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Original Research Article

ST SEGMENT RESOLUTION AFTER THROMBOLYSIS IN ACUTE MYOCARDIAL INFARCTION AS A PREDICTOR OF OUTCOME

Madhavi Kusuma[1], Satya Prasad Valluri[2], A.Gopal Rao[3], Kadali. Vinoda[4]

[1]*Associate Professor, Department of Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, India.*
[2]*Professor, Department of Medicine, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India.*
[3]*Associate Professor, Department of Medicine, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India.*
[4]*Assistant Professor, Department of Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, India.*

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Corresponding Author:
Dr. Kadali Vinoda
Assistant Professor, Department of Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, India.
Email: vinodakadali10@gmail.com.

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ABSTRACT

Background: Acute myocardial infarction is a major diagnosis in hospital admissions. It is a major affliction as it is linked to increased mortality in developed countries and is also becoming a foremost reason for mortality in developing countries. **Aim & Objective:** The objective of the current study is to examine the relationship between the ST- segment resolution and clinical consequences and acute complications and to determine whether ST- segment resolution can be used as a prognostic marker to assess the adverse outcomes following thrombolysis.

Materials and Methods: The current study is a _prospective study comprising a sample size of 100 patients who were admitted in the Department of Cardiology, Rangaraya Medical College, Kakinada, during the time period between December 2019 and August 2021.

Results: The _mean age of the population included in the study is 50.05 ± 9.4 years. Male to female ratio is 4:2 that depicts obvious male gender predominance. The usual presentation observed in 96%of individuals in the current study is chest pain succeeded by sweating and breathlessness. The most frequent risk factor observed in the current study is smoking followed in order by hypertension and diabetes respectively. Anterior wall MI represents 59% of the study population in contrast to the _Inferior wall MI which is 41.%. Patients were segregated into 3 categories in accordance with ST-segment resolution after 90minutes following thrombolytic therapy. Forty percent of patients comprised the group of >70% ST- segment resolution (Complete STR), forty-six percent of patients comprised the group of 30-70% ST- segment resolution (Partial STR and 14% patients comprised the group of <30% ST- segment resolution (No STR). Patients showing greater than 70% ST-segment resolution (Complete STR) is closely related to reduced adverse outcomes throughout the hospital stay and lower _in- patient mortality '. Patients showing less than 30% ST- segment resolution (No STR group) connected to increased adverse events and in-hospital mortality '. In-patient mortality is observed in 10% of patients. Cardiogenic shock is the most frequent reason for mortality in 80% patients accompanied by ventricular tachycardia(VT)/ ventricular fibrillation(VF) in 20% patients.

Conclusion: The present study concluded that, the percentage of ST-segment resolution 90 minutes subsequent to thrombolysis is a simple and non-invasive method and serves as a prognostic indicator of outcome that aids in risk stratification of patients.

Keywords: STEM, Thrombolysis, Tachycardia, Mortality, ECG, Myocardial infraction.

INTRODUCTION

Acute myocardial infarction is a major diagnosis in hospital admissions. It is a major affliction as it is linked to increased mortality in developed countries and is also becoming a foremost reason for mortality in developing countries. About half of the individuals affected with myocardial infarction attained mortality before reaching the hospital. Mortality in the developed nations had declined from 10% to 5% during last decade due to better treatment during the hospital stay.[1] In ST elevation myocardial infarction, the primary goal of treatment has been to restore normal blood flow in the blocked epicardial coronary artery as quickly as possible. Early and persistent patency of the occluded coronary artery is required, although this alone is not sufficient to assure a successful reperfusion treatment outcome. Therefore, the best treatment objective is reperfusion, which entails nutritional blood flow at the tissue level. In individuals with ST-elevation myocardial infarction(STEMI), thrombolytic therapy has been shown to have beneficial effects. If provided within time frame (within twelve hours of onset of clinical manifestations), there would be a time-dependent reduction in mortality and morbidity. The ST-segment resolution in STEMI following administration of thrombolytic has also been found to be a simple and non-invasive means of detecting reperfusion and is a useful predictor of LV functioning and clinical prognosis.

This study aims to consider the patients diagnosed as ST-elevation myocardial infarction (STEMI) and compare the findings of ECG prior and later thrombolysis, together with the result of thrombolytic therapy with regard to _morbidity‘ in addition to _mortality‘ throughout the admission period. Non-invasive signs of reperfusion include ST-segment resolution, improvement in or alleviation from chest pain and reperfusion arrhythmias (e.g., accelerated idioventricular rhythm). Chest pain resolution and biochemical markers were imprecise markers of resolution. The relief of chest discomfort was quite rapid and complete along with 70 percent ST segment resolution in the index lead (which showed the maximum degree of resolution during the initial presentation) is strongly suggestive of restoration of normal blood flow in a previously occluded vessel.[2] Therefore, resolution of ST-segment elevation is a simple, rapid and noninvasive, inexpensive indicator for appraising the effectiveness of reperfusion therapy but is inferior to the invasive assessment TIMI(Thrombolysis in Myocardial Infarction) staging in angiography.

These researchers found a substantial, stepwise connection between the degree of resolution of ST-segment at 180 mins and future mortality in a series of major fibrinolytic studies.[3,4]

The Hirulog Early Reperfusion/Occlusion-1 team found that patients with faster, consistent ST recovery had better infarct zone wall motion, regardless of TIMI flow grade, using continuous ST monitoring.

Aims and Objectives

1. The objective of the current study is to consider the ST-segment resolution 90 minutes following thrombolysis.
2. The objective of the current study is to examine the relationship between the ST- segment resolution and clinical consequences and acute complications and to determine whether ST-segment resolution can be used as a prognostic marker to assess the adverse outcomes following thrombolysis.

MATERIAL AND METHODS

Study design: Observational study

Place of study: Department of Cardiology, Rangaraya Medical College, Kakinada

Sample size: 100

Selection of subjects: Patients who were diagnosed as ―ST-segment elevation myocardial infarction (STEMI)‖ according to ACC/ AHA guidelines

Study Duration: December 2019 to August 2021

Study tools: Clinical examination that includes chief complaints, H/o present illness, past history, personal history, family history, general examination and systemic examination of cardiovascular system, respiratory system, gastrointestinal system, central nervous system.

A 12 lead ECG (Electrocardiography) consisting of twelve _conventional leads (and four_ right- sided leads whenever necessary)

Other investigations

- Haemoglobin
- Total Leucocyte Count
- _Differential count‘
- ESR
- Fasting Serum lipid profile
- FBS, PPBS wherever necessary
- B. urea
- S. Creatinine
- S. Electrolytes
- Troponin T or Troponin I
- 2D Echocardiography

Methodology

Serial ECGs are taken following thrombolysis at 0 mins, 30 mins, 60 mins, 90 mins and 120 mins in patients diagnosed with the acute STEMI (ST-segment elevation myocardial infarction). Patients will be categorized into 3 groups: Complete ST segment resolution group (>70% resolution following thrombolysis), partial resolution group (30% to 70% resolution following thrombolysis), no resolution group (<30% resolution following thrombolysis). Incidence of adverse events will be compared between the three study groups in order to find out the association between _ST-segment resolution‘ and efficacy of thrombolysis, therefore

to assess _ST- segment resolution‘ as a predictor of outcome.

Inclusion Criteria

All the patients diagnosed as STEMI according to ACC/AHA guidelines‖ after excluding the contradictions for thrombolysis who attend to ICCU within twelve hours of commencement of symptoms.

Exclusion Criteria

- Patients visiting ICCU after twelve hours of commencement of symptoms
- Patients with _contraindications ‘for thrombolytic therapy and who are not willing to receive thrombolysis.
- If patient is a known case of _valvular heart disease‘, _cardiomyopathies‘ as well as congenital heart disease.
- Any electrolyte disturbances.
- If death of the patient occurs within 90 mins following thrombolytic therapy.
- Any _bundle branch block‘.

Ethical issues

Prior approval from the institutional Ethics committee has been obtained. All the prerequisite permissions and requirements for the study had been obtained. Written informed consent will be obtained from the study subjects. The interviewees will be informed the details of the study and ensure confidentiality.

RESULTS

Table 1: Distribution of study subjects based on Age

Age group (years)	Number of cases	Percentage
20-40	20	20
41-60	70	70
61-80	10	10
TOTAL	100	100

Table 2: Distribution of Study subjects based on Gender

Gender	Number of cases	Percentage
Male	81	81.0
Female	19	19.0
TOTAL	100	100

Table 3: Distribution of Study subjects based on Age and Gender

Age group(years)	Males	Females	TOTAL
20-40	20 (100%)	0	20
41-60	54(77.1%)	16 (22.9%)	70
61-80	7(70%)	3(30%)	10
TOTAL	81	19	100

Table 4: Distribution of study subjects based on Clinical presentation

Symptoms	‘Number of cases’	‘Percentage’	P- value
Chest pain	96	96	Chi square value-251.2
Sweating	87	87	
Breathlessness	72	72	Df- 4
Palpitation	25	25	
Syncope	9	9	P value- <0.001

Table 5: Distribution of Study subjects based on _risk factors

‘Risk factors’	‘Number of cases’	Percentage
‘Smoking’	76	76
‘Hypertension’	49	49
‘Diabetes mellitus’	35	35
‘Past history of angina’	17	17
‘Family history’ of IHD	8	8

Table 6: Distribution of study subjects based on category of infarction

‘category of infarction’	‘Number of cases’	‘Percentage’
‘Anterior wall’	59	59
‘Inferior wall’	41	41

Table 7: Distribution of Study subjects based on resolution of ST-segment _90 minutes following thrombolysis

Resolution of ‘STsegment’	‘Number of cases’	‘Percentage’
CategoryA <30%	14	14
CategoryB 30-70%	46	46

Category C >70%	40	40

Table 8: Distribution of study subjects based on KILIP Class

KILIP CLASS	'Number of cases'	'Percentage'
ClassI	66	66
Class II	21	21
ClassIII	13	13

Table 9: Distribution of Study subjects based on Thrombolysis time

Thrombolysis time	'Number of cases'	'Percentage'
< '3 hours'	66	66
'3–5hours'	21	21
> '5hours'	13	13

Table 10: Distribution of Study subjects based on outcome of adverse events

'outcome of adverseevents'	'Number of cases'	'Percentage'
<48hours	88	88
>48hours	12	12

Table 11: Distribution of Study subjects based on Age in _ST-segment Resolution subgroups

		'Categories'				
		Category A <30%	**Category B 30-70%**	**Category C >70%**	**TOTAL**	
Age group (years)	20-40	1(5.0%)	11(55.0%)	8(40.0%)	20	p value — 0.64
	41-60	12(17.1%)	31(44.3%)	27(38.6%)	70	
	61-80	1(7.1%)	4(8.7%)	5(12.5%)	10	

Table 12: Distribution of study subjects based on Kilip Class in _ST- segment Resolution subgroups

	'Categories'				P value
	Category 'A' <30%	**Category 'B' 30-70%**	**Category 'C' >70%**	**TOTAL**	
Class I	3(4.5%)	31(47%)	32(48.5%)	66	<0.001
Class II	3(14.3%)	11(52.4%)	7(33.3%)	21	
Class III	8(61.5%)	4(30.8%)	1(7.7%)	13	
	*Significant with p value <0.001				

Table 13: Distribution of study subjects based on Thrombolysis time in _ST- segment Resolution subgroups

Thrombolysis time	'Categories'				P-value
	Category A <30%	**Category B 30-70%**	**Category C >70%**	**TOTAL**	
< _3hours'	4(14.8%)	1(3.7%)	22(81.5%)	27	<0.001
_3—5hours'	1(2.4%)	25(59.5%)	16(38.1%)	42	
_>5hours'	9(29%)	20(64.5%)	2(6.5%)	31	
	*Significant with p value <0.001				

Table 14: Distribution of study subjects based on Type of MI in _ST- segment Resolution subgroups

Type of MI	'Categories'				P value
	Category A <30%	**Category B 30-70%**	**Category C >70%**	**TOTAL**	
Anterior wall MI	13(22%)	25(42.4%)	21(35.6%)	59	0.021
Inferior wall MI	1(2.4%)	21(51.2%)	19(46.3%)	41	
*Significant with p value <0.05					

Table 15: Distribution of Study subjects-based on Onset of Adverse Events in _ST segment

Adverse Events	'Categories'				P-value
	Category A <30%	**Category B 30-70%**	**Category C >70%**	**TOTAL**	
<48hours	12 (24.5%)	26 (53.1%)	11 (22.4%)	49	0.001
>48hours	2 (3.9%)	20 (39.2%)	29 (56.9%)	51	
	*Significant with p-value <0.05				

Table 16: Distribution of Study subjects-based on Outcome in _ST- segment Resolution subgroups

Outcome	'Categories'			
	'Category A' <30%	**'Category B' 30-70%**	**'Category C' >70%**	**TOTAL**
'No adverse event'	0	15(34.1%)	29(65.9%)	44

'Adverse events excluding in-hospitalmortality'	5 (10.9%)	31 (67.4%)	10 (21.7%)	46
'In-hospital mortality'	9 (90%)	0	1(10%)	10

Table 17: Distribution of Study subjects-based on Adverse Events in _ST- segment Resolution subgroups

Adverse Events	Categories			TOTAL	P value
	Category A <30%	Category B 30-70%	Category C >70%		
LVF	11 (31.4%)	19 (54.3%)	5 (14.3%)	35	<0.001
Cardiogenic shock	8 (100%)	0	0	8	<0.001
Recurrent Angina	4 (23.5%)	13 (76.5%)	0	17	0.001
Arrhythmias	6 (21.4%)	16 (57.1%)	6 (21.4%)	28	0.051

DISCUSSION

The current study demonstrates the benefit of the standard ECG changes that is resolution of ST-segment 90 minutes following _thrombolytic therapy' as a predictor for _coronary reperfusion.

Mean age of population in the present study is 50.05 ± 9.4 years. On comparison with other studies, mean age of the study _population' is ten years younger than the present study population. Male preponderance (81%) can be observed in current study which is identical in various studies.

The predominant risk factor in the current study is Smoking which is common in other studies with percentage of smokers being higher (76%) in the current study in comparison with other studies, 48% in study done by Dong et al. (8) 2002 (n=121); 45.5% in study done by Zeymer U et al,[5] 2001 (n=761); 43% in study done by French et al,[6] 2001 (n=869); 39.5% in study done by Bhatia L et al.[7] (2004) (n=85).

Hypertension (49%) which is next common risk factor is similar in other studies with 45.5% in study done by Bhatia L et al. (2004) (n=85),[7] and37.8% in study Zeymer U et all,[5] 2001 (n=761). In study done by Dong et al. 2002 (n=121) percentage of hypertensives is higher (63%) than the current study while lower (27%) in study done by French et al. 2001 (n=869).

In the current study 40% percent of patients belong to ST- resolution sub-group-_Complete resolution group': >_70% resolution'. The mean age was 51.8years with SD 10.2, 26.3% of them are females .44.7% of people had a habit of smoking. Nearly 28.6% have Hypertension, 14.3% have diabetes as a comorbidity. Nearly 35.6 % of them had anterior wall MI and 46.3% had inferior wall MI. Time of treatment after symptoms developed was 2.8 hours with SD 0.94 hours.

In the study carried out by _Schroder et al.', in 1995 (n=1398),[9] 49% percent of patients are belonging to ST resolution sub-group-_Complete resolution group': >_70% resolution'. The mean age was 60.9 years, 24% of them are females. 42 % of people had a habit of smoking. Nearly 10% have diabetes and 30% had hypertension as a comorbidity. Nearly 33 % of them had anterior wall MI and 77% of them had inferior wall MI.

In present study 46% percent of patients belong to the _ST resolution sub group' Partial resolution group 30-70% resolution', the mean age was 48.3years with SD 8.8, 57.9% of them are females .40.8% of people had a habit of smoking. Nearly 51% have hypertension, 48.6% have diabetes as a comorbidity. Nearly 42.4 % of them had anterior wall MI and 51.2% of them had inferior wall MI. Time of treatment after symptoms developed was 5.02 hours with SD 1.01 hours.

In the study carried out by Schroder et al., 1995 (n=1398) 30% percent of patients belong to _ST resolution sub group'-_Partial resolution group _30-70% resolution). The mean age was 61.6 years, 26% of them are females. nearly 16% have diabetes as a comorbidity. Nearly 62 % of them had anterior wall MI followed by inferior wall MI (38%).

Adverse events in the _complete resolution group in the current study are almost equivalent to _other study groups. Arrhythmias are the common adverse events in the _present study group when equated to another studies succeeded by LV failure. In-hospital mortality is 10% in the current study which is greater than other studies.

In present study, the most common adverse event observed in complete resolution group was arrhythmias (_21.4'%), accompanied by left ventricular failure (LVF) (14.3%), and adverse events like cardiogenic shock and recurrent angina were not observed in this study group.

In the study carried out by Schroder et al., 1995 (n=1398), (9) the most commonly observed adverse event was left ventricular failure (LVF) (13%), arrhythmias (13%), recurrent angina (13%) followed by cardiogenic shock (2.6%).

In the study carried out by Anderson et al., 2002 (n=2352) the most common adverse event observed was left ventricular failure (13.9%) followed by recurrent angina (3.4%) and cardiogenic shock (2.2%s).

The frequent detrimental event in the _partial ST segment resolution group in the present study is recurrent angina (76.5%) followed by arrhythmias (57.1%), left ventricular failure (54.3%).

In the study carried out by Anderson et al., 2002 (n=2352),[10] the adverse event with higher frequency was left ventricular failure (LVF) (18.9%), accompanied by _cardiogenic shock‘ (3.5%), recurrent angina (2.7%).

In the study carried out by Schroder et al., 1995 (n=1398),[7] the most commonly observed adverse event was left ventricular failure (LVF) (20%) followed by recurrent angina (18.3%), arrhythmias (15%), cardiogenic shock (3.8%).

Most common adverse outcome in the _group with no ST segment resolution in the current study is cardiogenic shock which is observed in every patient followed by LVF (23.3%).

In the study carried out by Anderson et al., 2002 (n=2352) (10) the customary adverse event observed was recurrent angina (40%) followed by left ventricular failure (LVF). In a study conducted by Schroder et al., 1999(n=1398), (9) the most common observed adverse outcome was left ventricular failure (LVF) (32%) followed by arrhythmias (24%), cardiogenic shock (17%).

In-hospital mortality in the current study group is 90%which is also very much higher than the studies done by Schroder et al., (9) 1999 (n=1398)-18%, Anderson et al., 2002 (n=2352)-6.6%.[10]

However, persistence of elevation of the ST-segment after angiographically successful first degree PCI distinguish he patients with higher risk of dysfunction of left ventricle and mortality; perhaps due to microvascular damage in the infarct-myocardial zone. Therefore, the twelve lead ECG might reflect the biologic integrity of cardiac myocytes in the zone of infarction and recognise unsatisfactory perfusion of myocardium in spite of TIMI grade 3 flow. Therefore, extent of ST-segment resolution establishes a significant prognostic information regarding the management of STEMI patients.[11]

Limitations of The Study

The current study consisted of a smaller sample size which is only 100. ST- segment after STEMI (ST-segment elevation myocardial infarction) is dynamic and therefore, obtaining a _static measurement‘ might have resulted in errors in categorising the patients as _successful or failed reperfusion‘. In the current study, short-term outcomes alone are evaluated in sort of in- hospital adverse outcomes and in hospital mortality. There was no correlation of outcomes of the current study with _coronary angiography‘ (TIMI grading) or _cardiac magnetic resonance imaging‘ that are the gold standard investigations‖ for evaluation of patency of coronary artery and myocardial perfusion respectively.

Recommendations for Further Work

A large sample size representative of the whole community should be studied in a multi center trial with uniform age distribution and without any difference based on gender. Patients should be followed for the long term to see the impact of of treatment and to study the late onset adverse outcomes and to assess _left ventricular function‘ and long- term mortality.

CONCLUSION

On comparison with the partial and complete resolution groups, patients with _No ST- segment resolution 90 minutes subsequent to thrombolysis have higher adverse events and have an elevated mortality. The percentage of ST-segment resolution 90 minutes subsequent to thrombolysis is a simple and non-invasive method and serves as a prognostic indicator of outcome that aids in risk stratification of patients.

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