Locating the Culprit Lesion in Myocardial Infarction by Calculation of the Injury Vector from the ECG

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Knowledge of the culprit artery in acute myocardial infarction may be helpful in triage and PCI (Percutaneous Coronary Intervention) procedures. In this paper we present a vectorcardiographically based algorithm to determine, from the ECG, the culprit artery in patients who underwent PCI and had a TIMI (Thrombolysis In Myocardial Infarction) flow 0. The location of the occlusion was determined according to the American Heart Associations 16 segment model. We collected over 800 ECGs, both from STEMI (ST Elevation Myocardial Infarction) and NSTEMI (Non STEMI) patients, taken less than 1 hour prior to the intervention, and calculated the injury vector at J+40 ms, using our ECG analysis program LEADS. We included all ECGs with injury vectors of more than 50 V, regardless whether the STEMI criteria were met or not. The ECGs were divided into a learning set and a test set, with matching numbers of ECGs in each segment. For each of the 17 segments the average injury vector spatial orientation was calculated from the learning set. ECGs from the test set were compared to these vectors by any of the 3 following methods: 1) determination of the smallest vectorial angle, 2) dividing this angle by the number of ECGs in each segment (a-priori chance) or 3) by dividing the angle by the square root of the a-priori chance. Using the IM (index of merit = sensitivity + specificity - 100) to grade performance, method 3 performed best overall. Using this method, the exact segment could be predicted in 30% of all cases. Predicting the occlusion to within one segment adjacent to the culprit segment was 60%, and predicting the culprit artery was over 70% successful.. Most of the ECGs of NSTEMI patients corresponded to culprit lesion segments 11-15, i.e. the RCx, possibly due to ST depressions in V2.