Comparing Inverse Reconstructed Endocardial and Epicardial Activation and Recovery with Invasive Electroanatomic Mapping

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Introduction: Electrocardiographic imaging (ECG*i*) offers a non-invasive tool to visualize the functional aspects of the electrophysiological substrate, potentially assisting in risk stratification of patients with arrhythmogenic cardiomyopathy (ACM). Nevertheless, our Equivalent Diple Layer (EDL) based ECG*i* method is yet to be validated for cardiac repolarization. In this study, we aim to validate our EDL based ECGi method for ventricular activation and repolarization during sinus rhythm on the epicardium and endocardium with invasive electroanatomic mapping (EAM).

Methods: Seven ACM (n=4) and myocarditis (n=3) patients underwent endocardial and epicardial EAM and ablation. Activation times (AT) were annotated as the maximal amplitude in bipolar signals and repolarization times (RT) as the steepest upslope in unipolar signals. RTs could only be evaluated in 5/7 patients due to insufficient data quality. For ECG*i*, patients underwent 67-lead body surface mapping and cardiac imaging. Our equivalent dipole layer based ECG*i* method was improved by simulating the His-Purkinje system for ventricular activation and anatomical based gradients for ventricular repolarization. EAM AT/RT ranges and earliest/latest depolarized/repolarized areas were compared with ECG*i* maps.

Results: ATs showed similar ranges in EAM and ECG*i* maps (median 102 vs 105 ms), while RTs differed slightly (median RT 126 vs 99 ms). In 6/7 patients, the first and last activated area matched between EAM and ECG*i* maps. Regarding repolarization, the earliest area matched in 3/5 patients while the latest area matched in 4/5 patients. In the EAM and ECG*i* maps of ACM patients, the right ventricle was the latest activated and repolarized area (**Figure**) whereas the left ventricle was the latest repolarized area in patients with myocarditis.

Conclusion: This proof of principle study indicates the potential aid of ECG*i* in identifying the electrophysiological substrate, not only for ventricular activation but also repolarization. Upon successful validation, ECGi could potentially serve as a valuable tool for risk stratification in ACM.

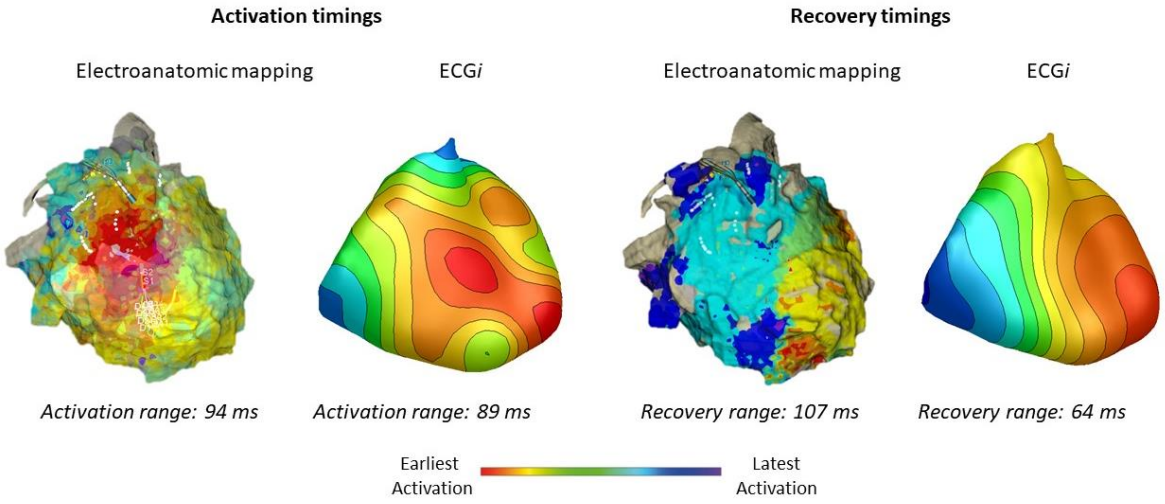

Figure Example of the epicardial activation and repolarization EAM and ECGi map of an ACM patient. Both maps are displayed in the anterior-posterior view form red (early) to blue (late).