

The Impact of Electrograms Types and Conduction velocity Estimation Techniques on Assessments of Conduction velocity during Ventricular Substrate Ablation

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Background: Identifying targets during substrate ablation of ventricular arrhythmias remains challenging. Conduction velocity (CV) mapping has the potential to identify critical regions of ventricular substrate ablation. However, it is unknown how electrogram choice and methodology affects CV estimation. We aimed to test these effects in a control population for patients with structural normal hearts and idiopathic ventricular ectopy.

Methods: Omnipolar mapping (Abbott Medical, Inc.) was performed using the HD-grid for patients with structurally normal hearts undergoing ventricular ectopy ablation. Omnipolar, bipolar and unipolar electrograms (EGMs) were exported, together with wavefront speed (Abbott omnipolar algorithm), and local activation times (LAT). LAT were interpolated to a 2mm resolution mesh using inverse distance weighting interpolation. CV was assessed using four methods: 1. Omnipolar wavespeed (Abbott); 2. local gradient estimation from the interpolated LAT field; 3. Fitting a planar wavefront to LAT measurements; 4. Fitting a circular wavefront and estimating CV. CV estimates were compared between methods, and between type of EGMs.

Results: We analysed a total of 25 maps for 5 cases. The overall mean CV did not depend on EGM or technique (t-test showed no significant differences). Gradient, Mean \pm SD (m/s); Omnipolar 0.62 ± 0.04 , bipolar 0.62 ± 0.045 unipolar 0.66 ± 0.3 . Fitting a planar wavefront; Omnipolar 0.92 ± 0.09 , bipolar 0.93 ± 0.1 , unipolar 0.99 ± 0.1 . Fitting a circular wavefront; Omnipolar 0.92 ± 0.09 , bipolar 0.93 ± 0.08 , unipolar 1.02 ± 0.1 . However, the median pointwise difference between EGMs and across techniques is large. Omnipolar (m/s); wavespeed vs gradient: 0.51, wavespeed vs fitting planar: 0.37, gradient vs fitting planar: 0.43. Bipolar; wavespeed vs gradient: 0.51, wavespeed vs fitting planar: 0.39 gradient vs fitting planar: 0.44. Unipolar; wavespeed vs gradient: 0.46, wavespeed vs fitting planar; 0.39 gradient vs fitting planar: 0.46.

Conclusion:

In structurally normal hearts undergoing ablation, the type of EGM recording does not affect the estimation of sinus rhythm CV. CV estimation technique has a large effect on CV maps calculated during ventricular substrate mapping.