insignificant. GISSI-2 (1990)[25] and Angeja *et al.,* (2002)[26] showed similar significant association of diabetes with failed thrombolysis. Our observation is in concordance with that of Chowdhury (2008), who concluded from their study that reperfusion failed in 67.2% of diabetic patients with STEMI in comparison with 19.8% in non-diabetic group[27]. 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 ischemic pain. In addition, diabetic patients have a lower ejection fraction.

6.3 2D-Echo Findings

In the present study, RWMA on 2D-Echo before thrombolysis was present in 58.3% of Unresolved STEMI and 47.4% of Resolved STEMI and the difference was statistically insignificant. RWMA on 2D-Echo after thrombolysis was present in 66.7% of Unresolved STEMI and 18.5% of Resolved STEMI and the difference was statistically significant.

6.4 Time to Thrombolysis

In the present study, > 6 hrs of time to thrombolysis was present in 83.3% of Unresolved STEMI and 28.9% of Resolved STEMI and the difference was statistically significant. This observation is in concordance with Kharash (1996)[28] who concluded that shorter the time lag between onset of pain and treatment the better are the results. This study was not intended to look into the causes of longer symptom-to-needle time, but a search through the records had identified possible reasons which included inappropriate initial triage, delay in transport, missed initial diagnosis and delay in starting treatment.

As per Keeley *et al.,* (2003), late presentation is an important risk factor for unresolved STEMI in AMI. Persistence of chest pain and non-resolution of reciprocal ST depression are significantly associated with failed thrombolysis[29].

GISSI-2(1990)[30] showed significantly higher proportion of resolved STEMI in patients presenting within 3 hours. Shah *et al.,* (2000)[31] and Gabriel *et al.,* (1990)[32] did not show such association.

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How to cite this article: Kamthe S, Chafekar D, Chafekar N. Comparative Outcome Study between Resolved and Unresolved St Segment in St Segment Elevation Acutemyocardial Infarction (STEMI) after Thrombolytic Therapy. MVP J. Med. Sci. 2022; 9(1): 24-29.