Dynamics of T-peak-to-T-end Morphology Changes in an Open-chest Porcine Model, and its Relation to Arrhythmic Events

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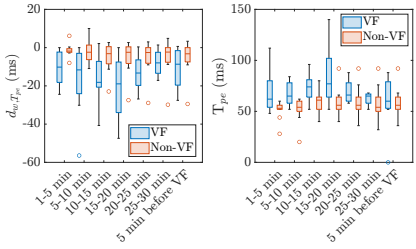
Introduction: T-peak-to-T-end interval (T_{pe}) based indices have shown value in quantifying the increase in ventricular repolarization dispersion (VRD) that has been associated with ventricular arrhythmias (VA). A time-warping-based index, $d_{w,\mathrm{T}_{pe}}$, quantifying morphology changes within the T-peak-to-end interval, has previously demonstrated utility in predicting VA in a 40-min porcine infarction model. This work assesses the contribution of $d_{w,\mathrm{T}_{pe}}$ as predictor of ventricular fibrillation (VF) episodes in a long-time open-chest porcine infarction model.

Methods: Oclussion and pre-occlusion (control stage) body surface ECG recordings from 20 pigs undergoing a 40-minute open-chest coronary occlusion were analyzed. The $d_{w,\mathrm{T}_{pe}}$ index quantifies the morphological differences between the T_{pe} morphology at different stages of the occlusion and at the control preoclussion recording. Results were compared with the classical T_{pe} interval.

Results: From 20 pigs, 8 suffered a delayed (later than 7 min from oclussion) VF episode (VF-group). $d_{w,\mathrm{T}_{pe}}$ remained stationary at control recordings, with a median [IQR] values of 0 [1.87] ms. During occlusion, the absolute value of $d_{w,\mathrm{T}_{pe}}$ followed a gradual increasing trend as ischemia progressed. At 0-5, 5-10, 10-15 and 15-20 minutes after the occlusion onset, $d_{w,\mathrm{T}_{pe}}$ absolute median values were significantly higher in the VF group than in the non-VF group (Kruskal-Wallis test), with values of 10.2, 11.7, 18.2 and 19.0 vs 1.8, 2.4, 3.2 and 2.4 ms, and p-values of 0.017, 0.041, 0.045 and 0.013, respectively (see Figure). The T_{pe} index did not present significant differences in any of the intervals between VF and non-VF groups.



Evolution of $d_{w,\mathrm{T}_{pe}}$ (left) and T_{pe} (right) throughout the occlusion period in pigs suffering (blue) and not suffering VF (red).

Conclusion: The time-warping-based morphology index, $d_{w,\mathrm{T}_{pe}}$, can monitor ischemia-induced changes. Larger dynamic increase of the $d_{w,\mathrm{T}_{pe}}$ index during ischemia progression is associated with VF episodes and suggest the need further clinical studies in humans.