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Meeting abstract

307 MRI-guided atrio-ventricular node ablation in swine models using MRI tracking

Ehud J Schmidt*[1], Aravinda Thiagalingam[2], Andre d'Avila[2], Godtfred Holmvang[2], Renee Guhde[3], Robert D Darrow[3], Jeremy D Dando[4], Scott Peterson[4], Richard P Mallozzi[3], Charles L Dumoulin[3] and Vivek Y Reddy[2]

Address: [1]GE Healthcare ASL, Newton, MA, USA, [2]Heart Center, Massachusetts General Hospital, Boston, MA, USA, [3]GE Global Research, Niskayuna, NY, USA and [4]Saint Jude Medical, Minnetonka, MN, USA

* Corresponding author

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Introduction

MRI-guided navigation, Electro-Physiological (EP) voltage mapping of the left ventricle, as well as mapping and Radio-Frequency Ablation (RFA) at the Pulmonary Vein/Left Atrium junction, were previously demonstrated in swine models (references [1-3]). This study is an extension of the MRI-tracked technique, using simultaneous multiple-catheter tracking, to locate, perform RFA and verify ablation of the Atrio-Ventricular (AV) node, with electrical and MRI signatures. AV node ablation is a treatment component for types of arrhythmia, usually followed by pacemaker implantation.

Purpose

To perform AV node ablation in an MRI scanner, utilizing clinical grade MRI-tracked catheters. To demonstrate MRI-guidance advantages in anatomic imaging and in the rapid post-delivery monitoring of the extent of ablation injury.

Methods

Intubated swines (n = 3) were used. Pre-procedural MRI included 3D ECG-gated MR Angiography and 3D wall motion Cine, which were reformatted and 3D rendered into navigational roadmaps. A 4-micro-coil MR-tracked sheath was advanced to the Right Ventricle (RV). A 5-microcoil MRI-tracked deflectable bipolar EP catheter, equipped with a 4 mm ablation tip, was passed through the sheath and used for ECG mapping and ablation. An additional tracked EP catheter was advanced into the RV and intra-cardiac ECG pacing commenced. The AV node was located by navigating on short-axis images to its assumed anatomic position, with physical contact verified electrically (Figure 1A). A slow drip of Gd-DPTA contrast was started. RFA was performed with a noise-filtered RFA generator. AV node block and ablation were confirmed on the ablation catheter's ECG signal. Following RFA, 2 mm slice contrast-enhanced 3D Myocardium Delayed Enhancement (3DMDE) was performed. Gross histology was performed following sacrifice.

Results

Locating the AV node was a lengthy procedure (> 20 minutes). Catheter voltage (Figure 1B) and high-resolution 3D MDE (Figure 1C) demonstrated the AV node ablation rapidly (< 2 minutes). Histology verified well-positioned ablation lesions. Total node blockage was achieved in 2 pigs, partial in 1 pig.

Conclusion

MRI-tracked AV node ablation, simultaneously visualizing 3 catheters at 12–15 frames per second, is feasible.

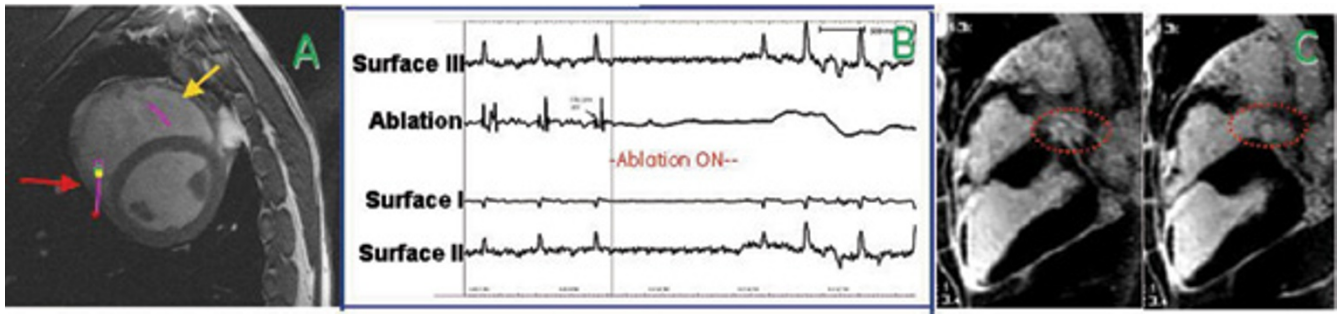

Figure 1
(A) Short-axis Cine slice with overlaid EP catheter (Red arrow) and pacing catheter (Yellow arrow) before AV node ablation (B) Electrical signals from the Ablation catheter and three Surface lead ports prior to, during RF ablation (Ablation ON region) and post-ablation, demonstrating complete AV node destruction, as seen via a lack of ECG signal at the Ablation catheter post-ablation (C) Two 3D MDE images post-ablation, showing hyper-enhanced ablated node (red dotted lines).

References

1. Dukkipati , *et al.*: *Circulation* 2005.
2. Thiagalingam , *et al.*: *HRS Proceedings* 2007.
3. Schmidt , *et al.*: *SCMR Proceedings* 2007.