Identification of Repolarization-Alternans Time Occurrence Improves Discrimination of Abnormal Cases

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Repolarization alternans (RA) is a promising noninvasive index for risk stratification. Although RA is characterized by its amplitude and the instant of its occurrence along the JT segment, the amplitude in the only parameter generally used to discriminate abnormal (RA+) cases. Assessment of the role of RA localization is the aim of the present study. ECG recordings from 201 coronary-artery-disease (CAD) patients and 167 control-healthy (CH) subjects from the THEW database were analyzed by means of our heart-rate adaptive match filter (AMF) method. RA was parameterized in terms of amplitude (RAA; V) and delay (RAD; ms), defined as the difference between the T-wave apex instant and the RA instant. Therefore, positive and negative RAD values indicate an RA occurring before and after the T-wave apex, respectively. RA parameters distributions over the CH population were used to define an RA normality region delimited by three thresholds, one for the non-negative RAA ($THR_{RAA;}$ equal to the 99.5th percentile), and two for RAD (THR_{RADmin} and $THR_{RADmax;}$ equal to the 0.5th and 99.5th percentiles, respectively). Compared to our CH subjects, our CAD patients showed higher mean RAA (CAD: 19$\pm$9 V, CH: 17$\pm$5 V; P$<$0.05) and comparable mean RAD (CAD: -33$\pm$37 ms, CH: -27$\pm$23 ms; P$>$0.05), though characterized by higher variability. The RA normality region, delimited by $THR_{RAA=35}$ V, $THR_{RADmin=-82}$ ms, and $THR_{RADmax=28}$ ms, allowed identification of 36 (17.9%) RA+ CAD patients, of whom 11 (5.5%) were characterized by abnormally high RAA, 22 (11.0%) by abnormally low RAD (4 having simultaneously abnormally high RAA), and 7 (3.5%) by abnormally high RAD. Only 3 CH subjects (1.8%) were found to be at the verge of abnormal conditions. Our results demonstrate that our RAD parameter plays a relevant role in discriminating RA+ cases occurring early ($RAD¡THR_{RADmin)}$ or late ($RAD¿THR_{RADmax)}$ in the repolarization segment.