EDITORIAL COMMENT

Lead aVR, a Mostly Ignored But Very Valuable Lead in Clinical Electrocardiography*

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In this issue of the *Journal of the American College of Cardiology*, Yamaji et al. (1) report on the use of lead aVR in the diagnosis of acute left main coronary artery (LMCA) obstruction. More specifically, the investigators compare the behavior of the ST-segment in lead aVR with lead V1 in that situation. They report that in LMCA occlusion, more ST-segment elevation is present in lead aVR compared to lead V1. They also found a relationship between the amount of ST segment elevation in this lead and mortality. To study the value of these findings in predicting the presence of this condition, they compared the LMCA population with two other acute coronary syndrome populations—that is, with proximal left anterior descending (LAD) or proximal right coronary artery obstruction (RCA). They observed not only a higher incidence of ST segment elevation in lead aVR in the LMCA group but also more ST-segment elevation. The ST-segment elevation in lead V1 was less in the LMCA group than in the LAD group. The finding of ST-segment elevation in lead aVR ≥V1 distinguished the LMCA group from the LAD group with high values for sensitivity (81%), specificity (80%) and positive predictive accuracy (80%). The ST-segment shift in lead aVR and inferior leads distinguished the LMCA group from the RCA group.

The investigators (1) conclude that ST-segment elevation in lead aVR with less elevation in V1 is an important predictor of acute LMCA obstruction and that the amount of ST-segment elevation is related to patient’s outcome. These findings may be very useful in the early noninvasive recognition of this highly serious disorder, allowing prompt institution of strategies to re-open the left main coronary artery.

However, the data have to be interpreted with some caution before they can be applied in clinical practice. The study, a retrospective one, has to be confirmed in a prospective design. The number of patients was small and was collected over a long period of time. Selection bias could have influenced the enrollment of study patients. For instance, the presence of well-developed collateral circulation could have led to the exclusion of less severe cases. Also, the control groups were derived from an angiographic database, which does not represent the total population with either an LAD or RCA infarction.

Infarctions due to circumflex branch occlusion were not included. Indeed, usually that situation leads to posterolateral and inferior wall ischemia with ST-depression in lead aVR and the mid-precordial leads and ST-elevation in the inferior and the left precordial leads. However, in some cases of circumflex branch occlusion, ischemia, most pronounced in the posterobasal area, ST-elevation in lead aVR, but not in lead V1, may occur. Also, a control group with an acute coronary syndrome due to three-vessel coronary artery disease was not included, although in this category ST-elevation in lead aVR has been described (2).

POSSIBLE MECHANISMS OF ST SEGMENT ELEVATION IN LEAD AVR

The augmented limb leads were developed to derive more localized information than the bipolar leads I, II and III could offer. For this purpose from the existing limb electrodes, new leads aVR, aVF and aVL were constructed, being unipolar leads looking at the right, left and lower part of the heart with the reference electrode constructed from the other limb electrodes. Thus, the purpose of lead aVR was to obtain specific information from the right upper side of the heart, such as the outflow tract of the right ventricle and the basal part of the septum. In practice, however, most electrocardiographers consider lead aVR as giving reciprocal information from the left lateral side, being already covered by the leads aVL, II, V5 and V6. This has been the reason that lead aVR has become largely ignored.

However, as shown by the study of Yamaji et al. (1) lead aVR can be very useful in identifying LMCA obstruction. Ischemia of the basal part of the interventricular septum is the electrocardiographic explanation for the occurrence of ST-segment elevation in this lead, as suggested by the investigators (1). In this situation, owing to the dominance of the basal ventricular mass, the ST-segment vector in the frontal plane (3) points in a superior direction, leading to ST-segment elevation in leads aVR and aVL and ST-depression in the inferior leads. We also found in proximal LAD obstruction, with involvement of the first septal branch, that ST segment elevation was present in a sizable number of patients (43%) (4,5). That incidence is exactly the same as in the study from Yamaji et al. (1). In distal occlusion of the LAD, not involving the proximal septal area, no ST-elevation but rather depression in lead aVR is observed. Concerning lead V1, in proximal LAD obtur-
Acute coronary syndromes
LMCA obstruction
Unstable angina in three-vessel disease
Acute pulmonary embolism

Arrhythmias
Identification of presence and configuration of P-wave
AV dissociation in ventricular tachycardia
Diagnosis of AV nodal tachycardia and circusmovement tachycardia using a (para)septally located accessory pathway

In summary, lead aVR is a frequently ignored lead, but it can be very helpful in diagnosing a number of different clinical disease entities.

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