ECG Changes After Alteplase Therapy in Patients with Acute Myocardial Infarction

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ABSTRACT:

BACKGROUND:

Acute myocardial infarction is a major cause of death throughout the world. Many important advances have become available to Coronary Care Units enabling them to reduce mortality and improve the prognosis, Reperfusion therapy is one of these important advances.

OBJECTIVE:

This study sought to identify the Electro-cardiographic (ECG) changes which occur after receiving Alteplase therapy and its relation to response to thrombolytic therapy.

METHODS :

Seventy-three patients with ST- elevation Acute Myocardial Infarction (AM I) who received Alteplase within 12 hours from the start of symptoms in coronary care unit were included in this study. Electro-cardiographic (ECG) was done to all patients at time of arrival to the coronary care unit(CCU), Alteplase therapy was given to all patients plus heparin intravenously, followed by electro-cardiographic (ECG) every 30 minutes for 2 hours.

RESULTS:

Fifty-seven and half percent of our patients showed 50% reduction in the ST segment elevation in the worst lead after 2 hours from starting Alteplase therapy and regarded as responders. Other ECG changes like rapid appearance of Q wave, T inversion, accelerated idioventricular rhythm (AIVR) are found to be specific for reperfusion with a high predictive value when the gold standard criteria was reduction 50 % in the ST segment elevation Resolution of reciprocal changes is sensitive and specific with high predictive value.

CONCLUSION :

Some ECG changes after thrombolytic therapy can predict the response in addition to the already known changes.

KEYWORDS: ECG reciprocal resolution sensitive .

INTRODUCTION:

Fibrinolytic treatment has produced an important impact on the natural history of ST- elevation AMI[1]. The goal of thrombolytic therapy is to lyse occlusion by coronary thrombi and thus reinstate adequate coronary blood flow[2,3].

Over the past decade, the critical importance of timely reperfusion of the occluded infarct- related coronary artery in patient with ST- elevation AMI has been recognized[4].Early administration of thrombolytic agents reduces infarct size and improves survival [5,6], with a reduction in the mortality by 25–50% [2,5,7,8] .

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Several studies have shown the value of non – invasive reperfusion indices in ST- elevation AMI [9,10] .

Various non – invasive indices were found useful for determining coronary reperfusion, such as ECG changes, change in quality of the chest pain, and enzymatic study.

In this study, we decided to evaluate the effect of thrombolytic therapy by ECG changes which occur after receiving the drug. We have chosen the ECG because it is simple, easily done, not invasive and has a well-established role in evaluating the effect of thrombolytic therapy and to evaluate the effect of Alteplase therapy in patients who presented with ST- elevation Acute Myocardial Infarction (AM I) by ECG changes based on the criteria of reduction in the ST segment

elevation and to evaluate the effect of time on response to treatment.This study was done in the coronary care unit(CCU) of Ibn-Siena Mosul Teaching Hospital from Sep.2000 to Oct.2001. We considered the reduction of ST elevation in the worst lead by 50% or more within the first 2 hours as the cut point for success or failure of reperfusion [11,12,13,14,15]. On the serial ECG s, the degree of ST elevation was measured and we tried to clarify these patients who got 50 % reduction. We evaluated other changes in the ECG, with respect to the ST reduction criterion as rapid appearance of Q wave[16], rapid appearance of T inversion[11,12] and appearance of accelerated idioventricular rhythm (AIVR) by ECG or monitor.Persistence or disappearance of reciprocal changes.

Statistical analysis:

The statistical methods which were used included:
Chi – square test difference between observations were considered not significant at p >0.05. Sensitivity , specificity and predictive value were all estimated for each ECG changes criterion using 2*2 tables.

RESULTS:

The main change noticed in the serial ECG included ST reduction (50%) ,accelerated idioventricular rhythm (AIVR), rapid appearance of Q wave, rapid appearance of T inversion and reciprocal changes. Out of 73 patients who received Alteplase therapy, 42 patients (57.5%) showed 50% reduction in the ST elevation after 2 hours from starting therapy, these patients are considered as responders, while 31 patients (42.5%) did not achieve this target, no side effect and no mortality were observed in this study.Table (1) shows the observed ECG changes in the responders group and the failure group within 2 hours after establishment of Alteplase therapy,

while table (2) exhibits the significance of the different ECG changes as a marker of success or failure when compared with the reduction of the ST segment elevation as criteria of response. Twenty out of 22 patients(91%) who showed accelerated idioventricular rhythm (AIVR) in the first 2 hours were from the responder group. This suggests that the appearance of AIVR is a strong indicator of success with p value < 0.001. in comparison with the ST reduction criteria, which we considered as the gold standard criterion for response, its specificity was 93.5% , predictive value was 90.9% and sensitivity was 47.6 %.Twenty-one out of 22 patients (95.4%) who showed rapid appearance of Q wave were from the responder group, making it another strong marker of success with p value <0.01. its specificity was 92.8%, predictive value was 95.4% and sensitivity was 52.5%, and seventeen out of 18 patients (94.4%) who developed T inversion 2 hours after starting Alteplase therapy were from the responder group, where p value was < 0.001. the specificity was 96.15%, predictive value was 95.4% and sensitivity was 40.4%.Forty- five patients had reciprocal changes on the base line ECG before starting Alteplase. Thirty-two patients were from the responder group, while 13 patients were not. Out of 32 patients who were responders, in 30 patients (93.7%), the reciprocal changes disappeared after receiving Alteplase. In 13 patients who failed to respond , 2 patients only had the reciprocal changes being disappeared makes the disappearance of reciprocal changes after thrombolytic therapy a strong indicator for response with p value <0.001. sensitivity was 93.7%, specificity was 84.6%, and predictive value was 93.7.

Table 1:The observed ECG changes in response and failed groups within 2 hours after establishment of Alteplase therapy.

ECG changes	Response group (n)	Percent (%)	Failure group(n)	Percent(%)	Total
accelerated idioventricular rhythm(AIVR)	٢٠	٩١	٢	٩	٢٢
Rapid appearance of Q wave	٢١	٩٥,٥	١	٤,٥	٢٢
Rapid appearance of T inversion	١٧	٩٤,٥	١	٥,٥	١٨
Resolution of reciprocal changes	٣٠	٩٣,٧	٢	٦,٣	٣٢

Table 2: The significance of the different ECG changes as a marker of success or failure when compared with the reduction of ST segment elevation as criteria of response.

ECG changes	Specificity(%)	Predictive value (%)	Sensitivity(%)	P value
accelerated idioventricular rhythm(AIVR)	٩٣,٥	٩٠,٥	٤٧,٦	< ٠,٠٠١
Rapid appearance of Q wave	٩٢,٨	٩٥,٤	٥٢,٥	< ٠,٠١
Rapid appearance of T inversion	٩٦,١٥	٩٥,٤	٤٠,٤	< ٠,٠٠١
Resolution of reciprocal changes	٨٤,٦	٩٣,٧	٩٣,٧	< ٠,٠٠١

Table 3: The response according to the time.

Time	response(n)	percent(%)	failure(n)	percent(%)	Total no.
2 hours	٢٤	٨٢,٧	٥	١٧,٢	٢٩
2 -6 hours	١٥	٦٠	١٠	٤٠	٢٥
> 6 hours	٣	١٥,٧	١٦	٨٤,٣	١٩

DISCUSSION:

The well accepted 50 % or more reduction in the ST segment elevation was considered in our study as the gold standard of response or failure. Failure of the elevated ST segment (measured 80 ns after the J point in a lead with a maximum ST elevation) to fall by 50% or more, if measured two hours after the start of thrombolytic therapy will give a diagnostic accuracy of about 80 -85 % for failure to achieve TIMI 3 flow[15,17]. On the other hand, in other study, using the reduction in the ST segment elevation by 50% or more as a sign of reperfusion will lead to 15 % of patients being falsely identified as having TIMI 2-3 flow[12,13]. In our study, depending on the reduction in the ST segment elevation by 50% or more in the worst lead 2 hours after treatment as a sign of response or failure to thrombolytic therapy, 57.5% of our patients who received Alteplase were responders. The response rate in our population as judged by ECG is lower than expected when compared to studies in which angiography was the diagnostic tool to assess reperfusion[15,17,18]. However, thrombolysis in MI study (TIMI-I), angiographic reperfusion occurs in 62% of patients after Alteplase therapy[19,20].

Other factors which may contribute to the low response rate in our patients is the delay in the time of arrival to coronary care unit (CCU) ((only 29 patients arrived to the CCU within 2 hours)).

In our study, 47.6% of those patients who responded to treatment developed accelerated idioventricular rhythm (AIVR) 2 hours after receiving Alteplase therapy, which when compared with the criteria of reduction in the ST segment elevation showed a high specificity and predictive value and low sensitivity rate. However, the low sensitivity may not truly reflect absence of AIVR because of the fact that many of these reperfusion arrhythmias are too slow to trigger rate alarms on the coronary care unit (CCU) and often go undetected by busy nursing staff[11].

The early occurrence of a negative T wave of more than 0.1 mv (1mm) in the most abnormal infarct lead was shown to be a sign of coronary reperfusion, this result is consistent with other studies [11,12,13].Forty percent of those patients who got 50 % reduction in the ST segment elevation developed the terminal negative T wave , 2 hours after starting thrombolytic therapy . this T inversion also seems specific for reperfusion with a high predictive value but low sensitivity.

In this study, the early resolution of reciprocal changes after giving Alteplase was shown to be a sign of reperfusion with a high sensitivity , specificity and predictive value, this makes it a reliable indicator for success of thrombolytic therapy in those patients who presented with reciprocal changes on the base line ECG before starting therapy.

The presence of pathological Q wave on the base line ECG predicts a low success rate for reperfusion , this may be explained by its relation to the duration of occlusion. Its importance, even when the duration of the chest pain is known, would imply that the latter is only a crude estimate of the duration of occlusion. T inversion before treatment the presence of T inversion in the base line ECG before starting thrombolytic therapy have shown to predict a poor response to treatment, and this may be explained also by its relation to the duration of occlusion and To the fact that the presence of T wave inversion on the

presenting ECG was associated with a low TIMI 3flow rate [21,22].

Inferior MI appear to predict a better result regarding reperfusion after Alteplase therapy , and this is consistent with other studies[23] this result could be explained by the fact that inferior MI is associated with small infract size in comparison with anterior MI which is associated to a large infract size. The amount of myocardium at risk has been shown to be two fold greater for anterior than for non- anterior infarction [24,25].

The earlier thrombolytic therapy is given after MI , the more effective it should be. Soon after coronary thrombosis, there is less blood clot with fewer fibrin, shorter period of ischemia, so there will be less extensive myocardial necrosis if reperfusion is established[26,27].

Our results are consistent with the well-known benefits of early administration of thrombolytic therapy.

CONCLUSION:

In this study , further ECG changes were shown to be specific for response with high predictive value, which may make them reliable criteria for reperfusion, these included:

Early resolution of reciprocal changes is sensitive and specific with high positive predictive value for reperfusion and early appearance of accelerated idioventricular rhythm (AIVR) has
a specific predictor for reperfusion.

The presence of Q wave , T inversion on the base line ECG appear to predict poor response to treatment.

early arrival to hospital with early initiation of thrombolytic therapy is an important factor for response to treatment.

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