

Reciprocal ST-segment changes in acute myocardial infarction

Leila Mahmoudi¹, Mahmoud M. Shabestari², Maryam Hashemian³

ABSTRACT

Objective: The presence of ST depression in electrocardiogram of a patient with STEMI may represent a reciprocal electrical effect or true remote ischemia, which has prognostic value. This study was conducted to investigate the relationship between ischemic regions through coronary angiographic findings with reciprocal ST-segment changes in acute myocardial infarction.

Methodology: From March 2007 to May 2008, 55 consecutive patients with diagnosis of acute myocardial infarction who had reciprocal ST depressions in electrocardiogram and were candidate for coronary angiography were recruited in our study. The amount of ST-segment depression at 0.08 seconds after the J point in the reciprocal leads on admission 12-lead electrocardiograms of the patients were evaluated for the quantification of reciprocal ST depressions (mm).

Results: Twenty five of 55 patients had anterior (45.5%) and 30 patients had inferior MI (54.5%). In inferior MI with 1VD, mean ST depression to mean ST elevation was 1.4. In inferior MI with multi vessel disease, mean ST depression to mean ST elevation was 2. In anterior MI with 1VD, mean ST depression to mean ST elevation was 0.25. In anterior MI with multi vessel disease, mean ST depression to mean ST elevation was 0.48.

Conclusion: Our result demonstrated a significant positive linear correlation between ST Depression/ST Elevation and the site and number of vessels with occlusion, indicating severe reciprocal ST depressions as a marker of extensive coronary artery disease.

KEY WORDS: Myocardial infarction, Electrocardiography, Coronary angiography, ST depression.

Pak J Med Sci October - December 2011 Vol. 27 No. 5 1064-1066

How to cite this article:

Mahmoudi L, Shabestari MM, Hashemian M. Reciprocal ST-segment changes in acute myocardial infarction. Pak J Med Sci 2011;27(5):1064-1066

INTRODUCTION

The ECG remains a key test in the diagnosis of acute coronary syndromes. The earliest and most consistent electrocardiographic finding during acute ischemia is deviation of the ST segment as a result of current of injury mechanism. When acute

ischemia is transmural, the overall ST vector is usually shifted in the direction of the outer layer, and ST elevations are produced over the ischemic zone. Reciprocal ST depression (RSTD) can appear in the leads sensing the contra lateral surface of the heart. Reciprocal ST Depression is known as at least one millimeter depression in the remaining electrocardiogram leads other than those showing myocardial infarction. Occasionally the reciprocal changes can be more apparent than the primary ST elevations.¹ Therefore the presence of ST depression in the electrocardiogram of a patient with ST elevation myocardial infarction (STEMI) may represent a reciprocal electrical effect², or true remote ischemia^{3,4} which has prognostic value.⁵ Jong showed that reciprocal changes in ECG can predict a left main coronary artery lesion in STEMI.⁶ As reciprocal ST depressions are common^{6,7}, this

1. Leila Mahmoudi, MD,
 2. Mahmoud M. Shabestari, MD,
 3. Maryam Hashemian, MD,
Department of Cardiology, Vaseie Hospital,
Sabzevar University of Medical Sciences, Sabzevar, Iran.
- 1, 2: Department of Interventional Cardiology, Imam Reza Hospital,
Mashhad University of Medical Sciences, Mashhad, Iran.

Correspondence:

Mahmoud M. Shabestari,
Department of Interventional Cardiology,
Imam Reza Hospital, Mashhad, Iran.
E-mail: shabestariimd@gmail.com

* Received for Publication: June 9, 2011

* Accepted for Publication: September 20, 2011

study was conducted in order to further investigate the relationship between ischemic regions revealed thorough coronary angiography with reciprocal ST-segment changes in acute myocardial infarction; a correlation which has not yet been fully clarified.

METHODOLOGY

From March 2007 to May 2008, 55 consecutive patients with the diagnosis of acute myocardial infarction who had reciprocal ST depressions in their electrocardiogram and were candidates for coronary angiography were included in our study. All consecutive patients who had suffered from chest pain for 20 minutes or its equivalent, their symptoms' onset time was less than 12 hours, and had an ST elevation ≥ 1 mm in ≥ 2 contiguous electrocardiographic leads were admitted to the Coronary Care Unit of Imam Reza general hospital or Javadolaeme hospital (Mashhad, Iran).^{8,9} To determine the amount of ST-segment depression, the admission 12-lead electrocardiogram of the patients was evaluated in the reciprocal leads, 0.08 seconds after the J point. Patients with bundle branch block or previous myocardial infarction were excluded. The location of ischemia was considered either anterior (leads I, aVL, VI through V6) or inferior (leads II, III, aVF). Coronary angiography was performed during the first 24 hours or one month after admission. The indications for performing coronary angiography in the studied patients were continuous chest pain, decreased left ventricular function or arrhythmia. The correlation between the RSTD and the location of ischemia was investigated through angiography.

The data were then analyzed using the Statistical Package for Social Sciences (SPSS, version15). Categorical data were analyzed by Chi-square, Kolmogorov-Smirnov, Fisher, t test and Tokey tests. P value < 0.05 was considered to be statistically significant.

RESULTS

Fifty five patients were enrolled in the study, 40 men (72.7%) and 15 women (27.3%), with a mean age of 55 ± 13.2 years. We assessed their medical history including diabetes, hypertension, hyperlipidemia and smoking as the most important risk factors.

Twenty five out of 55 patients had anterior (45.5%) and 30 patients had inferior MI (54.5%). The mean ST depression summation was 5.4 ± 2.8 mm in anterior MI and 13.8 ± 8.5 mm in inferior MI ($p = 0.0001$). Mean ST elevation summation was 17.9 ± 8.6 mm in anterior MI and 9.2 ± 5.9 in inferior MI ($p = 0.0001$).

Coronary angiography revealed 25 and 28 patients to have single vessel disease (SVD) and multivessel disease (MVD), respectively. Two patients had a normal angiography. 3.6% of patients were found to have left main coronary artery stenosis, 85.5% left anterior descending artery (LAD) stenosis, 61.8% left circumflex (LCX) stenosis and 55.4%, right coronary artery (RCA) stenosis.

There was no correlation between the site of ischemia and the site of occlusion in LAD and LCX; but in the proximal and midportion RCA there was a correlation. In anterior MI, 67% had one-vessel disease (1VD), 16% had two-vessel disease (2VD) and 12% had three-vessel disease (3VD) while 5% had normal vessels. In inferior MI, 26.7% had 1 vessel disease (1VD), 37% had 2 vessel disease (2VD) and 36% had 3 vessel disease (3VD) whereas 0.3% had normal vessels.

In anterior MI patients with ST elevation more than the ST depression, the patient was diagnosed with either 1VD or 2VD, but in inferior MI patients with ST elevation less than the ST depression 3VD or 2VD was detected. In inferior MI with 1VD, mean ST depression to mean ST elevation was 1.4. In inferior MI with multi vessel disease, mean ST depression to mean ST elevation was 2. In anterior MI with 1VD, mean ST depression to mean ST elevation was 0.25. In anterior MI with multi vessel disease, mean ST depression to mean ST elevation was 0.48. Finally 45% of ST depression changes were related to reciprocal changes and 55% were related to another true ischemia.

DISCUSSION

Our findings revealed that 45% of patients with ST depression represented a reciprocal electrical effect and 55% had true remote ischemia. More importantly, our data are the first to demonstrate that the proportion of ST depression to ST elevation has a numerical value which is of significance in anterior or inferior MI.

The ST changes have been regarded as reciprocal, but more recently it has been suggested that precordial ST segment depression in inferior infarction might indicate associated anterior ischemia rather than a reciprocal electrical phenomenon. Salcedo et al and Jennings et al concluded that in patients with reciprocal changes the prevalence of multivessel coronary artery disease, early mortality and cardiac morbidity are more common than patients without these changes.^{4,7} Our data proved that reciprocal changes occurring at the time of acute myocardial

infarction may suggest a more severe condition in the patient with coronary disease which is in consistent with Akhras' study that compared reciprocal ST depression changes during exercise electrocardiography with the findings in coronary angiography.¹⁰

Gipson et al showed that those patients with reciprocal ST segment changes had greater myocardial necrosis¹¹; while in another report it has been shown that there is no difference in left ventricular function in patients with and without reciprocal ST segment changes.¹² Zoghi M showed that the presence of RSTD during an acute inferior myocardial infarction may not only be an electrical phenomenon but also correlates with the presence of multivessel CAD.¹³

Murray DP believed that when assessing patients for further investigation after a myocardial infarction, the presence or absence of reciprocal changes alone is not adequate or reliable.¹⁴

Odemuyiwa showed that reciprocal ST depression during acute myocardial infarction does not predict concomitant disease in the coronary artery supplying the reciprocal territory.¹⁵ This study surely had its own limitations. The sample size was small and the simple sampling of consecutive patients assigned from two major hospitals can limit its generalizability.

In conclusion, our results demonstrated a significant positive linear correlation between the proportion of ST depression to ST elevation with the site and number of occluded vessels indicating severe RSTD as a marker of extensive coronary artery disease.

ACKNOWLEDGEMENT

We are grateful to Mashhad University of Medical Sciences for their financial support which made this project possible.

REFERENCES

- David M, Ary L. Electrocardiography. In Libby, Bonow, Mann, Zipes, editors. Braunwald's Heart disease. 8th edition. Philadelphia: Saunders; 2008: 172-183.
- Camara EJ. Reciprocal ST change in acute myocardial infarction: assessment by electrocardiography and echocardiography. *J Am Coll Cardiol* 1983;2(2):251-7.
- Shah PK, Berman DS. Implications of precordial S-T segment depression in acute inferior myocardial infarction. *Am J Cardiol* 1981;48(6):1167-8.
- Salcedo JR. Significance of reciprocal S-T segment depression in anterior precordial leads in acute inferior myocardial infarction: concomitant left anterior descending coronary artery disease? *Am J Cardiol* 1981;48(6):1003-8.
- Erdem A. The severity of ST segment elevation in acute inferior myocardial infarction: does it predict the presence of a proximal culprit lesion along the right coronary artery course? *Anadolu Kardiyol Derg* 2007;7(Suppl 1):189-90.
- Jong GP. Reciprocal changes in 12-lead electrocardiography can predict left main coronary artery lesion in patients with acute myocardial infarction. *Int Heart J* 2006;47(1):13-20.
- Jennings K, Reid DS, Julian DG. "Reciprocal" depression of the ST segment in acute myocardial infarction. *Br Med J (Clin Res Ed)*, 1983;287(6393):634-7.
- Van de Werf F. Management of acute myocardial infarction in patients presenting with persistent ST-segment elevation: the Task Force on the Management of ST-Segment Elevation Acute Myocardial Infarction of the European Society of Cardiology. *Eur Heart J* 2008;29(23):2909-45.
- Kushner FG. 2009 Focused Updates: ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction (updating the 2004 Guideline and 2007 Focused Update) and ACC/AHA/SCAI Guidelines on Percutaneous Coronary Intervention (updating the 2005 Guideline and 2007 Focused Update): a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation* 2009;120(22):2271-306.
- Akhras F, Upward J, Jackson G. Reciprocal change in ST segment in acute myocardial infarction: correlation with findings on exercise electrocardiography and coronary angiography. *Br Med J (Clin Res Ed)* 1985;290(6486):1931-4.
- Gibson RS. Precordial ST-segment depression during acute inferior myocardial infarction: clinical, scintigraphic and angiographic correlations. *Circulation* 1982;66(4):732-41.
- Croft CH. Clinical implications of anterior S-T segment depression in patients with acute inferior myocardial infarction. *Am J Cardiol* 1982;50(3):428-36.
- Zoghi M. The angiographic correlation between ST segment depression in noninfarcted leads and the extent of coronary artery disease in patients with acute inferior myocardial infarction: a clue for multivessel disease. *Can J Cardiol* 2003;19(1):67-71.
- Murray DP. Reciprocal change, exercise-induced ST segment depression and coronary anatomy: are they related in the post-infarct patient? *Clin Sci (Lond)* 1988;74(6):621-7.
- Odemuyiwa O. Reciprocal ST depression in acute myocardial infarction. *Br Heart J* 1985;54(5):479-83.