

# Time-warping analysis of the T-wave peak-to-end interval during ischemia as arrhythmia risk marker

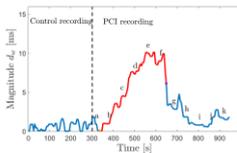
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**Introduction.** Ischemic events are associated with an increased dispersion of ventricular repolarization, and its related ventricular arrhythmia risk. Time-warping-based shape markers ( $d_w$ ) have been incorporated into T wave repolarization analysis trying to capture global morphological variations. This work proposes to use the  $d_w$  marker, estimated only in the T-wave peak-to-end interval, to capture ischemia-induced dispersion of repolarization. Restricting the analysis to the later area of the T wave avoids the influence of ST segment elevation/depression in the early part of the T wave.

**Methods.** ECG from the 101 patients in the STAFF-III database acquired during elective balloon percutaneous coronary intervention (PCI), lasting for an average of 4 minutes, were analyzed, together with their baseline recordings. Spatial Principal Components Analysis were used to generate a transformed lead emphasizing T-wave. A methodology for continuous Mean Warped T-Wave (MWTW) estimation along the recordings together with a reference MWTW election criteria was developed to compute the  $d_w$  series. A normalized marker,  $R_d^{PCA}$ , comparing  $d_w$  changes during PCI relative to those at control recordings, was proposed, providing information on the magnitude of change generated by ischemia.

**Results.** T-wave changes during PCI, were accompanied by  $d_w$  changes with average value at the end of the occlusion of 7.38 ms (standard deviation: 5.25), and following a gradually increasing trend as inflation time progresses (see Figure). On the contrary,  $d_w$  during control recordings remains stable with average value of 1.07 ms (standard deviation: 0.21). In average, 24% of the maximum  $d_w$  measured at PCI completion was reached after the first third of the occlusion. After the second third, up to 40% of the maximum change was measured. Repolarization changes appeared during the PCI procedure in the total study population,  $R_d^{PCA} > 1$  in all the studied patients.



*Time course of  $d_w$  along control and PCI recordings for a particular patient. Red line represents the balloon inflation interval.*

**Conclusion.** The T wave time-warping shape marker,  $d_w$ , based on the late T wave phase allows to monitor ischemia-induced repolarization dispersions changes.