

# 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?

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## ABSTRACT

**Objective:** Acute inferior myocardial infarction (AIMI) is generally characterized by ST segment elevation in the limb leads (D2, D3, aVF). Many trials have reported the close relation between the severity of this ST segment elevation and the extent of infarction, and also the prognosis. Based on the clinical studies, several electrocardiographic (ECG) criteria have also been propounded to identify the infarct-related artery. This study was conducted to investigate the possible relation between the severity of ST segment elevation and the proximity of the culprit lesion along the right coronary artery (RCA) course in AIMI.

**Methods:** Sixty patients (31 female, 29 male) admitted to our centre with diagnosis of first AIMI were included in the study. All cases underwent coronary angiography (CAG) on the 6th day of hospitalization. Patients with non-dominant RCAs were excluded from the study. The lesion with the highest degree of stenosis along the RCA course was accepted as the culprit lesion. The RCA was divided into 3 segments: proximal portion (from ostium to the first acute marginal (AM) artery), midportion (from the first AM to the last AM), distal portion (from the last AM on). In each case, a single value (STSE) was obtained by the addition of the amplitudes (mm) of ST segment elevation in the limb leads (D2, D3, aVF) during the hyperacute stage of AIMI.

**Results:** The patients with the culprit lesions in the proximal portion of the RCA were found to have a mean STSE value of  $12.61 \pm 3.79$  mm, while the patients having the culprit lesions in the mid and distal portions were found to have mean STSE values of  $6.88 \pm 1.20$  mm and  $5.05 \pm 0.97$  mm, respectively. There was a significant positive correlation between the severity of ST segment elevation and the culprit lesion proximity ( $r=0.82$ ,  $p<0.01$  for the proximal and  $r=0.7$ ,  $p<0.05$  for the mid portions of RCA).

**Conclusion:** In AIMI, the severity of ST segment elevation and the proximity of the culprit lesion along the infarct-related RCA was found to be closely related, indicating the informative feature of ST segment elevation in the prediction of culprit lesion location. (*Anadolu Kardiyol Derg 2007; 7 Suppl 1; 189-90*)

**Key words:** ST-segment elevation, acute myocardial infarction, right coronary artery

## Introduction

Acute myocardial infarction (AMI) has always been a potential health problem due to the life-threatening complications (1). Electrocardiogram (ECG) is an important tool in determining the therapeutic strategy in acute coronary syndromes. The ECG generally confers diagnostic features in half of the cases with AMI (2). In the setting of AMI, the diagnosis of infarct-related artery is also very important with regard to the prediction of potential complications and subsequent therapeutic strategy. A couple of studies have focused on the relationship between ECG findings and infarct-related artery, but absolute ECG criteria for the definition of infarct-related artery have not been propounded up till now. In acute inferior myocardial infarction (AIMI), the infarct-related artery is right coronary artery (RCA) in 80% of cases, while it is circumflex artery (Cx) in the rest (3). The AIMI is sometimes complicated by hypotension or bradycardia. In this setting of complications, RCA is generally the infarct-related

artery. Therefore, determination of infarct-related artery in AIMI is extremely important with regard to prediction of potential complications (4).

The severity of ST segment elevation (STSE) is well known to be related to the extent of infarction and prognosis. Complications of AIMI including bradycardia and hypotension generally occur in case of proximal RCA occlusion, so it is clinically important to determine proximal RCA occlusion to predict these potential complications and outline the therapeutic strategy in AIMI. In this study, the relation between the severity of STSE and the proximity of the culprit lesion along the infarct-related RCA was investigated in patients with AIMI.

## Methods

Sixty patients (31 female, 29 male, mean age:  $52 \pm 7.8$  years) admitted to our centre with diagnosis of first AIMI were included in the study. The AIMI was defined as the presence of persistent chest pain of ischemic nature (at least 30 minutes) accompanied by

STSE of at least 1 mm in at least 2 of the inferior derivations (D2, D3, aVF) and presence of at least twofold increase in creatine kinase (CK)-MB level compared to normal baseline value. The presence of ECG findings including presence of STSEs of <1mm in the inferior derivations, STSEs in the derivations other than the inferior derivations, left ventricular hypertrophy (LVH), left bundle branch block (LBBB) and presence of conditions causing ECG changes (electrolyte disturbances, myocarditis, pericarditis etc.) were accepted as exclusion criteria. Cases admitted in the later stages (other than the hyperacute stage) were also excluded from the study. In each case, a single value of STSE was obtained by the addition of the amplitudes (mm) of ST segment elevation in the limb leads (D2, D3, aVF, 0.08 sec after J point) during the hyperacute stage of AIMI. All ECGs were evaluated by two cardiologists who were uninformed about the study design. All cases underwent coronary angiography (CAG) on the 6th day of hospitalization. Coronary angiographies were performed via Judkins technique, and evaluated by two cardiologists who were uninformed about the study design. Patients with non-dominant RCAs were excluded from the study. The lesion with the highest degree of stenosis along the RCA course was accepted as the culprit lesion. The RCA was divided into 3 segments: proximal portion (from ostium to the first acute marginal (AM) branch), mid portion (from first AM to the last AM) and distal portion (from the last AM on).

#### Statistical analysis

Comparison of proportions was performed with the Chi-square test and the Fisher's exact test. Comparison of correlation variables was performed with the Spearman's correlation test. A p value of <0.05 was considered statistically significant.

#### Results

The patients with the culprit lesions in the proximal portion (n=23) of the RCA were found to have a mean STSE value of  $12.61 \pm 3.79$  mm while the patients having the culprit lesions in the mid (n=20) and distal (n=17) portions were found to have mean STSE values of  $6.88 \pm 1.20$  mm and  $5.05 \pm 0.97$  mm, respectively. A STSE value of >9 mm was found to have sensitivity and specificity of 91.3% and 94.6%, respectively in the prediction of infarct-related proximal RCA lesion.

#### Discussion

Despite the presence of breakthrough in therapeutic strategies of acute coronary syndromes, AMI has been an important cause of morbidity and mortality. Half of AMI related deaths generally occur in the first hour and, are usually due to the ventricular arrhythmias (5). The initiation of immediate and effective therapy has considerably decreased the mortality rates of AMI (5, 6).

In addition to tachyarrhythmias, severe bradyarrhythmias and hypotension may also be encountered in AIMI, particularly when the infarct-related artery is RCA. These complications in AIMI may be due to the increased parasympathetic tone, sinoatrial (SA) node dysfunction, atrioventricular (AV) node dysfunction or accompanying right ventricular (RV) MI. The determination of infarct-related artery in AIMI may be useful to predict these complications and outline the therapeutic strategy. Electrocardiography is generally considered more sensitive in the demonstration of left anterior descending (LAD) and RCA occlusions compared to that of circumflex artery occlusion (7). Co-existence of conditions including pericarditis, myocarditis,

electrolyte disturbances, early repolarization, collateral circulation etc. may adversely effect the prediction of infarct-related artery (4).

The presence of a more severe STSE in D3 compared to that in D2 was found to have a positive predictive value of 97% in the prediction RCA occlusion in AIMI (8). This criterion to predict the RCA occlusion in AIMI was also confirmed by Yokusoglu et al (9) with a positive predictive value of 78.9%, sensitivity of 89.4% and a specificity of 50%. Birnbaum et al (10) propounded ST segment depression in aVL lead as one of the most sensitive and earliest parameter of AIMI. Berry et al (11, 12) demonstrated that ST segment depression in both aVL and D1 leads was a marker of RCA occlusion in AIMI.

In addition to the occlusion of RCA, the proximity of the culprit lesion along the course of RCA is also important with regard to the potential complications (SA node dysfunction, RV infarction etc.) in AIMI. Therefore, it is clinically important to determine the proximity of culprit lesion along RCA to predict the patients potentially at risk for AIMI related complications including bradyarrhythmias and severe hypotension. In this study, the evaluation of ST segment elevation in the inferior derivations worked well to demonstrate the culprit lesion proximity along RCA with high sensitivity and specificity in AIMI.

In conclusion; in AIMI, the severity of STSE and the proximity of the culprit lesion along the infarct-related RCA were found to be closely related, indicating the informative feature of STSE on the prediction of culprit lesion location. Further large scale studies are still required to confirm this relationship.

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