Electrocardiographic and Scintigraphic Imaging of Myocardial Ischemia

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The purpose of this study was to further validate the electrocardiographic imaging method we introduced previouslyinvolving inverse calculation of heart-surface potential distributions from the 12-lead ECGby means of comparison with ECG-independent evidence provided by a single photon emission computed tomography (SPECT). To perform the electrocardiographic inverse solution (using Tikhonov regularization with 2nd order regularizing operator) a torso model with 352 body-surface and 202 heart-surface nodes was used. Coefficients for deriving 352 body-surface potentials from 8 independent leads of 12-lead ECG were derived from Dalhousie Superset (n = 892) of 120-lead body-surface potential maps (BSPMs). The test set consisted of 12-lead ECGs of 31 patients from STAFF3 database (Duke University Medical Center; Lund University) who underwent percutaneous transluminal coronary angioplasty (PTCA) of either the LAD (n = 8), RCA (n = 18), or the LCx (n = 5) coronary artery and had their ischemic state investigated by SPECT. BSPMs at J point of each patient were predicted from the 12-lead ECG and used to calculate bulls-eye displays of heart-surface potentials. The latter displays were found to have the area of positive potentials that corresponded in all but 2 cases with the underperfused territory. For the LAD and LCx groups all ECG-derived bulls-eye images indicated the expected territory and were consistent with SPECT images; for the RCA group only 13/18 ECG-derived bulls-eye images indicated the expected territory, but 3/5 of these misclassified cases were consistent with SPECT images. In conclusion, our findings suggest that noninvasive electrocardiographic imaging based on just the 12-lead ECG might provide useful estimates of the regions of myocardial ischemia that agree with those provided by scintigraphic techniques.