Propagation Direction for Enhanced Accessory Pathway Localization: In Silico Heart Model Evaluation

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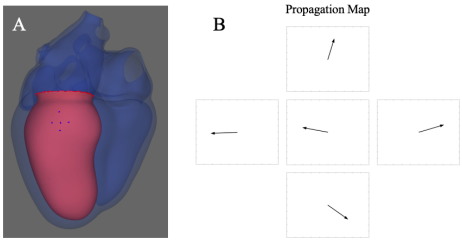
Aim: Wolff-Parkinson-White syndrome represents the most common abnormality of accessory pathways. During ablation surgery, doctors typically use mapping catheters like the Advisor™ HD Grid, from Abbott that provides electrogram (EGMs) signals to try to localise the accessory pathway and ablate at that point. Current indicators lack precision, often causing excessive tissue ablation. This study aims to improve accessory pathway detection by developing models and extracting parameters to enable accurate ablation.

Methods: Previous research involved constructing a detailed model of whole-heart electrophysiology customized for an individual subject to simulate a realistic normal sinus rhythm. Accessory pathways were inserted into the electrically-isolated basal heart surface as conductive paths. A new HD Grid modeling method was developed to extract near-accessory pathway surface uEGMs, replicating surgical procedures. To assess nearby intracavitary signals, 2x2 electrode arrays were used, computing cross bipolar (bEGM) and omnipolar (oEGM) electrograms in the locations specified in Figure 1.A, with the middle location as the accessory pathway termination. Finally, using the two-dimensional representation of the cross bEGMs signals, we determined the propagation direction as the maximum vector in this vector field.



Results: The model extracted EGM signals closely resembling clinical data, ensuring a reliable study to determine the accessory pathway location. The propagation direction from cross bEGM signals was the key parameter for locating the accessory pathway. Its location corresponds to where its propagation direction differs most from neighboring areas.

Conclusion: The propagation direction has proven to be a valuable indicator of the termination site of the accessory pathway.