Baseline drifting correction for automated MTWA measurements

T Winkert[1], P R Benchimol-Barbosa[12] and J Nadal[1]
[1] Biomedical Engineering Program, COPPE Institute, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.
[2] Hospital Universitário Pedro Ernesto, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil.
E-mail: thaiswinkert@peb.ufrj.br, ecgar@yahoo.com, and jn@peb.ufrj.br

Non-invasive risk stratification markers have been considered as an attempt to reduce sudden cardiac death (SCD) cases in subjects at high cardiac risk. Microvolt T-Wave alternans (MTWA) is an early marker of SCD risk and is defined as T-waves microvolt amplitudes variation. Usually, MTWA tests are carried out in noisy environments, and baseline drifting and other interferences are expected to contaminate the signal. Baseline drifting correction methods may add artifacts at ECG signals, masking low amplitude oscillation, as MTWA. This work assesses the impact of baseline drifting removal (BLDR) by two approaches, applied for automated MTWA measurement. A real ECG beat was used to synthesize a signal with controlled baseline drifting, respiratory fluctuations, and MTWA. The classical BLDR approach (CA) estimates baseline signal (BLS) using ECG fiducial points: two points in the T-P segment and the Q-wave onset. The time-space cancellation approach (TSC) is used to cancel the segment between T-Waves and the middle points at these cancelled segments were used. Both BLS were estimated by continuously interpolated points throughout the whole signal and BLDR was performed by deducting BLS from the synthesized ECG. The alternans spectrum (0 to 0.5 beats-per-cycle) from both corrected signals was compared with the spectrum of the ECG without baseline drifting by cross-correlation. The analysis at the alternation frequency, 0.5 cycles-per-beat, showed a higher correlation between the spectrum calculated from TSC (0.63), as compared to the correlation of the spectrum from CA (0.14). In respiratory rate, both correlations were high and similar (0.69 and 0.60). The low correlation in MTWA frequency between the signal without baseline drifting and the signal calculated using CA indicates that this approach may add artifacts to ECG that interferes with MTWA oscillation. The TSC signal showed a high correlation in MTWA frequency and has the potential to overcome CA limitations.