

Noninvasive unipolar electrogram T-wave upslope is an accurate marker of local refractoriness in explanted hearts with drug-induced repolarization dispersion

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Background: The relationship between T-wave morphology in local unipolar electrograms (UEGs) as mapped with noninvasive electrocardiographic imaging (ECGI) and local repolarization time (RT) has not been validated in pronounced RT dispersion.

Purpose: To study the time of upslope of the T-wave (T_{up}) in epicardial UEGs mapped with ECGI as a marker of time of local refractoriness (t_{refr} , a surrogate for RT) in intact hearts with RT dispersion.

Methods: Six pig hearts were Langendorff-perfused with selective perfusion of the LAD artery and submersed in a torso-shaped tank containing 256 electrodes on the torso surface (panel A). RT was prolonged in the non-LAD regions by infusing dofetilide ('Dof') and shortened in the LAD region using pinacidil ('Pin'). T_{up} was determined in both invasive UEGs (recorded with epicardial electrodes) and in noninvasive UEGs (reconstructed with ECGI). Programmed stimulation was used to determine t_{refr} , defined as the shortest coupling interval with capture. Both metrics were determined relative to the common pacing spike.

Results: In all six hearts, selective dofetilide and pinacidil infusion resulted in delayed t_{refr} and T_{up} in the non-LAD region, and shortened invasive t_{refr} and noninvasive T_{up} in the LAD region, respectively (panel B and C). Over all 59 observations, T_{up} showed high agreement with t_{refr} (values close to line of identity, panel D) with strong correlation ($r = 0.91$). This finding was independent of T-wave polarity (positive, negative or biphasic).

Conclusion: The moment of steepest upslope of the T-wave in a noninvasively reconstructed UEG accurately reflects end of local refractoriness in intact hearts, in case of pronounced RT dispersion. Under these circumstances, when local RT is defined by moment of re-excitability (allowing to link it to conduction block and re-entry), ECGI T-wave upslope can be taken as a truthful marker for local RT.

Abstract Figure. Results

