Importance of Reciprocal Leads in Acute Myocardial Infarction

GP Parale*, PM Kulkarni**, SK Khade***, Swapna Athawale****, Amit Vora+

Abstract

Objectives: To study the relevance of the ECG changes in the reciprocal leads in patients with acute anterior and inferior wall myocardial infarction, with regard to culprit artery localization and left ventricular (LV) function.

Methods: Three hundred patients of acute myocardial infarction (AMI) (180 anterior, 120 inferior) aged between 30-90 years (mean age - 60 yrs; M:F - 220:80) were studied with regard to the reciprocal lead changes which were correlated with the culprit coronary artery and LV function. 285/300 (95%) patients underwent echocardiography and 62/300 (20.67%) underwent coronary angiography (CAG).

Results: In patients with acute anterior wall MI (AWMI), Q wave in inferior leads was found in 38.8% (70/180) patients. Nineteen patients underwent (CAG) and all 70 patients underwent 2D echocardiography. CAG revealed 10/19 and 9/19 patients to have single vessel disease (SVD) and multivessel disease (MVD), respectively. In presence of SVD, 80% (8/10) patients were found to have a distal/mid LAD occlusion. The echocardiography of these 19 patients showed that 15/19 (78.94%) of these had LV ejection fraction (EF) > 40% as against only 4/19 (21.05%) patients with LVEF < 40%. The echocardiographic study of patients with and without reciprocal ST depression in inferior leads more than or equal to the ST elevation in anterior leads, showed higher incidence of LV dysfunction i.e. LVEF < 40% in patients with reciprocal changes (72.05%) as compared to patients without the reciprocal changes (27.94%).

In patients with acute inferior wall MI (IWMI), anterior and lateral ST depression more than or equal to ST elevation in inferior leads was found in 80% (96/120) patients. 27/96 patients underwent coronary angiography and all 96 underwent echocardiography. Patients with ST depression in I, a VL, V4-V6 (apicolateral leads) ≥ ST elevation in inferior leads were found to have more occurrence of multivessel disease (21/27) with LVEF < 40% (50/64 i.e. 78.12%, P < 0.001). 12.5% (4/32) patients with reciprocal changes in anterior i.e. V1-V3 leads and 15% (3/20) patients without significant reciprocal changes in anterior and lateral leads had LVEF < 40%. Also, patients with ST depression in I, aVL showed higher incidence of right coronary artery (RCA) lesion (23/27) (P < 0.001).

Conclusions: Patients of acute AWMI with Q waves in inferior leads indicate a smaller infarct with higher incidence of mid/distal LAD occlusion and a relatively preserved LV function. AWMI patients without reciprocal changes in inferior leads have a better LVEF. Patients of acute IWMI with ST depression in apicolateral leads have more occurrence of multivessel disease with significant LV dysfunction. Reciprocal ST depression in I, aVL suggests a possibility of RCA lesion.

INTRODUCTION

There are many investigations, which are done in the setting of AMI, however, ECG remains the most basic and readily available, widely accepted tool for its diagnosis. The ECG findings depend upon several factors such as the stage of reversibility of the ischaemia, duration of ischemia i.e. acute or chronic, the extent of damage - transmural or subendocardial, the location of ischemia like anterior or...
inferoposterior and presence of any underlying abnormality like ventricular hypertrophy or conduction defects.

Different AMI’s have different clinical implications and prognosis; depending on the localization of infarct related artery. Hence, knowledge of EGG is of utmost importance in identifying the culprit artery and to predict LV function which helps foresee the complications of each type of AMI at the earliest in the emergency care unit.

**MATERIAL AND METHODS**

In this study, a total 300 patients with anterior (180) and inferior (120) AMI (220 M, 80 F) aged between 30-90 years (mean age - 60 yrs), admitted at the Civil hospital, Solapur (Dr. VM Medical College Hospital) and Ashwini Sahakari Rugnalaya, Solapur from August 2001 to November 2002 and subsequently managed in intensive care unit, were selected. These patients subsequently underwent echocardiography and coronary angiography with due consent from the patients for the same. Total 285 (95%) patients underwent echocardiography and 62 (20.67%) patients underwent coronary angiography. These patients were studied with special reference to reciprocal lead changes which were correlated with LV function and the culprit coronary artery.

**Inclusion criteria**

Standard 12-lead ECG was recorded on admission and those showing changes of acute myocardial infarction i.e. ST elevation ≥ 1 mm in adjacent leads with typical symptoms of myocardial infarction were selected.

**Exclusion criteria**

Patients with history of previous AMI, ECG evidence of left ventricular hypertrophy and LBBB were excluded.

**ECG analysis**

This was done by two observers blinded to the patient’s history ST segment was measured from the isoelectric line. All ST-T changes including ST elevation, ST depression were studied on admission, during hospitalization and at discharge.

**Echocardiography**

This was done using VIVID-3 echo machine of GE Vingmed. Echocardiographic findings of 285 patients of AMI were studied with special reference to segmental wall motion abnormalities and left ventricular ejection fraction measured by Modified Simpson’s method.

**Coronary Angiography**

Coronary angiography was done using Siemens system. Sixty-two patients of acute myocardial infarction, who consented, underwent coronary angiography. More than 50% luminal narrowing was considered significant and included as vessel disease. Two or more vessel disease was considered as multiple vessel disease, whereas in case of LAD, occlusion beyond the first major septal or diagonal branch was labeled as mid/distal LAD disease.

**RESULTS**

**Acute anterior wall myocardial infarction**

Of 180 patients with anterior infarction, 70 had associated Q wave in inferior leads and 110 patients had reciprocal ST-T changes in inferior leads, with 23/110 patients presenting with reciprocal changes more than or equal to ST elevation in anterior leads.

19/70 patients with Q wave in inferior leads and 12/23 patients with reciprocal changes in inferior leads more than or equal to ST elevation underwent CAG.

10/19 and 9/19 patients with Q wave in inferior leads had SVD and MVD respectively. 8/10 patients with SVD were found to have mid/distal LAD lesion (Table 1). The echocardiography of these 19 patients showed 15/19 (78.94%) patients to have LVEF > 40%. The CAG of patients with reciprocal changes in inferior leads showed 5/12 and 7/12 patients to have SVD and MVD respectively (Table 1).

An echocardiographic study of AWMI patients with Q waves in inferior leads (70 patients) and without Q waves in inferior leads (105 patients) was performed. 55/70 (78.57%) patients with Q wave in inferior leads and 52/105 (49.52%) patients without Q wave in inferior leads had LVEF > 40%, whereas 15/70 (21.43%) patients with Q waves and 53/105 (50.47%) patients without Q waves in inferior leads had LVEF < 40%, p < 0.001.

49/68 (72.05%) AWMI patients without reciprocal ST depression (≥ ST elevation in anterior leads) in inferior leads and 42/100 (42%) patients with reciprocal changes had LVEF > 40%, whereas 19/68 (27.94%) patients without reciprocal changes and 58/100 (58%) patients with reciprocal changes had LVEF < 40%, P < 0.001.

**Acute inferior wall myocardial infarction**

96/120 (80%) patients with IWMI showed reciprocal ST depression ≥ ST elevation in anterior leads in inferior leads and 42/100 (42%) patients with reciprocal changes had LVEF > 40%, whereas 19/68 (27.94%) patients without reciprocal changes and 58/100 (58%) patients with reciprocal changes had LVEF < 40%, P < 0.001.

<table>
<thead>
<tr>
<th>Total no. of patients</th>
<th>Angiographic findings</th>
<th>Echocardiographic findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SVD</td>
<td>DVD*</td>
</tr>
<tr>
<td>With Q waves in inferior leads-19</td>
<td>1 0</td>
<td>Proximal LAD Mid/Distal LAD</td>
</tr>
<tr>
<td>With reciprocal changes inferior leads - 12</td>
<td>2 8</td>
<td>5 5</td>
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*DVD - Double vessel disease; **TVD - Triple vessel disease.
found that patients with ST elevation in inferior leads in AWMI

120 99 I, aVL, V4-V6 64 01 09 12 14 (21.87%) 50 (78.12%)

ST ST

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Lesion than those without (Table 1). This is indirectly supported by Tamura A, et al. and Musselman et al. They found that patients with ST elevation in inferior leads in AWMI

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Patients of inferior infarction with ST depression in lead III > II and ST depression in leads I, aVL have more likelihood of RCA lesion (Table 3). It was found that patients with ST elevation in lead III > II and ST depression in leads I, aVL have more likelihood of RCA lesion than left circumflex (Table 3). No definite ECG features suggestive of localization of LCx as infarct related artery (IRA) could be identified.

**DISCUSSION**

Patients of anterior infarction with a Q wave in inferior leads had an equal distribution of SVD and MVD. Our small study could not differentiate SVD from multivessel disease based on presence or absence of these Q waves. However, patients with SVD were more likely to have mid/distal LAD lesion than those without (Table 1). This is indirectly supported by Tamura A, et al. and Musselman et al. They found that patients with ST elevation in inferior leads in AWMI are more likely to have lesion distal to diagonal. Thus, Q waves in inferior leads do not indicate a large infarct rather they have mid/distal LAD lesion and indicate a smaller infarct. Also, these patients had a relatively preserved LV function with 78.94% of the patients having LVEF > 40% as compared to those without a Q wave in inferior leads who were found to have significant LV dysfunction i.e. EF < 40%. It seems that when there is anterior wall MI and Q wave in inferior leads in presence of a single vessel (LAD) disease, the LAD is wrapping around the apex and supplying the inferior wall as well. Possibly, with a proximal LAD occlusion and type III LAD, the Q waves in inferior leads are masked; however, this has not been evaluated in our study and needs further clarification. When patients of anterior MI with reciprocal changes more than or equal to ST elevation in inferior leads were compared to those without, we found that former were more likely to have significant LV dysfunction. This is consistent with previous studies.

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**Table 2 : Angiographic findings in patients of inferior infarction with reciprocal ST depression in anterior leads more than or equal to ST elevation in inferior leads**

<table>
<thead>
<tr>
<th>No. of patients of IWMI</th>
<th>No. of patients with reciprocal changes in precordial leads</th>
<th>Reciprocal changes more than or equal to ST elevation</th>
<th>Coronary angiography (27 patients) findings</th>
<th>Echocardiographic findings (EF%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>99</td>
<td>I, aVL, V4-V6 64</td>
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X^2 = 13.47; P < 0.001

**Conclusion**

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than left Cx lesion. This finding correlated with the previous studies. No definite ECG features could be identified to suggest localisation of left circumflex as infarct related artery. However, there have been studies which suggest the likelihood of left circumflex artery as the culprit artery in patients with ST elevation in lead II > III and ST depression in leads I and aVL.

The limitation of our study lies in the fact that the number of patients who underwent coronary angiography was only about 58/300 (20%) of the total 300 patients. So the findings need to be corroborated by larger angiographic study. However if echocardiography is considered as an adjunct for comparative study, then the findings gain more relevance as most of the 300 patients have undergone 2D echocardiography.

REFERENCES
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