



## ACUTE ST ELEVATION MYOCARDIAL INFARCTION; 70 % OR MORE ST SEGMENT RESOLUTION ON 90 MINUTES POST THROMBOLYSIS ELECTROCARDIOGRAM AS A PREDICTOR OF IN- HOSPITAL OUTCOMES

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**ABSTRACT... Objective:** To determine the frequency of in-hospital outcomes in patients of acute ST elevation myocardial infarction (STEMI) within five days of hospitalization with  $\geq 70$  ST segment resolution 90 minutes post thrombolysis. **Study Design:** Case series. **Place and Duration of Study:** Department of Cardiology, Faisalabad Institute of Cardiology, Faisalabad, from April, 2016 to October, 2016. **Methodology:** In 370 patients fulfilling the inclusion and exclusion criteria a baseline 12 lead electrocardiogram was recorded before initiation of thrombolysis and at 90 minutes thereafter. Conventional contraindications to thrombolysis were observed and streptokinase 1.5 mu was administered by intravenous infusion over 60 minutes. Successful thrombolysis was taken as 70% or more ST elevation resolution at 90 minutes from baseline electrocardiogram measured 80ms from J-point. Patients with successful thrombolysis were observed for in-hospital clinical outcomes of recurrent angina, congestive cardiac failure, ventricular arrhythmia and death within five days of hospitalization. **Results:** Out of 370 cases, 51.35 % (n=190) were male while 48.65 % (n=180) were female, 25.14 % (n=93) were between 30-50 years of age while 74.86 % (n=277) were between 51-65 years of age, the mean age was  $54.98 \pm 5.96$  years. Frequency of in-hospital outcome was recorded as 10.67 % (n=38) for congestive cardiac failure, 14.59 % (n=54) for ventricular arrhythmia, 5.40 % (n=20) for mortality while no case had recurrent angina. **Conclusion:** In-hospital outcome is better in patients of  $\geq 70\%$  ST resolution at 90 minutes post thrombolysis. This might assist in identification of low risk patients who can be discharged early and should not be considered for early invasive strategy.

**Key words:** Acute ST elevation myocardial infarction, 70% or more ST segment resolution, in-hospital outcome

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### INTRODUCTION

Worldwide, acute coronary syndrome (ACS), secondary to atherosclerotic disease of coronary arteries, is one of the major causes of mortality.<sup>1</sup> About half of these cases occur in Asia.<sup>2,3</sup> Acute ST-segment elevation myocardial infarction (STEMI) is a spectrum of symptoms resulting from myocardial ischemia due to coronary artery occlusion with characteristic up-sloping electrocardiographic ST segment elevation along with rise in markers of myocardial necrosis. Coronary artery occlusion is usually the result of rupture of vulnerable plaque causing platelet adhesion and activation with occlusive thrombus formation leading to infarction of the subjacent myocardium.<sup>4</sup> Acute STEMI, is the most important

form of ACS, accounting for 25%-40% of MI presentations with in-hospital mortality of 5%-6% in the developed countries.<sup>5</sup>

Pakistani population suffers from MI at relatively young age. A community study<sup>6</sup> from Pakistan reported a prevalence rate of 37/1000 of adults with 47% mortality from acute ST elevation myocardial infarction. People who survive MI, are at high risk of in hospital events like recurrent myocardial infarction, arrhythmias, congestive cardiac failure (CCF) and stroke.<sup>7</sup> Reperfusion therapy for myocardial infarction reduces morbidity as well as mortality.<sup>8,9</sup> It can be achieved through either thrombolysis or primary PCI. Thrombolysis is the most commonly used technique and streptokinase

is the usual agent in developing countries as it provides rapid, cheap and sustained restoration of normal blood flow in the infarct related artery and results in approximately 30% reduction in mortality.<sup>10</sup> However, in up to 60% of patients normal perfusion cannot be achieved.<sup>11</sup> Such incomplete restoration of perfusion however is associated with a bad prognosis.<sup>12</sup>

There are primarily two techniques to assess the myocardial reperfusion; coronary angiographic and electrocardiographic. Second one is easily available, non-invasive, simple and cheap. Coronary angiogram measures coronary blood flow and achievement of TIMI-III flow is a favorable sign.<sup>13</sup> Coronary blood flow does not provide information regarding myocardial reperfusion which is more related to prognosis.<sup>14,15</sup> ST segment resolution 90–180 minutes post thrombolysis has been associated with successful myocardial reperfusion.<sup>16</sup> Furthermore, ST segment resolution has been found to be correlated strongly with myocardial contrast echocardiography.<sup>20</sup> Degree of ST segment resolution following thrombolysis has also been associated with better survival and preservation of left ventricular function.<sup>17–19</sup>

In a study of 60 patients by Kumar MP<sup>20</sup> who were thrombolysed with streptokinase after acute STEMI, 41.7% had 70% or more ST segment resolution on 90 minutes post thrombolysis electrocardiograph (ECG). Out of these, recurrent angina developed in none, congestive cardiac failure in 12%, ventricular arrhythmia in 16% with a mortality rate of 4% only.

ST segment resolution after thrombolysis can be used to risk stratify the patients, however such simple bed side tool is often neglected even in developed countries.<sup>21</sup> Rationale of this study was that, if the patients of acute ST elevation myocardial infarction have 70% or more ST segment resolution on 90 minutes post thrombolysis, these patients may have better in-hospital outcomes and these cases should not be considered as candidates for early invasive strategy like rescue percutaneous angioplasty.

The objective of our study was to determine the

frequency of in-hospital outcomes in patients of acute ST elevation myocardial infarction who have 70% or more ST segment resolution on 90 minutes post thrombolysis electrocardiogram (ECG).

## OPERATIONAL DEFINITIONS

### ST-Elevation Myocardial Infarction

1. Typical chest pain at rest > 20 minutes duration
2. ST elevation at J point in at least 2 consecutive leads of  $\geq 2$ mm in men and  $\geq 1.5$  mm in women in leads V2-3 and/or of  $\geq 1$ mm in other consecutive chest leads or limb leads

### In-Hospital Outcomes

In terms of recurrent angina, cardiac failure, ventricular tachyarrhythmia and mortality within five days of hospitalization.

### Recurrent Angina

- Two or more episodes of chest pain occurring between ninety minutes to five days , post thrombolysis

### Cardiac Failure

- Failure of pumping of heart, causing difficulty in breathing due to congestion of lungs evident by crepitations on auscultation of lungs and fall in blood pressure to less than 90/60 mmHg.

### Ventricular Tachyarrhythmia

- Characterized by heart rate more than 100 beats per minute, with wide QRS complexes (more than 120 msec on ECG).

### Mortality

- Death of the patient occurring between ninety minutes to five days, post thrombolysis

## MATERIAL AND METHODS

### Setting and Duration of Study

Department of Cardiology, Faisalabad Institute of Cardiology, Faisalabad, from April, 2016 to October, 2016.

### Study Design

Descriptive case series

### Sample size

By using WHO sample size calculator:

$$P = 4\%.^6$$

Absolute precision required = 2%

Confidence level = 95%

Sample size = 370

### Sample Technique

Non-probability consecutive sampling.

### Inclusion Criteria

1. Age: 30-65 years
2. Sex: Either
3. Patients thrombolysed with streptokinase within 12 hrs of chest pain
4. Patients with 70% or more ST segment resolution on 90 minutes post thrombolysis ECG

### Exclusion Criteria

1. Patient with H/O documented cardiac failure
2. Patient with H/O documented ventricular tachyarrhythmia
3. Patients with contraindications to thrombolysis
4. Patients died before 90 minutes after thrombolysis
5. Patients with less than 70% ST segment resolution 90 minutes post thrombolysis ECG
6. Patients not willing for hospital admission
7. Patients having LBBB on ECG.

### DATA COLLECTION

After getting approval from ethical committee three hundred seventy (370) cases of acute ST segment elevation myocardial infarction with 70% or more ST segment settling, ninety minutes post thrombolysis, were selected for study through Emergency Department, Faisalabad Institute of Cardiology, Faisalabad.

After baseline ECG all patients received 300mg of chewable aspirin, 300mg clopidogrel and 5000 units of heparin by IV route followed by thrombolysis using 1.5 million units of streptokinase by IV infusion over 60 minutes after observing standard contraindications. 5 ml of blood was taken and sent to hospital lab for routine investigations including cardiac enzymes and troponin-I for each patient. Repeat ECG was recorded after

90 minutes and lead with maximal ST elevation used to evaluate ST segment resolution 80 msec from J point and compared with baseline ECG ST segment to evaluate for 70% or more ST segment resolution post thrombolysis as marker of effective thrombolysis. After written informed consent, patients with effective thrombolysis were selected and observed for recurrent angina, cardiac failure, ventricular tachyarrhythmia and mortality within five days of hospitalization through prescribed Performa.

### DATA ANALYSIS

Data was analyzed by SPSS-22.0 software. Quantitative variables like age, duration of chest pain were calculated by mean and standard deviation. Qualitative variables like gender, recurrent angina, cardiac failure, ventricular tachyarrhythmia and mortality were calculated by frequency and percentage. Effect modifiers like patient gender, age, and duration of chest pain were stratified to control their effect on outcome variables. Chi-square test was used for post stratification and P values of  $\leq 0.05$  were considered significant.

### RESULTS

This study of three hundred seventy (370) patients was done to determine the frequency of in-hospital outcomes in patients of acute STMI with 70% or more ST segment resolution on 90 minutes post thrombolysis ECG.

Regarding age distribution 25.14 % (n=93) of patients were between 30-50 years of age while 51-65 years of age constituted 74.86 % (n=277) patients, mean age was (54.98 $\pm$ 5.96 years). (Table No. I)

Regarding gender distribution 51.35 % (n=190) were male while 48.65 % (n=180) were female. (Table No. I)

Mean duration of chest pain was calculated as 5.61 $\pm$ 2.21 hours. (Table No. I)

Frequency of in-hospital outcome was recorded as 10.67 % (n=38) for congestive cardiac failure, 14.59 % (n=54) had ventricular arrhythmia,

mortality was 5.40 % (n=20) while no case found for recurrent angina. (Table No. II)

The effect modifiers like age, duration of chest

Variable	Frequency	Percentage
<b>Gender</b>		
Male	190	51.35%
Female	180	48.65%
<b>Total</b>	<b>370</b>	<b>100%</b>
<b>Age (in Years)</b>		
30-50	93	25.14%
51-60	277	74.86%
<b>Mean±sd</b>	<b>(54.98±5.96)</b>	
<b>Duration of chest pain (in hrs)</b>	<b>Mean</b>	<b>SD</b>
	5.61	2.21

**Table-I. Patients Characteristics**

pain and gender were stratified to control their effect on outcome variables. Chi-square test was used for post stratification and P values of  $\leq 0.05$  were considered significant. (Table No. III)

In hospital outcome	No. of patients	Percentage
Recurrent angina	0	0%
Congestive Cardiac failure	38	10.67%
Ventricular arrhythmia	54	14.59%
Mortality	20	5.40%

**Table-II. Frequency of in-hospital outcome**

In-Hospital Outcome		Gender		P-Value	Age(In Years)		P-Value	Duration of Chest Pain		P-Value
		Male	Female		30-50	51-65		1-6 hrs	7-12 hrs	
		Yes	-		-	-		-	-	
Yes	-	-	-	-	-	-	-	-		
Congestive Cardiac Failure	Yes	19	19	0.86	8	30	0.54	18	20	0.06
	No	171	161		85	247		208	124	
Ventricular Arrhythmia	Yes	27	27	0.83	17	37	0.24	30	24	0.36
	No	163	153		76	240		196	120	
Mortality	Yes	8	12	0.29	5	15	1.34	11	9	0.56
	No	182	168		88	262		215	135	

**Table-III. Stratification for frequency of in hospital outcome**

## DISCUSSION

After acute STEMI; myocardial and coronary microvascular reperfusion can be assessed using standard 12 lead ECG in a cost effective way by determination of ST resolution after thrombolytic therapy. ST resolution of 70% or more 90 minutes post thrombolysis is considered complete resolution and it correlates well with successful thrombolysis. Following reperfusion therapy outcome is related to restoration of myocardial reperfusion rather than to coronary blood flow on angiogram. Post thrombolytic complete ST resolution correlates well with myocardial and microvascular reperfusion and has been linked to prognosis and preservation of left ventricular function.<sup>22</sup> Degree of ST resolution can be used to categorize patients into low and high risk. This categorization can be used to make plan for early invasive strategy or for early discharge with further out-patient work up.

The objective of our study was that , if patients of acute ST elevation myocardial infarction have 70% or more ST segment resolution on 90 minutes post thrombolysis ECG, these patients may have better in-hospital outcome and such cases should not be considered as candidates for early invasive strategy like rescue percutaneous coronary intervention(PCI).

In present study none of our patients suffered recurrent angina during five days hospitalization which is similar to the observation by Kumar MP<sup>10</sup> study in which none of patients suffered from recurrent angina. In a study by Ioannis vogiatzis et al<sup>23</sup> recurrent angina was found in only 3.08% of the patients with complete ST resolution compared with 4.21% in those patients with no ST resolution after thrombolysis. Similarly results from a study done by Shuja-ur-Rehman and his colleagues<sup>24</sup> showed recurrent angina in 20%

patients with complete ST resolution compared with 59% with no resolution at 60 minutes post streptokinase (SK) thrombolization. Although the results in last two studies are different from our study but overall frequency of recurrent angina was less in patients with complete ST resolution compared with no resolution.

We found ventricular arrhythmia in 14.59% patients (n=54) with ST resolution. Similarly results from Kumar MP<sup>10</sup> study showed ventricular arrhythmia in 16% of patients. Shuja-ur-Rehman and colleagues<sup>24</sup> found arrhythmias in only 10% of the patients with ST resolution compared with 32% with no ST resolution. Similarly results in a study by Ioannis Vogiatzis et al<sup>23</sup> reported arrhythmias in 2.1% patients with persistent ST elevation in post SK ECG compared with only 1.5% of the patients with complete resolution. These results from above studies also show that arrhythmias are less common with complete ST resolution compared with no resolution.

The overall in-hospital mortality rate was 5.40% in our study. This rate is almost similar to a study done by Kumar MP<sup>10</sup> which reported a mortality rate of 4% in his study. Similarly, Ioannis Vogiatzis<sup>23</sup> et al found in-hospital mortality rate of 4% in their study. A similar study by de Lemos et al<sup>25</sup> reported mortality of 2.4% with complete ST resolution compared with 4.9% for partial resolution and 8.1% for no resolution (p <0.001). He defined post thrombolysis ST resolution as, complete =  $\geq 70\%$ , partial = 30 to <70% and no resolution = <30% when compared with baseline ECG ST segment.

Heart failure is one of the most common in-hospital complications after MI. In present study 10.67% patients (n=38) had congestive cardiac failure which is in agreement with the results from Kumar MP<sup>10</sup> who in his study reported an incidence of 12% for congestive cardiac failure. Shlomi Matetzky et al<sup>26</sup> reported incidence of left ventricular dysfunction and heart failure of 19% among patients with ST resolution compared with 28% among those without ST resolution. Baine KR et al<sup>27</sup> reported in their study that incidence of in-hospital congestive heart failure (CHF) and CHF/death rate is significantly lower in patients

with 70% or higher ST segment resolution. These studies also show a low incidence of in-hospital heart failure with complete ST resolution post thrombolysis.

Thus in patients with ST complete resolution over all frequency of in-hospital events is less compared with non-resolution. Complete ST resolution can be taken as a surrogate for tissue level perfusion. Such complete resolution 90 minutes after thrombolysis represents successful reperfusion at myocardial and micro-vascular level with excellent prognosis.

## CONCLUSION

Frequency of in-hospital outcomes is better in patients of acute ST elevation myocardial infarction (STEMI) with 70% or more ST segment resolution 90 minutes post thrombolysis. These cases should not be considered for early invasive strategy like rescue percutaneous coronary intervention (PCI).

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

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*The best things in life, aren't things.*

– Unknown –

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