Improving the Microvolt T-wave Alternans Peak by changing the T-Wave Search Window Duration

[1]Thais Winkert, [2]Paulo R. Benchimol-Barbosa, [1]Jurandir Nadal

[1]Universidade Federal do Rio de Janeiro and [2]Universidade do Estado do Rio de Janeiro
Rio de Janeiro, Brazil

Microvolt T-wave Alternans (MTWA) is a risk marker for sudden death. The classical method (CM) quantifies MTWA by detecting T-wave peaks in consecutive sinus beats. The alternative Hilbert Transform approach (HT) quantifies MTWA with comparable performance. Because HT relies on beat-to-beat T-wave pattern alternation, MTWA quantification may depend on T-wave search window (TSW) length. This work investigated the impact of the TSW length on alternans peak in HT and CM. ECG signals of five controls and nine high SCD risk subjects from Physionet T-wave Alternans Database were analyzed. Signals were 30 Hz low-pass filtered and had baseline drifting corrected. regular QT interval (QTr) was assessed using triangle area approach. TSW was set from 80 ms after Q-wave to 25 ms after T-wave endpoint and tapered by a straight line connecting the extremes. TSW length was recursively shortened sample-by-sample and T-wave peaks detected. In CM, alternans peak (AP) was measured at 0.5 beats per cycle of 128 peaks series Fourier spectrum. In HT, 128 consecutive TSW were concatenated, and series envelope calculated. AP occurred at half the fundamental beat-cycle frequency of the Fourier spectrum. Both APs were calculated in all TSWs. The endpoint of the TSW corresponding to the maximum AP was employed to calculate a putative QT interval (QTp). AP was calculated in all leads and compared between methods by correlation analysis. QTp and QTr were compared by Friedman's test. Alpha error level was set at 0.05. AP and QTp showed good correlation between methods (respectively, 0.92 and 0.85; $p<0.05$ for both) although peak amplitudes were different (left figure). QTr vs. QTp correlations for CM and HT were, respectively 0.71 and 0.71 ($p<0.05$ for both). QTp-CM and QTp-HT were equivalent, and both larger than QTr (right figure). AP is maximized slightly after T-wave endpoint, indicating an optimal TSW for MTWA.