Noninvasive identification of small single or double ischemic lesions from variations in surface cardiac electric field

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Local ischemic lesion arises as a consequence of decreased blood perfusion in the area of one of the main coronary arteries. The ischemic disease in initial state is not recognizable in ussual 12-leads ECG measured at rest conditions, but it could be detected at stress measurements of ECG by typical shifts of ST segment. In simulation study we suggested the method for identification of two simultaneous ischemic lesions from difference integral map (DIM). DIMs were computed by subtracting the QT integral of body surface potential map (BSPM) simulated for model of healthy heart and the QT integrals of BSPMs simulated for set of modeled one or two local ischemic lesions in the heart. We specified the criteria for identification two ischemic lesions solving the inverse problem of electrocardiography with two dipoles from DIM in inhomogeneous model of torso. Not only the best pair of dipoles representing the input DIM, but also the pairs representing the DIM with the relative error within 1% from the best one were taken into consideration. Using suggested criteria we were able to identify 75% cases with simultaneous two lesions and refuse all cases with small single lesions from identification. Average localisation error for identified lesions was 1.2cm (0.2-3.1cm), average error of dipole orientation was 20º (2º-57º).

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