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Study of utility of > 50% ST segment resolution as criteria of reperfusion in patients with acute myocardial thrombolytic therapy

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Abstract

Background: The use of thrombolytic therapy in the treatment of acute myocardial infarction is widely accepted. Non-invasive methods for monitoring the reperfusion of the infarct related vessel include clinical markers, electrocardiography findings, and monitoring the specific cardiac proteins in plasma. Present study was aimed to study the usefulness of early changes in ST segment in predicting reperfusion occurring spontaneously or after thrombolysis in patients with AMI. **Material and Methods:** Present study was single-center, prospective, observational study, conducted patients of acute myocardial infarction (AMI) presenting within 12 hours of chest pain. All the patients received conventional therapy for AMI and those patients who were eligible for thrombolytic therapy received 7.5 lakh units of streptokinase (STK). **Results:** Out of 66 cases studied, 36 patients (54.54%) received thrombolytic therapy. The sudden relief of chest pain within 3 hours of initiating the treatment was observed in 28 patients (70%) in thrombolysed group and 12 patients (30%) in non thrombolysed group. The ST segment reduction of > 50% at 180 minutes was observed in 23 patients (63.88%) and 08 patients (26.66%) in the two groups respectively. Ten patients (27.77%) developed reperfusion arrhythmias in streptokinase group compared with 06 patients (20%) in non-streptokinase group. Significantly higher proportion of patients in streptokinase group achieved the criteria of reperfusion such as sudden relief of chest pain within three hours of initiating the treatment and >50% ST segment resolution at the end of 180 minutes ($p < 0.05$). However, statistically significant difference was not observed when reperfusion arrhythmia was considered as a criteria of reperfusion between the two groups ($p > 0.05$). **Conclusion:** Using simple measurement of ST segment elevation, we were able to identify the high and the low-risk groups of patients as early as 60 minutes after initiating thrombolysis in the patients of AMI.

Keywords: Thrombolytic therapy, acute myocardial infarction, ST segment elevation, ECG

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Introduction

The use of thrombolytic therapy in the treatment of acute myocardial infarction is widely accepted.[1] The aim of the thrombolysis in Acute myocardial infarction (AMI) is early and complete myocardial reperfusion.[2] It reduces the mortality and preserves left ventricular function.[3] The incomplete or delayed reperfusion is associated with an increased risk of the death and left ventricular dysfunction.[2]

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The TIMI grade-3 (Thrombolysis in myocardial infarction criteria) flow in the infarct related coronary artery is achieved in 54% of the patients by 90 minutes with the front loaded tissue plasminogen activator (t-PA) and in 31% of patients receiving streptokinase.[3] While the choice of thrombolytic agent may change the outcome, many patients have the sub-optimal perfusion after standard thrombolytic therapy.[5] Immediate post thrombolytic coronary angiography to identify high risk patients is not a practical option for most district hospital nor is it desirable for all patients.[4]

Therefore, a practical noninvasive marker of reperfusion is required to identify those patients who might benefit from rescue strategies. Noninvasive methods for monitoring the reperfusion of the infarct related vessel include clinical markers (such as resolution of chest pain), electrocardiography findings (such as occurrence of idioventricular rhythm and rapid resolution of the ST segment), and monitoring the specific cardiac proteins in plasma.[6,7] Lawrence et al.,[8] reported spontaneous reperfusion to be occurring in 46.15% of patients with improvement in global and regional wall ejection fraction. Present study was aimed to study the usefulness of early changes in ST segment in predicting reperfusion occurring spontaneously or after thrombolysis and its effect on clinical outcome in the form of 30-day mortality in patients with AMI.

Material And Methods

Present study was single-center, prospective, observational study, conducted in department of Medicine, Government Medical College and Hospital, Aurangabad, India. Study duration was of 2 years (January 1998 to December 1999). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- patients of acute myocardial infarction (AMI) presenting within 12 hours of chest pain were included in the study. The diagnosis of AMI was based on chest pain for 30 minutes or greater and ST segment elevation in two or more leads on standard 12 lead ECG (0.1 mv in limb leads or 0.2 mv in chest leads),[5] willing to participate in present study

Exclusion criteria

1. Absolute contraindications to STK therapy : Active interval bleeding, suspected aortic dissection, recent cerebrovascular accident known to be hemorrhagic, major surgery or trauma within 2 weeks duration.
2. Relative contraindications - Sustained hypertension (BP > 180/110 mmHg), active peptic ulcer, H/o cerebrovascular accident, prolonged or traumatic cardio-pulmonary resuscitation, diabetic haemorrhagic retinopathy or other haemorrhagic ophthalmic conditions, pregnancy, prior exposure to STK or APSAC in last 6 to 9 months and knowing bleeding diathesis and current use of anticoagulants.

Study was explained to patients in local language & written consent was taken for participation & study. The history in detail and finding on physical examination were entered into the proforma. All the patients received conventional therapy for AMI and the choice of therapy was left to the treating physicians. Those patients who were eligible for thrombolytic therapy received 7.5 lakh units of streptokinase (STK) dissolved in 100 ml of normal saline infused over 30 minutes. All patients received 300 mg of aspirin (chewed) irrespective of whether they received thrombolytic therapy or not.

During the STK therapy, patients were observed for an indirect evidence of reperfusion in the form of sudden relief of chest pain, appearance of reperfusion arrhythmias, rapid resolution of ST segment towards base line. A baseline 12 lead ECG was recorded immediately before initiation of thrombolysis and at 60, 90 and 180 minutes 60 thereafter. The ST segment was measured by caliper at 80 ms beyond the J point. The lead of maximum ST elevation was

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determined from baseline ECG measurements.
The sum ST segment elevation was calculated from the baseline ECG by adding together the ST elevation for all leads other than aVR. The ST segment deflections of 60, 90 and 180 minutes were compared with baseline ECG.[5] The AMI was categorized as anteroseptal if ST elevations occurred in leads vl-v4, anterolateral if ST elevations occurred in leads vl-v6, extensive anterior wall myocardial infarction if ST elevations occurred 1in leads I, aVL, v1-v6 and inferior if ST elevation occurred in leads II, III, and aVF.[10]
The key value for analysis was reduction of 50% or more in ST elevation in chosen lead or in sum ST elevation compared with baseline. Those patients who did not receive streptokinase therapy were taken as control. The duration of stay in hospital, complications observed and mortality during one month follow-up were studied in the two groups.
Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

Results

The present study was carried out in 66 patients, admitted for treatment of AMI. Mean age of the patients was 53.05 years. The maximum number of patients, 40 (60%) were seen in 41-60 years age group. Total 12 patients (18%) were having age < 40 years. Out of 66 cases 51 were male and 15 were female with M: F ratio of 3.4: 1.

Table 1: Age and sex distribution

Age Groups	Male	Female	Total	Percentage
21-40	12	00	12	18
41-60	31	09	40	60
61-80	07	05	12	18
>80	01	01	02	04
Total	51	15	66	100

Out of 66 patients, majority patients reached hospital within 6 hours (51%) as compared to within 12 hours of chest pain (49%). In majority cases, anterior wall infarction was observed (54.50%) followed by inferior wall infarction (42.50%). Posterior wall involvement was seen in 1 case (1.5%) while global infarction was noted in 1 case (1.5%). Out of 36 cases of anterior wall infarction, 14 cases (21.2%) were having anteroseptal , 8 cases (12.1%) were of anterolateral wall infarction and another 14 cases (21.2%) were suffering from extensive anterior wall myocardial infarction. Arrhythmias was the commonest complication observed (45.45%) followed by presence of congestive heart failure (12.12%) & cardiogenic shock (7.57%).

There were total 10 deaths (15.56%) in the 66 cases of AMI studied at the end of 30 days. Out of 36 patients who received Streptokinase, 4 patients (11.11%)expired. Out of 30 Patients who did not receive thrombolytic therapy, 7 patients (20%) died. The difference in the mortality between the two groups was found to be Statistically significant (P < 0.05).

Table 2: Duration of chest pain, type of infarction & complications

Characteristic	No. of Patients	Percentage
Duration of chest pain		
Less than 6 hours	34	51.00
6-12 hours	32	49.00

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Type of Infarction		
Anterior	36	54.50
Inferior	28	42.50
Posterior	01	01.50
Global	01	01.50
Complications		
Arrhythmias	30	45.45
Congestive Cardiac Failure	08	12.12
Cardiogenic Shock	05	07.57

Out of 66 cases studied, 36 patients (54.54%) received thrombolytic therapy. Out of 36 cases who received streptokinase, seven patients (19.44%) had complications. Minor allergic reactions in the form of nonspecific urticaria and pruritus were observed in one patient (2.77%) and 06 patients had hypotension (16.66%), which did not require specific treatment. 30 patients did not receive the thrombolytic therapy.

Table 3: Complications after administration of STK

Complications	**No. of Cases**	**Percentage**
Hypotension	6	16.67
Allergic Reactions	01	02.77

Smoking was the commonest risk factor observed in 53 patients (80.30%) followed by hypercholesterolemia in 13 patients (19.69%), family H/O IHD and obesity in 11 patients each (16.66%), hypertension in 7 patients (10.60%) and diabetes in 4 patients (6.06%).

The baseline characteristics of patients in the two groups were comparable. The mean age in thrombolysed group was 48.30 years as compared to 57.30 years in non thrombolysed group. The mean chest pain duration was 308 minutes (5.08 hrs.) in thrombolysed group and 428 minutes (7.08 hrs.) in non thrombolysed group. The mean chest pain to needle time observed was 219 minutes (3.39 hrs.) and mean door to needle time observed was 36.86 minutes.

Table 4 Baseline characteristics of patients

Parameters	**Thrombolysed Group**	**Non-Thrombolysed Group**	**Total Patients**
Number (%)	36 (54.44%)	30 (45.45%)	66 (100%)
Age	48.30 Years	57.30 Years	52.8 Years
M : F Ratio (%)	32 : 4 (80:10%)	19 : 11 (63:37%)	51 : 15 (77:23%)
Hypertension (%)	04 (11.11%)	03 (10.00%)	07 (10.60%)
Diabetes Mellitus (%)	01 (02.77%)	03 (10.00%)	04 (06.06%)
Smoking (%)	29 (81.00%)	24 (80.00%)	53 (80.30%)
Hypercholesterolemia (%)	09 (25.00%)	04 (13.33%)	13 (19.69%)
Family H/O IHD	06 (16.66%)	05 (16.66%)	11 (16.66%)
Obesity	06 (16.66%)	05 (16.66%)	11 (16.66%)
Chest Pain Duration	308 Mins (5.08 Hrs.)	428 Mins (7.08 Hrs.)	368 Min (6.08 Hrs.)

All the patients were observed for three hours after administration of streptokinase and/or aspirin for indirect evidence of reperfusion in the form of appearance of reperfusion arrhythmias, rapid resolution of ST segment towards the baseline and sudden relief of chest pain within three hours of initiation of treatment. By infarct site shows that lower proportion of patients with anterior myocardial infarction achieved a > 50% decrease in ST elevation

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compared with inferior AMI which is statistically non-significant (P > 0.05). Analysis of this data by infarct site shows that lower proportion of patients with anterior wall AMI achieve a > 50% decrease in ST elevation compared with inferior AMI. The difference was found to be statistically non-significant (p > 0.05). The percentage of patients achieving > 50% ST segment resolution at 60, 90 and 180 minutes were significantly higher in thrombolytic therapy compound with non-thrombolytic group (p < 0.05). The percentage of the patients achieving >50% ST segment resolution were significantly higher in streptokinase group compared with non-streptokinase group (p < 0.05).

Table 5: ST segment resolution in ECG

Minutes	Maximum lead		Maximum ST segment elevation lead		Using sum ST		Using sum ST elevation lead	
	Anterior AMI	Inferior AMI	Anterior AMI	Inferior AMI	Anterior AMI	Inferior AMI	Anterior AMI	Inferior AMI
60	30	46	7,14	12.5	21.73	38.46	7,14	12.5
90	39.18	53.8	7.14	31.25	39.13	61.53	7.14	25
180	60	69.23	14.28	37.25	52.17	69.23	14.28	31.25
P value	> 0.05		> 0.05		< 0.05		> 0.05	

The sudden relief of chest pain within 3 hours of initiating the treatment was observed in 28 patients (70%) in thrombolysed group and 12 patients (30%) in non thrombolysed group. The ST segment reduction of > 50% at 180 minutes was observed in 23 patients (63.88%) and 08 patients (26.66%) in the two groups respectively. Ten patients (27.77%) developed reperfusion arrhythmias in streptokinase group compared with 06 patients (20%) in non-streptokinase group. Significantly higher proportion of patients in streptokinase group achieved the criteria of reperfusion such as sudden relief of chest pain within three hours of initiating the treatment and >50% ST segment resolution at the end of 180 minutes (p <0.05). However, statistically significant difference was not observed when reperfusion arrhythmia was considered as a criteria of reperfusion between the two groups (p > 0.05).

Table 6: Non-invasive markers of reperfusion studied

Criteria of reperfusion	STK Group No. of patients (%)	Non STK Group No. of patients (%)	Total No. of patients (%)
Sudden relief of chest pain (< 3 hours of initiating treatment)	28 (70%)	12 (30%)	40 (60.60%)
ST segment reduction of >50% at the end of 3 hours	23 (63.88%)	08 (26.66%)	31 (46.96%)
Reperfusion arrhythmias	10 (27.77%)	06 (20%)	16 (24.24%)

In STK group, sudden relief of chest pain was observed in 21 patients (91.30%) and reperfusion arrhythmias were observed in 08 patients (34.78%). In non-streptokinase group, 06 patients (75%) experienced sudden relief of chest pain while 03 patients (37.50%) developed reperfusion arrhythmias.

Table 7: Relationship between ≥ 50% ST segment resolution with sudden relief of chest pain

ST segment resolution of ≥ 50% at the end of 3 hours	STK Group (36) 23 Patients	Non STK Group (30) 8 Patients	Total (66) 31 Patients
Relief of chest pain within 3 hours of initiating treatment	21(91.30%)	06 (75.00%)	27 (87.09%)

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Reperfusion arrhythmias within 3 hours	08 (34.78%)	03 (37.5 %)	11 (35.48%)

The difference in cardiac mortality between the two groups (those achieving >50% ST segment resolution and those who do not) was statistically significant at 60 minutes but not at 90 and 180 minutes ($p < 0.05$).

The 60-minute ECG predicts the cardiac mortality with high sensitivity (100%) but with low specificity (40.63%). ECGs taken at later time (180 minutes) predict cardiac mortality with higher specificity (70.97%) but at the expense of fall in sensitivity to 80%.

Table 8: Relationship between achieving ≥ 50% resolution in ST segment elevation in maximal ST elevation lead and 30-day cardiac mortality in patients receiving streptokinase

Time (Min)	ST Fall (%)	Cardiac Mortality (n)	Cardiac Mortality (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
60	≥ 50	0/13	0	100	40.83	17.39	100
	< 50	4/23	17.99				
90	≥ 50	1/17	05.80	75	61.9	15.79	96.3
	< 50	3/19	15.78				
180	≥ 50	1/23	04.34	80	70.97	30.77	95.65
	< 50	3/713	23.07				

PPV = Positive predictive value, NPV = Negative Predictive Value.

Using sum ST segment analysis, it was observed that the patients with ≥ 50 ST segment resolution by 60, 90 or 180 minutes experienced lower cardiac mortality at the end of 30 days compared with those having persistent ST elevation. The difference in the cardiac mortality between the two groups was Statistically significant at 60 minutes ($p < 0.05$) but not at 90 or 180 minutes ($p > 0.05$). The sum ST segment analysis predicted the cardiac mortality with lower sensitivity and specificity at 60-, 90- and 180-minutes post-thrombolysis compared with maximal lead ST segment ($p > 0.05$ statistically non-significant).

Table 9: Relationship between achieving a ≥ 50% resolution in ST elevation by using sum ST elevation leads and 30 cardiac mortality in patients receiving streptokinase

Time (Min)	ST Fall (%)	Cardiac Mortality (n)	Cardiac Mortality (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
60	≥ 50	0/11	0	100	38.04	16.48	100
	< 50	4/25	16				
90	≥ 50	1/15	6.66	72.78	60.10	14.19	95.06
	< 50	3/21	14.28				
180	≥ 50	1/21	04.76	79.60	69.10	28.06	94.60
	< 50	3/15	20.00				

The patients with >50% ST segment resolution in the lead of maximal ST elevation by 60-, 90- or 180-minutes experience lower cardiac mortality at the end of 30 days. The difference in cardiac mortality between the two groups (those achieving >50% ST segment resolution and those who do not) was statistically significant at 60 minutes ($p < 0.05$) but not at 90 or 180 minutes ($p > 0.05$). The 60-minute ECG predicts the 30 day cardiac mortality with high sensitivity (100%) but with low specificity (12.5%) ECG taken at 180 minutes increases the specificity to 29.17% at the expense of sensitivity which falls to 83.33%.

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TABLE 10: Relationship between achieving ≥ 50% resolution in ST elevation and 30-day clinical outcome in non thrombolysed patients using maximal lead ST elevation

Time (Min)	ST Fall (%)	Cardiac Mortality (n)	Cardiac Mortality (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
60	≥ 50	0/03	0	100	12.50	22.22	100
	< 50	5/27	22.22				
90	≥ 50	1/06	16.66	83.33	20.83	16.67	83.33
	< 50	5/24	20.33				
180	≥ 50	17/08	12.50	83.33	29.17	22.72	87.50
	< 50	5/22	22.70				

Discussion

The thrombolytic therapy and angioplasty are now the standard of care in appropriately selected patients. The emphasis on early recanalization of occluded infarct - related artery has led to a decline in short term mortality from AMI. ST segment elevation on 12 lead ECG of patient with history compatible with AMI is highly suggestive of thrombotic occlusion of epicardial coronary artery and its presence should serve as the trigger for a well-rehearsed sequence of rapid assessment of patients for contraindications to thrombolysis and initiation of a reperfusion strategy.[11]

In international t-PA / streptokinase mortality trial, allergic reactions (1.7 %), hypotension (10 %) were noted. Intracranial hemorrhage was most serious complication of thrombolytic therapy and its overall incidence was 0.75%.[12] In this study, transient hypotension (16.66%) and minor allergic reaction (2.77%) were noted. No gastrointestinal bleed or stroke was not noted in any case.

In the large multicenter, randomized study,[12] effect of treatment was evaluated in 11,712 patients, 5860 treated with intravenous Streptokinase and 5852 who served as control group. Streptokinase therapy was associated with Statistically significant 18% reduction in overall mortality with beneficial effect most striking in patients treated within 3 hours of onset of chest pain. Mortality in this subgroup was reduced by 23%. The mortality reduction with streptokinase was also statistically significant in patients treated within 3 to 6 hours after onset of symptoms. Although mortality was lower in streptokinase treated patients than in control group when therapy was initiated 6 to 9 hours after onset of chest pain, the difference was not Statistically significant. In present study, the difference in mortality between streptokinase group (11.11%) and non-streptokinase group (20%) was found to be statistically significant ($p < 0.05$).

The patients most likely to benefit from Streptokinase therapy are those who are admitted within 4 to 6 hours of onset of chest pain with ECG showing ST segment elevation compatible with acute Q wave myocardial infarction. The presence of abnormal Q waves in the same leads in which gr segment is elevated may be an indication of advanced infarction and patients with such findings may derive less benefit. Also, patients with prolonged chest pain with ST segment depression or T wave inversion fail to show benefit of thrombolysis. These patients frequently show only subtotal coronary occlusion on angiography. The risk benefit evaluation in these patients may lead to their exclusion from therapy.[14]

The coronary recanalization rate reported with intravenous infusion of Streptokinase varies widely depending on methods used to define recanalization. The TIMI trial[15] using strict

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criteria for reperfusion that is baseline angiography proven occlusion as well as documentation of significant antegrade flow in infarct related artery after recanalization, found a recanalization rate of 31% in 145 cases studied. Mueller et al.,[14] reported recanalization rate of 45% with intravenous streptokinase infusion. Ganz et al.,[16] reported reperfusion rate to be 96%. In GUSTO trial[4], the 90 minutes coronary artery patency rate was reported to be 60% for streptokinase with intravenous heparin and 81% for accelerated t-PA.

When noninvasive markers of coronary reperfusion has been used to evaluate intravenous streptokinase, higher recanalization rates have been reported ranging from 73 to 94%, with an average of 84%. Noninvasive marker like rapid release of CK-MB, sudden relief of chest pain, rapid resolution of ST segment and reperfusion arrhythmias overestimate the rate of reperfusion because patient without total occlusions are Not excluded from evaluation.[14]

Thrombolytic therapy in AMI has been shown to be effective in preserving left ventricular function and reducing short and long term mortality. Although 60-70% of treated patients can be successfully reperfused, thrombolytic treatment fails in substantial proportion. These non-responsive patients have significantly high mortality rates and may therefore be candidates for emergency (salvage) angioplasty or coronary artery bypass graft surgery (CABG).[17] We need early reliable indicators to distinguish between patients who will respond favorably to thrombolytic treatment and those who will not. Coronary angiography immediately after treatment is the most accurate way to document coronary artery patency.

However, only few medical centers can provide timely angiographic evidence of reperfusion for each patient with AMI. Therefore, practical noninvasive marker of reperfusion is required to identify those patients who might benefit from rescue strategies. The post thrombolytic ECG has shown the promise as a noninvasive marker of reperfusion. Several studies have shown an association between early resolution of ST segment elevation after thrombolysis and improved coronary artery patency and clinical outcome.[18] Other non-invasive markers of reperfusion are sudden relief of chest pain[19], early peaking of serum concentration of CK-MB and reperfusion arrhythmias[20]. Hogg et al.,[21] reported that the 12 lead ECG is simple and useful method for determining reperfusion in patients of AMI undergoing thrombolysis.

Ganz et al.,[17] reported subsidence of chest Pain in 19 (95%) of 20 patients of AMI treated with thrombolytic agents. Barbash (1990) reported that in a Multivariate analysis abrupt resolution of chest pain had no independent predictive value for any of outcome Variables. In this study, relief of chest pain within 3 hours of initiation of treatment was observed in 28 patients (70%) in thrombolytic group and 12 patients (30%) in nom thrombolytic group. The difference between the two groups was found to be statistically significant ($p < 0.05$).

The sum ST elevation also predicts the outcome but with lower sensitivity and specificity. The difference was not found to be statistically significant ($p > 0.05$). Fewer patients with anterior MI achieved 50% ST resolution at 60 and 90 minutes compared with inferior MI (statistically significant). This was also observed in Koren G et al.,[22] and INJECT[23] studies which suggest that thrombolysis may be jess effective in anterior than inferior AMI. For streptokinase treatment this may relate to fibrinolysis itself because fewer patients with anterior wall AMI achieved systemic fibrinolytic state 60 minutes after streptokinase (fibrinogen <0.4 gm%) than patients with inferior AMI : 59.5% compared with 76.1% ($p < 0.05$).

Saran et al.,[1] studied 45 patients of AMI and compared 12 lead ECG findings with angiographic findings 3 hours after thrombolysis. They reported that reduction >25% in ST elevation 3 hours after thrombolytic treatment predicted coronary artery patency with sensitivity of 97% but specificity of only 43%. Hogg et al,[21] in their study of 45 patients of AMI reported high sensitivity of 99% and specificity of 67% for fall of >50% in lead

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showing maximum ST elevation (for coronary reperfusion). Clemmensen et al,[24] studied 53 patients with AMI treated with thrombolytic therapy. Angiography patency was assessed using TIMI classification. Similar findings were noted in present study.
Recent studies reveals that newer techniques such as continuous computer assisted multilead ECG monitoring and continuous electrocardiographic monitoring can predict coronary artery Patency with great than serial 12 lead ECG. Krucoff et al,[18] using continuous 12 lead ECG Monitoring in 3; patients with AMI reported that less (on angiography) with 90% Sensitivity and 92% specificity. Continuous ST segment recovery analysis provides both real time and retrospective determination of speed and stability of reperfusion which appears to provide unique and useful information for both investigational and clinical purposes.

Conclusion

Thrombolytic therapy is corner-stope in the management of AMI and subject of intravenous thrombolysis has perhaps peep one of the most rapidly evolving areas in the management of Patients with AMI. Using simple measurement of ST segment elevation, we were able to identify the high and the low risk groups of patients as early as 60 minutes after initiating thrombolysis in the patients of AMI. Single lead data proved a simple and universally applicable marker that could predict the outcome at least as accurately as more time consuming measurements of sum ST changes. The 60 minute ECG prediction of clinical outcome emphasizes the importance of early reperfusion and identifies high risk patients who may benefit from rescue reperfusion therapy. The patients in whom there is failure of ST segment elevation to decrease at all by 60 minutes seem to warrant the most aggressive treatment.

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