

# RECIPROCAL CHANGES IN ACUTE INFERIOR MYOCARDIAL INFARCTION: CORONARY ANGIOGRAPHIC RESULTS OF PATIENTS TREATED BY THROMBOLYSIS

Mehmet Rıdvan YALÇIN, M.D., Orkun GENÇOSMANOĞLU, M.D., Volkan ÖZDURAN, M.D.,  
Bülent BOYACI, M.D., Atiye ÇENGEL, M.D., Özsev DÖRTLEMEZ, M.D., Halis DÖRTLEMEZ, M.D.

Gazi University, Faculty of Medicine, Department of Cardiology , Ankara, Turkey  
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## SUMMARY :

**Purpose :** Reciprocal ECG changes are commonly observed in acute myocardial infarction. It is still debated whether these ECG findings are benign or related with worse prognosis. The aim of our study was to determine any relationship between reciprocal ECG changes and coronary angiographic findings in patients with acute inferior myocardial infarction treated by thrombolysis. In addition, we tried to find out whether reciprocal ECG changes were related to left ventricular systolic function and success of thrombolytic therapy, which are determinants of prognosis after acute myocardial infarction. **Methods :** Seventy-six patients admitted to Gazi University Hospital coronary care unit with a diagnosis of acute inferior myocardial infarction and treated by thrombolysis were included in the study. All ECGs provided before thrombolytic therapy were analyzed for ST segment changes. Coronary angiography and ventriculography were performed to patients within the first week of admission. Coronary arteries with significant stenosis, TIMI (Thrombolysis in myocardial infarction) flow level of infarct related arteries and left ventricular ejection fraction were recorded. **Results :** Forty-eight patients (63.2%) had reciprocal anterior (V1-4) ST-segment depression, while 28 (36.8%) did not. In patients with or without reciprocal ECG changes, the presence of significant LAD stenosis (37.5% vs. 28.6%), three vessel disease (25% vs. 28.6%), successful thrombolysis (66.7% vs. 78.6%), or ejection fraction (54.75% vs 57.07%) was not significantly different ( $p>0.05$ ) for all comparisons. **Conclusion :** We concluded that reciprocal ST-segment depressions in anterior ECG leads occur in majority of acute inferior infarctions and these ECG findings cannot be used to predict thrombolysis success, degree of left ventricular dysfunction, or extent of coronary heart disease.

**Key Words:** Electrocardiography, Myocardial Infarction, Coronary Angiography.

## INTRODUCTION

Acute total occlusion of a major coronary artery usually results in ST- segment elevation in the ECG leads facing the effected area of myocardium. Accompanying the ST elevations, there is ST depression in leads remote from the infarction area

in a high proportion of patients (1). During acute inferior infarction, anterior ST segment depression was noted in about two thirds of the cases in the literature and the significance of these ECG findings is still debated (2). Some studies concluded that these ECG findings only represent a

benign electric phenomenon, while some others suggested "ischemia at distance" or "more extensive ischemic area" as the cause and associated with worse prognosis.

The aim of our study was to determine any relationship between reciprocal ECG changes and coronary angiographic findings in patients with acute inferior myocardial infarction treated by thrombolysis. In addition, we tried to find out whether reciprocal ECG changes were related to left ventricular systolic function and success of thrombolytic therapy (as TIMI flow rates) which are determinants of prognosis after acute myocardial infarction.

## MATERIALS AND METHODS

### Study population

The study group consisted of 76 consecutive patients admitted to Gazi University Hospital coronary care unit with a diagnosis of acute inferior myocardial infarction, who had thrombolytic therapy over a period of one year. These patients included 66 men and 10 women with a mean age of 54 (range, 35-74 years), who had been admitted for spontaneous chest pain, which was resistant to nitroglycerin and lasted for more than 30 minutes. Their ECGs showed an ST segment elevation of more than 1 mm in at least two inferior leads (D2, D3 and aVF). None of the patients had history or ECG findings of a previous myocardial infarction. All patients received intravenous 1,500,000 units of streptokinase infusion over one hour, which was started in less than 6 hours from the onset of chest pain.

### Electrocardiographic Recordings

Patients were connected to a Petaş Kardiopet three-channel recorder. Standard 12-lead ECGs at a paper speed of 25mm/sec were obtained immediately before streptokinase infusion. All ECGs were analysed for ST-segment changes by first two of the authors independently and discrepancies were settled by consensus. ST-segment shifts in anterior precordial leads V1 -V 4 were considered to be significant if they were at least 1mm or more at 80 milliseconds from the J-point. PR segment was used as the isoelectric reference point. Patients were grouped according to presence (group I) or absence (group II) of reciprocal changes in anterior precordial leads V1 - V 4 on ECGs obtained before thrombolytic therapy.

ST-segment elevation in inferior leads were defined as minor when there was an elevation of 0.5-2mm and major when these changes were greater than 2mm to simplify comparisons.

### Angiographic analysis

Coronary angiography and ventriculography was performed within the first week of admission. The third author, without any knowledge of recorded ECGs and patients, evaluated all films. Coronary arteries with significant stenosis (50 %) and TIMI (Thrombolysis in Myocardial Infarction) flow level of the infarct-related arteries were recorded. TIMI II and III flows were accepted as successful thrombolysis. We calculated left ventricular ejection fraction using area-length ellipsoid method from single plane cineangiocardiograms obtained in the right anterior oblique projection (3).

### Statistical analysis

The results are given as mean and standard deviation. Frequencies were compared with the chi-squared test. A p value of less than 0.05 was considered as significant.

## RESULTS

The study included 76 patients with a mean age of 54±9.6 years. All patients had thrombolytic therapy within 6 hours of chest pain. Forty-eight (63.2%) of the patients had reciprocal anterior (V1-4) ST-segment depression (group I) on baseline ECG while 28 (36.8%) of the patients did not (group II). Time of thrombolytic therapy for group I and group II was not significantly different (3.08±1.18 hours vs. 3.21±1.42 hours, p>0.05). In group I thrombolysis was successful in 66.7 % (32 of 48 patients) and in group II success was achieved in 78.6% (22 of 28 patients). Coronary angiographic findings of patients are summarized in table 1. Success of thrombolytic therapy was not found significantly different in the presence or absence of reciprocal anterior ST-segment depression (p>0.05). Mean ejection fraction values were calculated as 54.75 (12.15% for group I and 57.07 ± 19.70 % for group II with no significant difference (p>0.05). Significant LAD (left anterior descending coronary artery) stenosis was present in 37.5 % (18 of 48 patients) of group I and in 28.6% (8 of 28 patients) of group II and the difference between two groups was insignificant (p>0.05). Three vessel stenosis was present in 25 % (12 of 48

	GROUP I (%) n = 48	GROUP II (%) n = 28	p value
Significant LAD stenosis	37.5	28.6	>0.05
Three vessel disease	25	28.6	>0.05
Successful Thrombolysis (TIMI II,III flow)	66.7	78.6	>0.05
Left ventricular ejection fraction (%)	54.75±12.15	57.07±19.70	>0.05

Table 1 : Coronary angiography findings of patients with (group I) or without (group II) reciprocal ECG changes.

patients) in group I and in 28.6 % (8 of 28 patients) in group II with no significant difference between two groups ( $p>0.05$ ). 38 patients had major and 38 patients had minor inferior ST-segment elevation in inferior leads on baseline ECG. Patients with major inferior ST-segment elevation had significantly more reciprocal anterior ST-segment depression (30 of 38 patients, 78.5%) than patients with minor inferior ST-segment elevation (18 of 38 patients, 47.4%), ( $p<0.05$ ).

## DISCUSSION

Interest in reciprocal ECG changes in acute myocardial infarction has yielded many findings, which have led to broadly differing inferences. Some studies have concluded that reciprocal changes represent an electrophysiological phenomenon related with an injury at the infarct site. Others assume that reciprocal changes are associated with more extensive ischemic area or larger infarction (2,4, 5).

Hlatky et al. (5) studied importance of precordial ST-segment depression during inferior acute MI in 162 patients and concluded that precordial ST-segment depression predicts a larger infarction, a higher hospital mortality, and a worse long-term prognosis after discharge. Berland and associates (2) studied anterior ST depression in inferior myocardial infarction and correlated ECG findings with result of intracoronary thrombolysis in 38 patients. Like our observation, success rate of thrombolysis was not significantly different in patients with reciprocal changes. However, in successful thrombolysis subgroup, there was improvement of regional contraction in patients with precordial ST depression as opposed to absence of change in patients without precordial ST depression. They suggested that patients with inferior MI and anterior ST depression have an extensive ischemic area rather than anterior wall ischemia. In our study, reciprocal changes were not related to presence of significant LAD stenosis and

this finding is likewise against the idea of anterior ischemia. Willems et al. (6) found higher mortality and larger infarct size in patients with large ST deviations and they suggested that large ST-segment depressions at admission in leads  $V_{1-4}$  in patients with evolving inferior myocardial infarction are indicative of large infarct. They concluded that such cases might benefit more from thrombolysis.

There are contradictory findings in other studies. Tabbalat et al. (1) tried to determine mechanism of reciprocal changes in a study including 66 patients undergoing 79 PTCA procedures. 88 % of ECGs obtained during balloon inflation showed reciprocal ECG changes, which were seen equally in patients with single and multivessel coronary disease. With another PTCA study Kracoff et al. (7) suggested that reciprocal changes are not a specific indicator of remote ischemia or multivessel disease and magnitude of ischemic changes correlates with the magnitude of reciprocal changes. In our study we observed that anterior ST depressions are detected more in patients with major inferior ST-segment elevation. Wasserman et al. (8) studied 219 patients with acute myocardial infarction with a three year follow up. Mortality was similar in patients with or without precordial ST-segment depression. Ferguson and associates (9) could not find angiographic evidence of remote ischemia in a study of 23 patients with reciprocal ST-segment depression and acute myocardial infarction. Fletcher et al. (10) with a study of myocardial perfusion imaging, supported theory that inferior ST depression in patients with transmural anterior ischemia is a reciprocal finding and does not represent inferior ischemia.

Lew et al. (11) reported that coronary artery occlusions proximal to right ventricular branch represents lower right ventricular ejection fraction, ischemia and lesser precordial ST depression than distal occlusions in acute inferior myocardial

infarction. In our study we did not determine right ventricular ejection fraction. According to ECG findings we observed 4 (8.3 %) right ventricular infarction in the group with reciprocal ECG changes and 2 (7.1 %) right ventricular infarction in the other group. 8 (34.3 %) of 23 patient with proximal right coronary artery occlusions and 20 (37.7 %) of 53 patients with distal right coronary or circumflex artery occlusions had reciprocal ECG changes. These results did not show statistical difference .

The prevalence of anterior ST-segment depression in our series was similar to previously reported inferior MI series (2). In our patients with or without reciprocal ST-segment depression, the prevalence of significant left anterior descending coronary artery stenosis was not different. With increase in magnitude of ST-segment elevation, the prevalence of reciprocal ST-depression increased as well. We conclude that reciprocal ST-segment depressions in anterior ECG leads occur in the majority of inferior MI cases, and they might represent a benign electric phenomenon. The presence of these ECG findings cannot be used to predict success of thrombolytic therapy, degree of left ventricular dysfunction, or extent of coronary heart disease.

**Correspondence to :** Dr.Mehmet Rıdvan YALÇIN  
Gazi Üniversitesi Tıp Fakültesi  
Kardiyoloji Anabilim Dalı  
Beşevler  
06500 ANKARA - TÜRKİYE  
Phone : 312 - 214 10 00 / 5629

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