Clinical significance of inferior ST elevation during acute anterior myocardial infarction

Akira Tamura, Hajime Kataoka, Kimiaki Nagase, Yoshiaki Mikuriya, Masaru Nasu

Abstract

Objectives—To clarify the genesis and clinical significance of inferior ST elevation during acute anterior myocardial infarction.

Patients and design—A total of 106 patients with first acute anterior myocardial infarction (<6 h) were divided into two groups according to the presence (group A, n = 12) or absence (group B, n = 94) of ST elevation of ≥1 mm in at least two of the inferior leads on the admission electrocardiogram.

Results—On admission electrocardiograms, group A had a smaller summed ST deviation in the lateral limb leads than group B. On emergency coronary arteriograms, the incidence of a wrapped left anterior descending artery was higher in group A than in group B (100% vs 27%, P < 0.01). The incidence of occlusion of a left anterior descending artery distal to its first diagonal branch was higher in group A than in group B. Group A had better left ventricular ejection fraction and regional wall motion in the anterobasal and anterolateral regions in the chronic phase than group B. In contrast, regional wall motion in the diaphragmatic region was reduced to a greater extent in group A than in group B.

Conclusions—Inferior ST elevation during acute anterior myocardial infarction appears only in the presence of a combination of a lesser degree of transmural ischaemic myocardium in the anterobasal and anterolateral wall together with transmural ischaemic myocardium in the inferior wall; in all cases there was occlusion of a wrapped left anterior descending artery distal to its first diagonal branch. Patients with such an ST elevation appear to have a better in-hospital prognosis than those without it.

Methods

Patients

Between January 1989 and December 1992, 121 patients with acute anterior myocardial infarction were admitted to our hospital within 6 h of the onset of chest pain. Patients who met the following criteria were selected for this study: (1) typical chest pain lasting for at least 30 min; (2) ST elevation of ≥2 mm in at least two adjacent precordial leads; (3) abnormal elevations of serum creatine kinase and of MB creatine kinase activity; (4) no history or electrocardiographic evidence of previous myocardial infarction; (5) no electrocardiographic evidence of left ventricular hypertrophy, bundle branch block, or interventricular conduction disturbance (QRS > 0.12 s); (6) no primary valvar disease or myocardial disease; (7) no reperfusion treatment before emergency coronary angiography; (8) identification of the infarct related lesion by emergency coronary arteriography; and (9) angiographic visualisation of the entire distribution of the left anterior descending coronary artery following reperfusion treatment. There were 106 patients (80 men and 26 women, aged 36 to 81 years, mean 62 years) who met the inclusion criteria.

Standard 12-lead electrocardiograms

Standard 12-lead electrocardiograms were obtained, being recorded at a paper speed of 25 mm/s and a standardisation of 10 mm = 1 mV. The magnitude of ST elevation or depression relative to the TP segment was measured to the nearest 0.5 mm at 80 ms after the J point. Measurements were obtained by the consensus of two observers who were blinded to all clinical and angiographic information. Inferior ST elevation was defined as

Keywords: acute myocardial infarction; inferior ST elevation; prognosis after AMI

While the aetiology and clinical significance of inferior ST depression during acute anterior myocardial infarction have been investigated extensively, there are few reports concerning inferior ST elevation in such an infarction. Sapin et al recently reported that inferior ST elevation during acute anterior myocardial infarction is commonly seen in patients with a distal occlusion of a left anterior descending coronary artery that extensively supplies the left ventricular inferior wall, the so-called wrapped left anterior descending artery. However, the clinical features and in-hospital prognosis of patients with inferior ST elevation during acute anterior myocardial infarction have not been fully studied. Our objective was to re-evaluate the aetiology of inferior ST elevation during acute anterior myocardial infarction and to clarify the clinical features and in-hospital prognosis of such patients.
Table 1  Clinical characteristics

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years (SD)</td>
<td>64 (14)</td>
<td>61 (10)</td>
<td>NS</td>
</tr>
<tr>
<td>Men</td>
<td>7 (58%)</td>
<td>73 (78%)</td>
<td>NS</td>
</tr>
<tr>
<td>Time to ECG recordings, min (SD)</td>
<td>189 (75)</td>
<td>154 (76)</td>
<td>NS</td>
</tr>
<tr>
<td>Spontaneous recanalisation</td>
<td>2 (17%)</td>
<td>12 (13%)</td>
<td>NS</td>
</tr>
<tr>
<td>Good collaterals</td>
<td>3 (25%)</td>
<td>16 (17%)</td>
<td>NS</td>
</tr>
<tr>
<td>Multivessel disease</td>
<td>5 (42%)</td>
<td>23 (24%)</td>
<td>NS</td>
</tr>
<tr>
<td>Proximal LAD occlusion</td>
<td>0 (0%)</td>
<td>51 (54%)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Wrapped LAD</td>
<td>12 (100%)</td>
<td>25 (27%)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Methods of reperfusion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTCA</td>
<td>10 (83%)</td>
<td>85 (90%)</td>
<td>NS</td>
</tr>
<tr>
<td>PCI</td>
<td>6 (50%)</td>
<td>50 (53%)</td>
<td>NS</td>
</tr>
<tr>
<td>Unsuccessful reperfusion</td>
<td>1 (17%)</td>
<td>17 (18%)</td>
<td>NS</td>
</tr>
<tr>
<td>Peak CPK, IU/L (SD)</td>
<td>1789 (1339)</td>
<td>2548 (1844)</td>
<td>NS</td>
</tr>
<tr>
<td>Reocclusion rate</td>
<td>2 (17%)</td>
<td>11 (12%)</td>
<td>NS</td>
</tr>
<tr>
<td>In-hospital death</td>
<td>0 (0%)</td>
<td>6 (6%)</td>
<td>NS</td>
</tr>
</tbody>
</table>

ECG, electrocardiogram; LAD, left anterior descending coronary artery; PTCA, percutaneous transluminal coronary revascularisation; PTCA, percutaneous transluminal coronary angioplasty; CPK, creatine kinase.

ST elevation ≥ 1 mm in at least two of the inferior leads.

CORONARY ANGIOGRAPHY AND REPERFUSION THERAPY

Emergency coronary arteriography was conducted using the Judkins or Amplatz technique. Multiple projections were recorded to ensure optimal visualisation of the coronary vessels. When the infarct related lesion was totally obstructed, we gave an intracoronary injection of isosorbide dinitrate followed by an intracoronary injection of urokinase or tissue plasminogen activator. If reperfusion could not be obtained or if there was severe residual stenosis, we performed coronary angioplasty. The grade of collateral filling in the left anterior descending artery was evaluated according to the criteria of Rentrop et al.7 A good collateral was defined as grade 2 or 3. A wrapped left anterior descending artery was defined as a left anterior descending artery that perfused at least one fourth of the inferior wall of the left ventricle.3 The establishment of reperfusion was defined as in the thrombolysis in myocordial infarction trial, as grade 2 or 3 flow in the infarct related artery.8

LEFT VENTRICULOGRAMS

One month after the onset of acute myocardial infarction, the surviving patients underwent coronary arteriography and left ventriculography. Left ventriculograms were recorded in the 30 degree right anterior oblique and the 60 degree left anterior oblique view. End diastolic and end systolic endocardial contours were carefully traced by an experienced cardiologist unaware of the patient's clinical data. The global ejection fraction was calculated by the centreline method, and regional wall motion was expressed as standard deviation per chord. The anterobasal, anterolateral, apical, or diaphragmatic area was defined as chord number 1 to 20, 21 to 40, 41 to 60, or 61 to 80, respectively.

RESULTS

Admission electrocardiograms showed that 12 patients had inferior ST elevation (group A), while 94 patients did not (group B). The two groups did not differ as to age, gender, time elapsed from the onset of infarction to the electrocardiographic recording, the success rate of reperfusion therapy, or the rate of reocclusion (table 1).

ST ELEVATION IN THE PRECORDIAL AND LATERAL LIMB LEADS ON ADMISSION ELECTROCARDIOGRAMS

While the sum of ST deviation in the precordial leads on the admission electrocardiograms did not differ significantly between the two groups, at 31 (SD 13) mm versus 25 (12) mm, the sum of ST deviation in the lateral limb leads was smaller in group A than in group B: 0 (1.7) mm vs 1.7 (1.8) mm, P < 0.01 (figure).

EMERGENCY CORONARY ANGIOGRAMS (table 1)

The incidence of a wrapped left anterior descending artery was higher in group A than in group B (100% vs 27%, P < 0.01). When we investigated the site of the occlusion of the left anterior descending artery, group A showed a higher incidence of occlusion of the left anterior descending artery distal to its first diagonal branch than group B (100% vs 46%, P < 0.01).

CLINICAL VARIABLES (table 1, 2)

Peak serum creatinine kinase values tended to be lower in group A than in group B, at 1789 (1339) μl 2548 (1844) IU/l, NS. In-hospital mortality tended to be lower in group A than in group B (0% vs 6%, NS). Global left ventricular ejection fraction in the chronic phase was significantly greater in group A than in group B, at 59 (11)% vs 51 (12)% P < 0.05. Regional left ventricular wall motion in the anterobasal and anterolateral regions was less reduced in group A than in group B: 0.2 (1.0) v−1.3 (0.9), P < 0.01; and −1.0 (1.9) v−2.3 (1.5), P < 0.05, respectively. In contrast, regional wall motion in the diaphragmatic region was more reduced in group A than in group B: −0.9 (1.1) v 0.2 (1.3), P < 0.05.

DISCUSSION

We investigated the incidence of a wrapped left anterior descending coronary artery in patients with acute anterior myocardial infarc-
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