Development and Comparison of Single-parameter Indices Characterizing the Severity of Acute Myocardial Ischemia

John Wang*, James Warren, Galen Wagner and Milan Horacek

Philips Healthcare, Andover, MA, United States

Introduction: The aim of this study was to assess both the sensitivity and specificity of two single-parameter indices of ischemia severity (—ST— and ST-RMS) for 5 lead-triplets: Frank-leads/X,Y,Z; V2,V5,aVF; V2,V5,III; V3,V5, III; and V3,V6,III, each derived from 7 subsets of Mason-Likar (M-L) 12-lead ECG using only limb leads and two precordial leads (V1,V3; V1,V4; V1,V5; V2,V4; V2,V5; V3,V5; V3,V6). Our hypothesis was that a single-parameter index using derived Frank orthogonal leads would be the best. Methods: Regression coefficients for deriving 5 lead-triplets from 7 sets of predictor leads were developed from the Dalhousie Superset consisting of 120-lead ECGs from 892 subjects. The test dataset was the STAFF3 database, consisting of M-L 12-lead ECGs acquired for 99 patients before and during episodes of acute ischemia induced by balloon-inflation angioplasty. We compared the tested ischemic indices to detect ischemic state by varying their threshold values and constructing receiver operating characteristic curves (ROC). Ischemia-detection ability was assessed as an area under the entire ROC curve (AUC) and, in addition, as an area under the ROC curve in the useful range of specificity, between 80% and 90% (AUC80-90). Results: The averaged AUC performance results for the 5 triplets derived from the 7 sets of dual-precordial leads are (in the format of: Derived triplets/AUC from —ST—/AUC from ST-RMS): Frank-leads/88.36/88.84; V2,V5,aVF/88.62/86.47; V2,V5,III/89.40/87.51; V3, V5,III/90.38/90.33; and V3,V6,III/90.45/90.25. The best-performing triplets of derived leads are V3,V5,III and V3,V6,III. The ranking for AUC80-90 values is about the same. Conclusions: We conclude that the currently used indices of ischemia using pseudo-orthogonal triplet of leads V2,V5,aVF, as well as those using Frank orthogonal leads X,Y,Z are outperformed in ischemia detection by indices based on triplets V3,V5,III and V3,V6,III. It should be noted though that the differences in performance are small and thus our results should be corroborated on a larger study population.