

## Reciprocal Changes in Acute Inferior Wall Myocardial Infarction - Are They Significant?

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### ABSTRACT

**Aim and Objectives :** The present study was undertaken to determine the utility of reciprocal ST-T changes in acute inferior wall myocardial infarction in prediction of coronary artery involvement by coronary angiography and to correlate these changes with outcome.

**Method :** A total of 100 patients with Acute Inferior Myocardial Infarction (AIMI) were enrolled and divided into two groups. Group 1 : consisted of 50 patients of AIMI with at least 1 mm of ST segment depression in leads V1 to V4, lead I or aVL. Group 2 : consisted of 50 patients of AIMI without ST segment depression in precordial leads, lead I or aVL. Both the groups were studied with regard to coronary artery involvement by coronary angiography and mortality at the end of 1 month.

**Results :** The mean ejection fraction in group 1 and group 2 was  $47.7 \pm 5.26\%$  and  $46.53 \pm 6.47\%$ . The mean CKMB level was  $96.28 \pm 40.90$  IU/L and  $95.76 \pm 48.43$  IU/L respectively ( $p > 0.05$ ). The cardiac regional walls hypokinesia on 2D echo and extent of coronary arteries involvement on angiography between group 1 and 2 had similar prevalence, ( $p > 0.05$ ). Reciprocal ST Segment depression in AIMI was associated with multiple coronary artery involvement than patients without reciprocal ST Segment depression, however p value was not significant. ( $p > 0.05$ ), also was not associated with significant LV systolic dysfunction. Mortality was observed in 6 patients (12%) in group 1 and 4 (08%) patients in group 2 which also was not statistically significant.

**Conclusion :** Reciprocal S-T segment depression occurs commonly during early evolution of IWMI, and that it is not generally caused by functionally important anterior ischemia, and hence it cannot be used to measure the extent of coronary artery involvement and degree of left ventricular dysfunction.

**Key-words :** Reciprocal, Myocardial infarction, Coronary artery angiography, Segment depression, Mortality

### Introduction :

Inferior wall myocardial infarction (IWMI) accounts for 40-50% of all acute myocardial infarctions and are generally viewed as having a better prognosis than Anterior wall MI<sup>1,2</sup>. ECG remains the broadly acknowledged and effectively done test for the diagnosis<sup>3</sup> Acute Myocardial Infarction (AMI).

In acute inferior wall myocardial infarction, the leads showing the greatest magnitude of ST elevation are, in descending order : leads III, aVF, and II. The vast majority (80-90%) of patients with ST elevation in these 'inferior' leads has an

occlusion of the RCA; however, an occlusion of the left circumflex artery can produce a similar ECG pattern. In addition to ST elevation in the inferior leads II, III, and aVF, reciprocal ST depression in lead aVL is seen in almost all patients with AIMI<sup>2,4,5</sup>. Reciprocal ST Segment depression (RSTD) is a typical ECG finding frequently associated with ST segment elevation myocardial infarction (STEMI).

AIMI in its early stages is usually accompanied by ST segment depression in the precordial leads. Patients with ST elevation in one myocardial zone, often have concurrent ST depression in other myocardial zones. Such ST depression may represent pure "mirror image" reciprocal changes or may be indicative of acute ischaemia due to coronary artery disease in non-infarct related arteries ("ischaemia at a distance")<sup>2</sup>. The ECG changes reflect the picture of the affected myocardial territory<sup>6</sup>. It is thought that patients of

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acute IWMI with ST depression in apico-lateral leads have more occurrence of multivessel disease with significant LV dysfunction. Reciprocal ST Depression in I, aVL suggests a possibility of RCA lesion<sup>7</sup> or an electrical mirror projection of the ST-segment elevation at a distance from the infarcted area<sup>5</sup>. These reciprocal changes have been discussed in several studies. Although most researchers agree that the origin of these reciprocal changes is purely electric, some argue that their presence is a marker for adverse prognosis<sup>5,8</sup>.

Hence the present study was done at Tertiary Care Centre to assess the significance of reciprocal ST-T changes in AIWMI and also to determine the utility of reciprocal ST-T changes in AIWMI in prediction of coronary artery involvement by coronary angiography and correlate these changes with outcome.

#### **Materials and Methods :**

A study design was a case control study. After obtaining Institutional Ethics Committee approval, this study was conducted on 100 patients with acute inferior myocardial infarction admitted in ICU of Department of Medicine and Cardiology Department, Government Medical College and Hospital & Super-Specialty Hospital, Nagpur during a period of 24 months from November 2017 to October 2019. The patients were divided into two groups : Group 1 : consisted of 50 patients of AIMI with at least 1 mm of ST segment depression in leads V1 to V4, lead I or aVL. Group 2 : consisted of 50 patients of AIMI without ST segment depression in precordial leads, lead I or aVL. Patients with history of previous myocardial infarction (documented on ECG/CAG), ECG evidence of left bundle branch block(LBBB), clinical evidence of Cor-pulmonale, suspected pulmonary embolism, associated pericardial disease, patient with congenital heart disease and left ventricular hypertrophy and also with associated anterior and lateral wall myocardial infarction, patients not consenting to participate were excluded from the study.

All patients were evaluated as per preset proforma and information was collected. A careful physical examination was done with special reference to

hemodynamic parameters like jugular venous pulse (JVP), hypotension, presence of third and fourth heart sounds and cardiac murmur. Patients were also evaluated for coronary risk factors like diabetes mellitus, Hypertension, smoking, obesity, alcohol consumption and dyslipidemia. All relevant investigations included CPKMB, lipid profile, blood sugar, renal function and liver function test were performed. In all the patients, 12-lead ECG, cardiac enzyme assay, echocardiography and Coronary angiography was done. The 12-lead ECG recordings were made at 25 mm/sec speed and 1mV=10 mm setting and monitoring was done during the stay in ICU for identification of arrhythmias and conduction blocks. A 12 leads resting ECG was recorded including leads V3R, V4R and posterior leads before and after infusion of streptokinase. All patients, on admission, received thrombolytic therapy and also, received routine coronary care therapy such as oxygen, aspirin, analgesia and sedation. Other drugs such as nitrates, beta blocker, and angiotensin converting enzyme inhibitors were added whenever needed. Complications were treated as required.

The extent of coronary artery involvement was assessed as per coronary angiographic finding. 70% stenosis of coronary artery was considered as significant involvement on angiography<sup>9</sup>. And the outcome in all patients in both the groups was assessed in the form of mortality at the end of 1 month after discharge.

**Criteria for acute myocardial infarction :** MI is defined as a clinical (or pathologic) event in the setting of myocardial ischemia in which there is evidence of myocardial injury<sup>10,11</sup>. According to the 2018 European Society of Cardiology / American College of Cardiology Foundation / American Heart Association / World Health Federation Universal Definition of MI, the following are the classic ECG criteria for the two major categories of ECG manifestations of acute myocardial ischemia<sup>11</sup>.

**1) Findings consistent with ST-elevation MI :**  
New ST-segment elevation at the J-point in two contiguous leads with the cut-points :  $\geq 1$  mm in all leads other than leads V2-V3. For leads V2-

V3 :  $\geq 2$  mm in men  $\geq 40$  years,  $\geq 2.5$  mm in men  $< 40$  years, or  $\geq 1.5$  mm in women regardless of age. This assumes usual calibration of 1 m V/10 mm.

2) **Findings consistent with non-ST elevation MI or unstable angina** : New horizontal or down sloping ST-depression  $\geq 0.5$  mm in two contiguous leads and/or T inversion  $> 1$  mm in two contiguous leads with prominent R wave or R/S ratio  $> 1$ .

**The findings on the ECG depend upon several characteristics of the ischemia or infarction including** : 1) Duration - Hyperacute, acute, evolving, or chronic, 2) Location Anterior, lateral, inferior-posterior, or right ventricle and 3) Size Amount of myocardium affected.

Diagnostic criteria for inferior wall MI<sup>12</sup> : 1) ST segment elevation in the inferior leads (II, III, aVF) and 2) Reciprocal ST segment depression in the lateral and/or high lateral leads (I, aVL, V5 & V6).

**Extent of coronary arteries involvement on angiography** : In this study to measure extent of coronary arteries involvement on angiography, 70% stenosis of coronary artery was considered as significant.

#### Statistical Analysis :

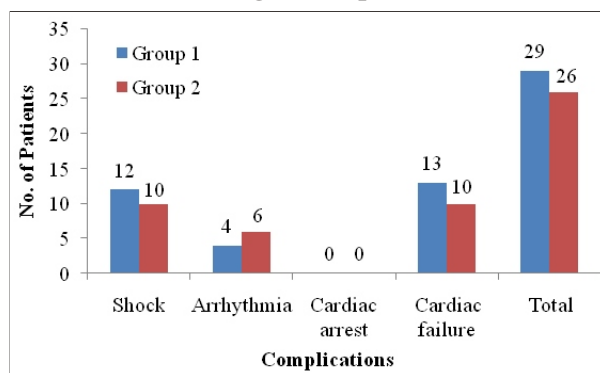
Numerical variables were described as Mean  $\pm$  SD. Categorical variables were described as percentages. Comparisons between two groups were done using student t-test. P-Value was considered significant if  $< 0.05$ .

#### Observations and Results :

In both the groups, majority of the patients were from the age group of 41-60 years. In group 1, 40 (80%) patients were males and 10 (20%) patients were females while in group 2, 35 (70%) patients were males and 15 (30%) were females, ( $p > 0.05$ ). The mean BMI of group 1 patient was  $26.15 \pm 2.93$  kg/m<sup>2</sup> and group 2 patients was  $27.07 \pm 2.96$  kg/m<sup>2</sup>, ( $p > 0.05$ ). Majority of patients had typical precordial chest pain and hypertension was the most common risk factor noted in both the group. There was no significant difference among groups

regarding haemodynamic parameters, hypertension stages, mean lipid profile, dyslipidemia and complications ( $p > 0.05$ ). **Figure 1** show the distribution of patients according to complications.

**Figure 1 : Distribution of study population according to complications**



In group 1, mean ejection fraction was  $47.7 \pm 5.26$  % and the mean CKMB level was  $96.28 \pm 40.90$  IU/L while in group 2, mean ejection fraction was  $46.53 \pm 6.47$  % and the mean CKMB level was  $95.76 \pm 48.43$  IU/L. There was no significant difference in mean ejection fraction and CKMB values between two groups, ( $p > 0.05$ ).

The cardiac regional wall hypokinesia on 2D echo and extent of coronary arteries involvement on angiography between group 1 and 2 had similar prevalence, ( $p > 0.05$ ). Prevalence of multivessel disease (DVD + TVD) was more in group 1 as compared to group 2 but not statistically significant ( $p > 0.05$ ). After angiography, management in the form of medical management, percutaneous transluminal coronary angioplasty (PTCA) and Coronary artery bypass grafting (CABG) advised between group 1 and 2 had similar prevalence, ( $p > 0.05$ ), (**Table 1**). Outcome was observed in the form of mortality at the end of 1 month. In group 1, mortality was observed in 6 (12%) patients and in group 2, mortality was observed in 4 (08%) patients, ( $p > 0.05$ ).

#### Discussion :

The significance of reciprocal ST segment depression during the early phases of acute myocardial infarction has been an area of debate,

**Table 1 : Comparison of 2D Echo, Coronary Angiography findings & Management advised in Study Subjects**

<b>Cardiac regional wall hypokinesia on 2D echo</b>	<b>Group 1 No. of patients (%)</b>	<b>Group 2 No. of patients (%)</b>	<b>P-value</b>
Inferior Wall hypokinesia	28 (56%)	29 (58%)	0.840
Inferio-septalhypokinesia	3 (6%)	3 (6%)	1.000
Inferio-septal Lateral hypokinesia	19 (38%)	18 (36%)	0.836
<b>Extent of coronary arteries involvement on Coronary angiography</b>	<b>No. of patients (%)</b>	<b>No. of patients (%)</b>	<b>P-value</b>
RCA	13 (26%)	18 (36%)	0.280
LAD	02 (04%)	01 (02%)	1.000
LCX	00 (00%)	03 (06%)	0.242
RCA+LAD	13 (26%)	07 (14%)	0.134
RCA+LCX	07 (14%)	05 (10%)	0.538
LCX+LAD	01 (02%)	02 (04%)	1.000
RCA+LAD+LCX	07 (14%)	06 (12%)	0.766
< 70 % STENOSIS	02 (04%)	04 (08%)	0.678
MINOR PLAQUE	05 (10%)	04 (08%)	1.000
<b>Multivessel coronary artery involvement on coronary angiography</b>	<b>No. of patients (%)</b>	<b>No. of patients (%)</b>	<b>P-value</b>
SVD	15 (30%)	22 (44%)	0.147
DVD	21 (42%)	14 (28%)	0.142
TVD	07 (14%)	06 (12%)	0.766
< 70% Stenosis	02 (04%)	04 (08%)	0.678
Minor plaque	05 (10%)	04 (08%)	1.000
<b>Management Advised</b>	<b>No. of patients (%)</b>	<b>No. of patients (%)</b>	<b>P-value</b>
Medical Management	06 (12%)	09 (18%)	0.401
PTCA	25 (50%)	30 (60%)	0.315
CABG	19 (38%)	11 (22%)	0.081

whether it is a sign of multivessel disease, ischemia at a distance and poor prognosis or merely a benign electrical phenomenon<sup>5,13,14</sup>. In the present study, echocardiographic assessment was performed in all study subjects. There was no significant difference in prevalence of cardiac regional walls hypokinesia on 2D echo between group 1 and 2 as per Student t-test ( $p > 0.05$ ). These findings added support to our general conclusion in patients with inferior myocardial infarction that “reciprocal” S-T depression during AMI is not usually a marker of additional ischemic depression of ventricular function. These results are concordance with the study done by *Croft et al*<sup>15</sup>. On evaluation of extent of

coronary artery involvement by angiography, we found no significant difference in group 1 and 2, this correlated well with the study done by *Tabbalat et al*<sup>16</sup>. *Yalcin et al*<sup>17</sup> concluded that reciprocal ST Segment depressions in anterior ECG leads occur in the majority of inferior wall MI cases, and they might represent a benign electrical 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. The present study also had similar results.

In the present study Reciprocal ST Segment depression in acute myocardial infarction was

associated with multiple coronary artery involvement as compared to patients without reciprocal ST Segment depression; however the p value was not significant. It is thought to represent a benign electrical phenomenon. Also, it was not associated with significant LV systolic dysfunction. The reciprocal changes cannot be used to measure the extent of coronary artery involvement and degree of left ventricular dysfunction. Similar finding have been reported in our study<sup>2</sup>.

After angiography treatment in the form of surgical or only medical management was advised to all the patients. In group 1 more number of patients were advised CABG as compared to in group 2. In group 2 more number of patients was advised PTCA as compared to in group 1. There was no significant difference in management advised between group 1 and 2 as per Student t-test ( $p > 0.05$ ). These results are not available in previous studies for comparison with our study. Outcome was observed in the form of mortality at the end of 1 month. In group 1, mortality was observed in 6 (12%) patients and in group 2, mortality was observed in 4 (08%) patients. This finding is concordant with the study done by *Yalcin et al*<sup>17</sup>.

#### Limitation of Study :

As per current guidelines routine early angiography is recommended in a time window of 3-24 hours, if there are no contraindications<sup>12,18,19</sup>. This could not be performed in current study subjects.

#### Conclusion :

The present study conclude that “reciprocal” S-T segment depression occurs commonly during early evolution of acute inferior myocardial infarction, and that it is not generally caused by functionally important anterior ischemia, and hence it cannot be used to measure the extent of coronary artery involvement and degree of left ventricular dysfunction.

#### References :

- Warner MJ, Tivakaran VS. Myocardial Infarction, Inferior. [Updated 2019 Jan 11]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470572/>
- Nour MK. Significance of reciprocal ST segment depression in ST elevation myocardial infarction. *Egypt J Crit Care Med.* 2017;5(1):23-27.
- Parale GP, Kulkarni PM, KhadeSk, Swapna A, Amit V. Importance of reciprocal leads in acute myocardial infarction. *JAPI* 2004;52:376-9.
- Quyyumi AA, Rubens MB, Rickards AF, Crake T, Levy RD, Fox KM. Importance of “reciprocal” electrocardiographic changes during occlusion of left anterior descending coronary artery. Studies during Percutaneous Transluminal Coronary Angioplasty. *Lancet.* 1986;327(8477):347-350.
- Wasserman AG, Ross AM, Bogaty D, Richardson DW, Hutchinson RG, Rios JC. Anterior ST segment depression during acute inferior myocardial infarction: Evidence for the reciprocal change theory. *Am Heart J.* 1983;106(3):516-520.
- Edmundo JN, Camara MD, Nisha Chandra MD, Pamela Ouyang MD, Sheldon H, Gottlieb MD, Shapiro Edward P. Reciprocal ST change in acute myocardial infarction : assessment by electrocardiography and echocardiography. *J Am CollCardiol* 1983;2:251-7.
- Mendes LA, Picard MH, Sleeper LA, et al. Cardiogenic shock : Predictors of outcome based on right and left ventricular size and function at presentation. *Coron Artery Dis.* 2005;16(4):209-215.
- Kracoff OH, Adelman AG, Marquis JF, Caspi A, Aldridge HE, Schwartz L. Twelve-lead electrocardiogram recording during percutaneous transluminal coronary angioplasty. Analysis of reciprocal changes. *J Electrocardiol.* 1990;23(3):191-198.
- Gould KL. Does Coronary Flow Trump Coronary Anatomy? *JACC Cardiovasc Imaging.* 2009;2(8):1009-1023.
- Jeffrey L. Anderson, M.D., and David A. Morrow MD. Acute Myocardial Infarction. *New Engl J Med.* 2017;376:2053.
- Thygesen K, Alpert JS, Jaffe AS, et al. Fourth universal definition of myocardial infarction (2018). *Eur Heart J.* 2019;40(3):237-269.
- Surawicz B, Childers R, Deal BJ, et al. AHA recommendations for ECG reading: part III. *Circulation.* 2009;119(10):e235-40.
- Mirvis DM. Physiologic bases for anterior ST segment depression in patients with acute inferior wall myocardial infarction. *Am Heart J* 1988;116:1308-22.
- Little WC, Rogers EW, Sodiums MT. Mechanisms of anterior ST segment depression during acute inferior myocardial infarction. *Ann Intern Med* 1984;100:226-9.
- Croft CH, Woodward W, Nicod P, et al. Clinical implications of anterior S-T segment depression in patients with acute inferior myocardial infarction. *Am J Cardiol.* 1982;50(3):428-436.
- Tabbalat RA, Haft JI. Are reciprocal changes a consequence of “ischemia at a distance” or merely a benign electric phenomenon? A PTCA study. *Am Heart J.* 1993;126(1):95-103.
- Yalcin MR, Gencosmanoglu O. Reciprocal changes in acute inferior myocardial infarction: coronary angiographic results of patient treated by thrombolysis. *Turkey Gazi Med J.* 1998;9:125-128.
- Steg PG, James SK, Atar D, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart J.* 2012;33(20):2569-2619.
- Costa C, Durão D, Belo A, Domingues K, Santos B, Leal M. Coronary angiography after successful thrombolysis - Is the recommended time interval of 24 h an important issue? *Int J Cardiol.* 2016;222:515-520.