Activation pattern during his pacing: how close are we to normal physiology?

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Background: His bundle pacing aims to mimic the activation pattern of normal conduction to maintain ventricular synchrony. However, selective His capture can be challenging, and the activation sequence during His pacing may not replicate normal conduction.

Purpose: Compare the right ventricular (RV) and left ventricular (LV) activation pattern in sinus rhythm and His bundle pacing.

Methods: Baseline LV and RV map was created in sinus rhythm using Rhythmia mapping system (Boston Scientific Corporation) in canine animal model. Medtronic 3830 lead was placed near the bundle of His under fluoroscopic, intracardiac echocardiogram, and electroanatomic guidance. Conduction system capture was confirmed by observing a QRS duration $<$120ms and an isoelectric segment between pacing artifact and QRS on surface ECG. Repeat LV and RV activation map was obtained during His pacing. Average QRS, HV and pacing to V intervals were calculated with standard deviation.

Results: Mapping was performed successfully in four animals. At baseline, the average QRS duration was 44±2.6ms and HV interval was 32±4.2ms. Earliest site of myocardial activation was in the mid-septal LV region. The earliest RV myocardial activation was also at the septum closer to the apex, but later than the LV (Figure1A). With His pacing, the average QRS duration was 70±17.0ms and the average stim to V interval was 31±8.7ms. During His pacing, the earliest site of activation was in the RV septum, with an activation pattern from base to apex in both the RV and LV.

Conclusion: Unlike normal physiology, the activation pattern during conduction system pacing is from base to apex with earliest site in the RV.

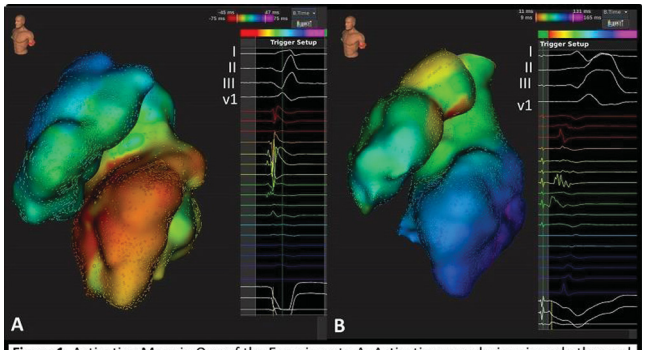

Figure 1. Activation Maps in One of the Experiments. A=Activation map during sinus rhythm and normal conduction with surface and Intra-cardiac electrograms at earliest site. Fascicle signals seen in yellow with earliest ventricular activation in left ventricle at mid-septum. B= Activation map during His bundle pacing and with surface ECG and intra-cardiac electrograms. Earliest site of activation was in right ventricle.