

Non Precordial Leads and the Level of Coronary Obstruction in Acute Anterior Myocardial Infarction: Something Clinically Useful or Only Redundant Information?

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In the acute phase of myocardial infarction, the electrocardiogram (ECG) offers valuable information about the extension of the ischemic area, so that the magnitude of ST-segment elevation in different leads usually corresponds well with the magnitude of the ischemic area and myocardial damage.¹ In relation to therapy, elevation of the ST segment definitely helps to reach the first decision about the use of fibrinolytic agents and to assess the effectiveness of rechanneling treatment.² By convention, ST-segment elevation in the precordial leads from V1 to V4 is related to ischemia of the anterior and septal territory, whereas in I and aVL it indicates involvement of the upper lateral face, and in V5 and V6 it reflects involvement of the lower lateral face. The different locations of ST-segment elevation indicate involvement of the first septal branch, especially V1, and the first diagonal branch, when I and aVL are affected.

Nevertheless, recent studies,³⁻⁸ including those of Prieto et al⁷ and Martínez-Dolz et al,⁸ which are published in the current number of the REVISTA ESPAÑOLA DE CARDIOLOGÍA, have given special attention to the information that can be obtained from leads other than the conventional leads used in anterior infarction, as a way of assessing the site of occlusion in the anterior descending coronary artery. The main contribution of these studies centers on the value of ST-segment depression in the inferior face³⁻⁹ and ST-segment elevation in aVR,⁶⁻⁸ a «forgotten» lead. The findings of these investigations indicate that ST-segment depression in the inferior face could help to identify lesions proximal to the first septal and first

diagonal branches, whereas ST-segment elevation in aVR provides selective information about lesions proximal to the first septal branch. The study of Prieto et al⁷ indicates that 77% of patients with a lesion proximal to the first septal and first diagonal branches have ST-segment depression in the inferior face, compared with 32%-42% of the patients with lesions distal to these two branches. In this study, the changes in aVR revealed even greater differences in relation to the incidence of lesions proximal to the first septal among patients with ST-segment elevation in this lead (70%) and those without it ($\geq 11\%$). Likewise, Martínez-Dolz et al⁸ report that the sensitivity of ST-segment depression on the inferior face for detecting lesions proximal to the first septal and first diagonal branches was 79% to 86% if this deviation was ≥ 1 mm at point J or ≥ 0.5 mm 80 ms from this point, with a specificity of 70% to 61%. In this study, the sensitivity for detecting lesions proximal to the first septal or first diagonal ranged from 60% to 70% for deviations ≥ 1 mm at point J or ≥ 0.5 mm 80 ms from this point, with a specificity of 70% to 65%, respectively. For these authors, however, the sensitivity of ST-segment elevation ≥ 0.5 mm in aVR was low, 36% for lesions proximal to the first septal and first diagonal branches, and even smaller for lesions distal of each of these branches. However, the specificity was very high, 90%. Although indirectly, the findings of Prieto also indicate that the sensitivity of aVR in detecting proximal lesions is less than that of ST-segment depression on the inferior face, but the specificity is high.⁷ However, the two studies do not offer quantitative information about the magnitude of ST-segment elevation in aVR or ST-segment depression on the inferior face and the possible relation with the magnitude of ST-segment elevation from V2 to V4 or in I and aVL. In fact, and judging from the results reported by Engelen et al, the changes in aVR are discrete, which is why deviations of more than 0.5 mm were assessed.⁶

Both studies have additional limitations that derive,

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to a great extent, from the fact that they were retrospective analyses of patients in which catheterization was indicated in the hospital phase. In the work of Prieto et al,⁷ the ECG showing the largest changes in the ST segment in the first 3 days was used, although it was routinely the lead recorded at admission, in the first 6 h of infarction. In this study, coronariography was performed in the first 15 days. Although it was practiced in the first 3 days in 90% of cases, the correspondence with the ECG could vary by 1 to 3 days.⁷ This is especially important in view of the fact that 59% of these patients underwent primary PTCA and another 33% underwent thrombolysis. In addition, these authors analyzed the ST segment 40 ms from point J, when 80 ms is accepted as most representative.⁷ In the study of Martínez-Dolz et al,⁸ the ECG recorded before fibrinolysis that showed the maximum ST-segment elevation was selected, but catheterization was performed about 6 days later on the average. These points are relevant whenever the analysis of the ST segment in the interval between onset of pain and ECG recording appreciably affects both the magnitude of the displacement and the number of leads affected. It also is important that the ECG analyzed precede the onset of rechanneling treatment, since this can quickly improve repolarization,^{2,8} sometimes after a sharp transitory re-elevation of the ST segment.⁹ In the two studies, the electrocardiographic criteria for inclusion were not comparable. The study of Prieto et al⁷ included patients with ST-segment elevation in V2 and V3 and the study of Martínez-Dolz et al⁸ included those with ST-segment elevation in two or more precordial leads from V1 to V6. Neither of the studies specifies the proportion of patients with ST-segment elevation in the different leads and they do not indicate the number of patients with deviations of the ST segment ≥ 1 mm.^{7,8} They also do not mention the magnitude of the average displacement of the ST segment in the patients under study. This information is relevant when small changes are being assessed, since it is possible that artifacts cannot be reliably excluded in some of the electrocardiographic tracings, particularly in a retrospective study. A final limitation is the absence of information relative to the presence or absence of recurrent angina before infarction, which could modify the magnitude of changes in repolarization as a result of the ischemic preconditioning phenomenon.

The possible utility of these electrocardiographic markers of the site of occlusion or stenosis of the anterior descending coronary artery in relation to ventricular function is not analyzed in either of the two studies,^{7,8} although it is touched upon in the study by Martínez-Dolz.⁸ Ventricular function was frankly impaired in 30% of the patients with lesions distal to the first septal and first diagonal branches, and in 17% of those with proximal lesions, and it was better

preserved in 50% and 25%, respectively.⁸ However, it is important to investigate the functional implications of these new electrocardiographic findings and to determine if they help to improve conventional assessment based on the sum of ST-segment elevations in the infarction zone.

In spite of these limitations, the information provided by both studies is interesting. In effect, this new electrocardiographic information, especially regarding ST-segment elevation in aVR, may enhance the usefulness of the ECG in identifying the site of obstruction of the anterior descending coronary artery in the context of anterior infarction. In relation to ST-segment depression on the inferior face, this information may have less practical use since these changes are merely a reciprocal expression of what is happening in I and aVL in most cases.^{3,5,6} Consequently, III, the most sensitive lead for the inferior face, reflects changes in I, and aVF reflects changes in aVL.^{3,5,6} In fact, in the study by Prieto et al the incidence of ST-segment elevation in aVL in lesions proximal to the first diagonal branch was 94%, higher than ST-segment depression in the inferior face, which was 77%, although apparently less specific.⁷

On the other hand, ST-segment elevation in aVR has drawn interest recently due to its association with serious stenosis of the common trunk^{10,11} or extensive multivessel disease in the context of unstable angina or infarction without a Q wave.¹⁰ In this sense, a more definitive interpretation of the findings of Prieto et al⁷ and Martínez-Dolz⁸ will have to await the results of comparative assessments of studies including patients with more extensive coronary artery disease to better define the meaning of these changes in anterior infarction. Recently, Gorgels et al¹² emphasized the fact that aVR provides information mainly about disturbances that take place in the right ventricular outflow tract and the lower part of the interventricular septum. Therefore, it is likely that ST-segment elevation in aVR indicates the presence of transmural ischemia in the lower septum due to occlusion of the anterior descending coronary artery before the first septal branch or the common trunk.¹²

REFERENCES

1. Maroko PR, Kjekshus JK, Sobel BE, Watanabe T, Covell JW, Ross J Jr, et al. Factors influencing infarct size following experimental coronary artery occlusions. *Circulation* 1971;43:67-75.
2. Clemmensen P, Ohman EM, Sevilla DC, Peck S, Wagner NB, Quigley PS, et al. Changes in standard electrocardiographic ST-segment elevation predictive of successful reperfusion in acute myocardial infarction. *Am J Cardiol* 1990;66:1407-11.

3. Fletcher WO, Gibbons RJ, Clements IP. The relationship of inferior ST depression, lateral ST elevation, and left precordial ST elevation to myocardium at risk in acute anterior myocardial infarction. *Am Heart J* 1993;126:526-35.
4. Tamura A, Kataoka H, Mikuriya Y, Nasu M. Inferior ST segment depression as a useful marker for identifying proximal left anterior descending artery occlusion during acute anterior myocardial infarction. *Eur Heart J* 1995;16:1795-9.
5. Birnbaum Y, Solodky A, Herz I, Kusniec J, Rechavia E, Sulkes J, et al. Implications of inferior ST-segment depression in anterior acute myocardial infarction: electrocardiographic and angiographic correlation. *Am Heart J* 1994;127:1467-73.
6. Engelen DJ, Gorgels AP, Cherieux EC, De Miunck ED, Oude AJ, Daseen WR, et al. Value of the electrocardiogram in localizing the occlusion site in the left anterior descending coronary artery in acute anterior myocardial infarction. *J Am Coll Cardiol* 1999;34:389-95.
7. Prieto JA, González C, Hernández MA, De la Torre JM, Llorca J. Predicción electrocardiográfica del nivel de la lesión en la arteria descendente anterior en el infarto agudo de miocardio. *Rev Esp Cardiol* 2002;55:1028-35.
8. Martínez-Dolz L, Arnaiz MA, Almenar L, Rueda J, Osa A, Quesada A, et al. Utilidad del electrocardiograma para predecir el lugar de la oclusión en el infarto agudo de miocardio anterior con enfermedad aislada de la arteria descendente anterior. *Rev Esp Cardiol* 2002;55:1036-41.
9. Figueras J, Bermejo B. Additional elevation of the ST segment. A possible early electrocardiographic marker of experimental myocardial reperfusion. *Cardiovasc Res* 1996;32:1141-7.
10. Gorgels AP, Vos MA, Mulleneers R, Zwaan C, Bar FW, Wellens JJ. Value of the electrocardiogram in diagnosing the number of severely narrowed coronary arteries in rest angina pectoris. *Am J Cardiol* 1993;72:999-1003.
11. Yamaji H, Iwasaki K, Kusachi S, Murakami T, Hirami R, Hamamoto H, et al. Prediction of acute left main coronary artery obstruction by 12-lead electrocardiography. ST segment elevation in lead VR with less ST segment elevation in lead V1. *J Am Coll Cardiol* 2001;38:1348-54.
12. Gorgels AP, Engelen DJ, Wellens JJ. Lead aVR, a mostly ignored but very valuable lead in clinical electrocardiography. *J Am Coll Cardiol* 2001;38:1355-6.