Editorial Comment

The Contribution of Additional Electrocardiographic Leads in Acute Myocardial Infraction. Aims and Benefits in Patients with Acute Inferior Wall Infarction

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Significant progress has been made in cardiology over the last decade. There have been developments affecting both diagnosis and prognosis and, in consequence, the therapeutic approach to patients with heart disease has also changed. A contributory factor has been the discovery and application of new diagnostic methods in cardiology that make the cardiologist's job much easier and enable the management of each case of heart disease individually. In recent years, we have seen the publication of many important clinical studies (multicentre or not) aimed at helping in the risk stratification of patients with heart disease in order to assess their short- and long-term prognosis as regards the occurrence of severe complications or death. As a result, the cardiologist's decision making with respect to the management of cardiac patients has been affected and the therapeutic approach to individual problems has been altered.

It is well known that in our era, compared to the last 30 years, coronary artery disease is the most frequent form of heart disease and is due to stress, lack of correct diet, incorrect management of risk factors and lack of exercise.

Many diagnostic methods have been devised and applied for the best and most accurate diagnosis of coronary artery disease, with a view to detecting myocardial ischaemia and evaluating its extent, assessing viable myocardium in patients with myocardial infarction using non-invasive methods, and locating the affected coronary vessel and the degree of its stenosis using invasive methods (coronary angiography).

In the particular case of acute myocardial infarction, the first direct diagnosis is made using the surface electrocardiogram (ECG). The information yielded by the ECG is thus of great importance, since it provides us with an initial analysis of the patient's condition. It gives us directly the location of the infarct in the walls of the heart (anterior, inferior, lateral, posterior, etc.), its extent, and basically the artery that has been occluded.

Since we can evaluate the location, the extent and the artery whose occlusion caused the acute myocardial infarction, apart from arriving at a correct diagnosis we can also predict the patient's prognosis, namely, the chances of the occurrence of complications (and of which ones) in the near future. Therefore, a detailed analysis of changes in the ST segment of the ECG can affect the way we manage the patient

and the choice of treatment (pharmaceutical or invasive), as well as indicating the urgency of any invasive therapy, given that we know the region of the myocardium that is at risk and the occluded artery. Apart from that, the ECG may show arrhythmias and the appearance of new intraventricular conduction disturbances that affect the prognosis of patients with an acute infarction.

The study of the ECG in acute myocardial infarction may be affected by the existence of earlier infarctions, the development of collateral circulation and by previous coronary bypass surgery. Attempts have been made from time to time to improve the diagnostic capability of the ECG further, especially in cases with acute myocardial infarction, as regards the location of the affected artery and the region of myocardium at risk.

Some researchers combined the ST changes from different leads in an attempt to arrive at a more precise evaluation of the severity of the patient's condition by locating approximately the point of occlusion of the affected coronary vessel. In the case of an anterior wall infarction it was clear that ST elevation in leads V_1, V_2, V_3 was indicative of this type of infarction and pointed to occlusion of the anterior descending branch of the left coronary artery. Further, this finding could indicate a proximal occlusion of the anterior descending artery if accompanied by ST elevation also in lead aVL along with ST depression ≥1 mm in lead aVF or by ST depression ≥1 mm in leads II, III, aVF. Under these circumstances, therefore, it could be diagnosed that a large region of the myocardium was at risk. In contrast, if ST elevation in leads V_1, V_2, V_3 was accompanied by ST elevation in leads II, III, aVF, this was indicative of peripheral occlusion of the anterior descending artery and a small region of myocardium at risk, with a sensitivity of 66% and a specificity of 73%. Occlusion of the anterior descending after the 1st. diagonal branch could be diagnosed when the elevations in V_1-V_3 were accompanied by non-significant ST depressions in leads II, III, aVF.[1,2]

Knowledge of the permutations of ST changes in these cases is, of course, extremely valuable, since it gives us an initial picture of the severity of the patient's condition and guides us in our choice of action. It appears that in the case of an anterior infarction the 12 ECG leads are sufficient for a precise diagnosis.

For infarctions of the inferior wall of the myocardium the arteries involved are mainly the right coronary and the circumflex arteries. In this case, the ST changes need to be able to detect the affected vessel, since the severity of an inferior infarction depends on the artery that caused it and its extent,[3] the haemodynamic complications that accompany it,[4] and the prevention of these complications when the culprit vessel is known.[5] Important research has been directed at the detection of the affected artery using combinations of ST changes in specific leads. Thus, a large ST segment elevation in lead III rather than lead II and ST depression ≥1 mm in leads I and/or aVL were found to be indicative of disease of the right coronary artery and not the circumflex artery, with sensitivity 90% and specificity 71%. When these changes were accompanied by ST elevation in lead V_1, V_4R or both, they pointed to proximal occlusion of the right coronary artery, with sensitivity 79% and specificity 100%, and a right ventricular infarction.[6,7]

ST elevation in lead III no greater than that in lead II, accompanied by ST elevation in lead aVL or ST elevation in leads I, aVL, V_5, V_6 and ST de-pression in V_1, V_2 and V_3, were findings indicative of circumflex artery occlusion, with sensitivity 83% and specificity 96%.[8]

However, in patients with an inferior infarction it is necessary to determine not only the affected vessel but also the extent of the infarct. In an inferior infarction the infarct may extend to the posterobasal, the posterolateral and another 2-3 sections,[4] in which case the region of myocardium at risk can be quite large.

With the standard 12 leads of the surface ECG detection of these regions is not certain. Although some maintain that ST changes in the form of depression on leads V_1-V_3 during the acute phase of an inferior infarction imply probable involvement of the posterolateral wall,[9] another study concluded that it is difficult to diagnose posterolateral wall involvement from the 12-lead ECG alone, especially in the case of inferior infarctions.[10] ST changes in V_1-V_3 may be related with ischaemia of the anterior wall or be concealed by right bundle branch block.

In view of the above data, other researchers[11-13] used posterior leads V_7-V_9 and determined that in this way the posterolateral wall involvement in an acute inferior infarction could be detected with greater accuracy. This observation was extremely important, because it provides a way of assessing the extent of the myocardium at risk as well as the likelihood of many severe complications, such as extension of the infarction, congestive heart failure and death.[14] Knowing of these complications, our first choice is thrombolysis, since it has been proved that a large section of the myocardium at risk can be saved, cardiac dysfunction reduced, and left ventricular remodelling

improved by an improvement in regional wall motion disturbances in the posterolateral wall, with the result that most of these serious complications may be avoided.

The correlation between radioisotope studies and the location of an acute infarction of the inferior myocardial wall is significant when it is the circumflex artery that is occluded, because the filling defects in the myocardial scintigraph relate to the posterolateral wall, which makes up an appreciable part of the whole myocardium.[15] In such cases, ST elevations on the posterior leads V_7-V_9 show the extent of the myocardium at risk for each section of the inferolateral wall.

Taking into account all these correlations and the findings of various studies, we should focus our attention on maximising our ability to diagnose individual sections of the myocardium correctly, because this will lead to an improvement in the prognosis of patients who have an inferior infarction and also to an improvement in these patients' quality of life.

Thus, I believe that the research reported in this issue by my Greek colleagues[16] is of great value. Viewing it in combination with other investigations in this field leads to the conclusion that every time a patient is admitted to the coronary care unit with an acute inferior myocardial infarction, apart from the conventional 12 ECG leads the posterior leads V_7-V_9 should also be recorded in order to determine the possible involvement of the posterolateral wall, as should the right precordial leads (especially V_3R and V_4R) so as to evaluate right ventricular involvement in inferior wall infarctions.

Furthermore, the value of these additional ECG leads in inferior infarctions is that they not only help us to achieve a more precise assessment of the infarct, but also assist in prognosis, since monitoring the changes in these leads as they steadily improve will show the patient's favourable course and response to thrombolysis or other kinds of therapy.

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