Changes in T-peak-to-T-end Morphology Measured by Time-Warping Are Associated with Ischemia-Induced Ventricular Fibrillation in a Porcine Model

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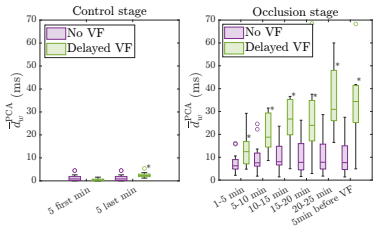
Background and Aim: Dispersion of ventricular repolarization reflected on the T-peak-to-T-end interval (T_{pe}) has shown potential in predicting arrhythmic risk, being less influenced by the presence of ischemia than the early part of the T wave. A time-warping-based index, d_w, quantifying changes in the morphology from the peak to the end of the T wave, has previously demonstrated utility tracking short-time changes in dispersion of repolarization induced by ischemia in humans. This work assesses the value of d_w as predictor of ventricular fibrillation (VF) episodes in a porcine model of myocardial ischemia.

Methods: ECG recordings from 26 pigs undergoing a 40-minute coronary occlusion were analyzed, together with their control recordings, acquired immediately before occlusion. The d_w series was obtained by quantifying the morphological differences between the final part of the T wave at different stages of the occlusion and the final part from a reference T wave from the control recording. Results were compared by groups according to the VF-susceptibility.

Results: During control recordings, d_w remained stationary with a median value [IQR] of 1.76 ms [1.80 ms]. During artery occlusion, d_w followed a well-marked gradual increasing trend as ischemia progressed, with median of 15.47 ms [18.53 ms]. At the 20-to-25 min period after occlusion onset (and at 5 min prior to VF episode) d_w averages were significantly higher in the VF group than in the non-VF group (Kruskal-Wallis test), with median values of 40.0 (and 34.4) vs 7.8 (and 7.7) ms, with p-values of 0.002 (and 0.001), respectively.



Comparison of d_w averages, for the VF subgroup (green color) and non-VF subgroup (purple color), measured in different 5 minutes segments.

Conclusion: The time-warping-based morphology marker, d_w, restricted to T-peak to T-end interval, allows to monitor ischemia-induced changes. Larger dynamic increase of the d_w index during ischemia progression is associated with VF occurrence and suggest further clinical studies in humans.