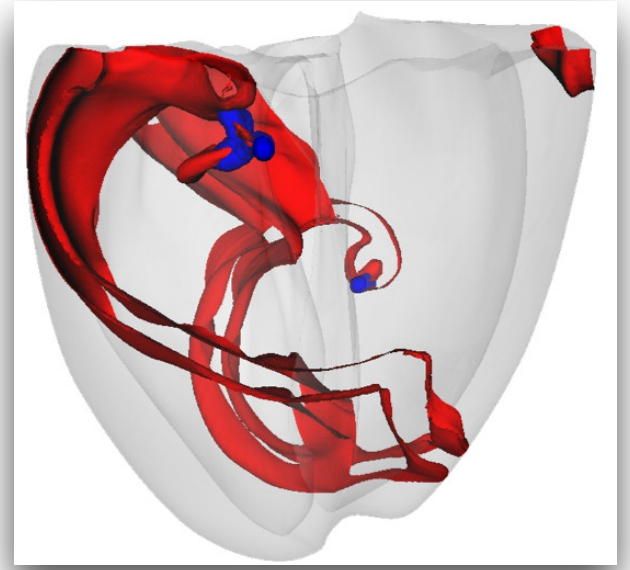

Image-based Modeling of Cardiac Tachyarrhythmias

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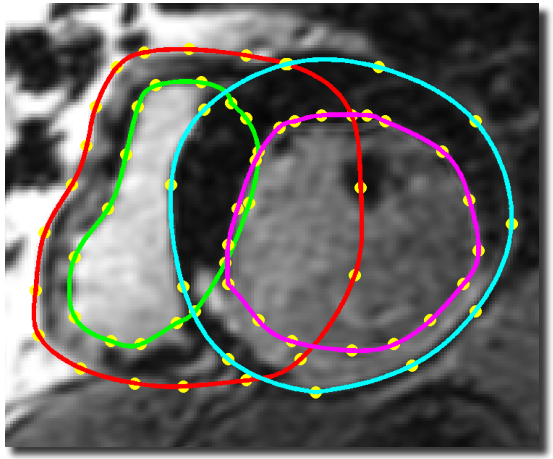
VEPL Project

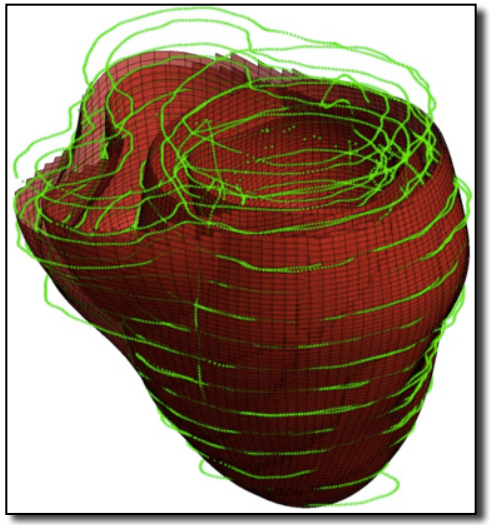
Modeling of VT in Hearts with Infarction

Patient MRI

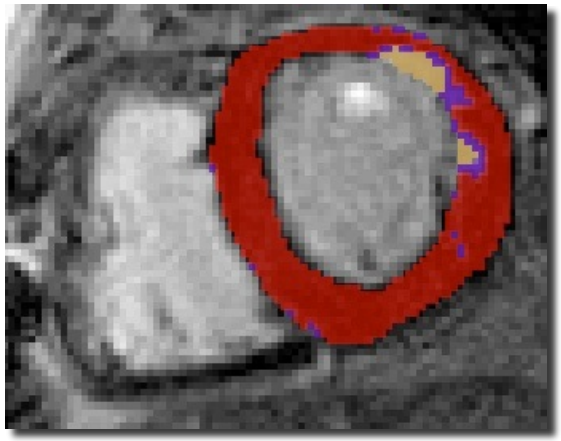
Anatomy Segmentation



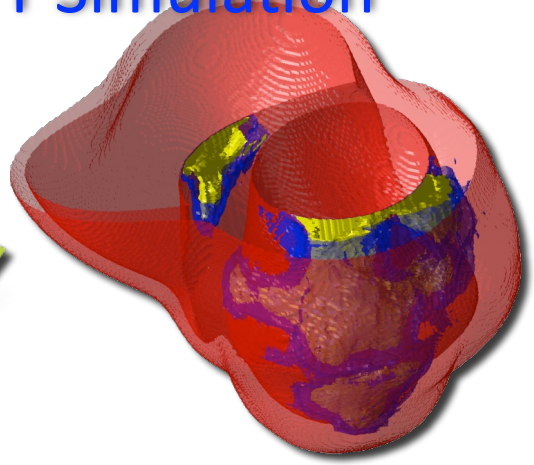
Volume Reconstruction



Infarct Segmentation



VT Simulation



Retrospective Feasibility Study

Feasibility of image-based simulation to estimate ablation target in human ventricular arrhythmia

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BACKGROUND Previous studies suggest that magnetic resonance imaging with late gadolinium enhancement (LGE) may identify slowly conducting tissues in scar-related ventricular tachycardia (VT).

OBJECTIVE To test the feasibility of image-based simulation based on LGE to estimate ablation targets in VT.

METHODS We conducted a retrospective study in 13 patients who had preablation magnetic resonance imaging for scar-related VT ablation. We used image-based simulation to induce VT and estimate target regions according to the simulated VT circuit. The estimated target regions were coregistered with the LGE scar map and the ablation sites from the electroanatomical map in the standard ablation approach.

RESULTS In image-based simulation, VT was inducible in 12 (92.3%) patients. All VTs showed macroreentrant propagation patterns, and the narrowest width of estimated target region that an ablation line should span to prevent VT recurrence was 5.0 ± 3.4 mm. Of 11 patients who underwent ablation, the results of image-based simulation and the standard approach were consistent in 9 (82%) patients, where ablation within the estimated target region was associated with acute success (n = 8) and ablation outside the estimated target region was associated with failure (n = 1). In 1 (9%) case, the results of image-based simulation and the standard approach were inconsistent, where ablation outside the estimated target region was associated with acute success.

CONCLUSIONS The image-based simulation can be used to estimate potential ablation targets of scar-related VT. The image-based simulation may be a powerful noninvasive tool for preprocedural planning of ablation procedures to potentially reduce the procedure time and complication rates.

KEYWORDS Image-based simulation; Ventricular arrhythmia; Catheter ablation; Cardiac MRI; Computer simulation

ABBREVIATIONS 3-D = 3-dimensional; **ECG** = electrocardiogram/electrocardiographic; **EPS** = electrophysiology study; **HZ** = heterogeneous zone; **ICD** = implantable cardioverter-defibrillator; **LGE** = late gadolinium enhancement; **LV** = left ventricular; **MI** = myocardial infarction; **MRI** = magnetic resonance imaging; **SI** = signal intensity; **VT** = ventricular tachycardia

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Progress: 1st Patient Enrolled