

Cardiovascular MR Imaging: Pushing the Limits - Part 1: CMR in Cardiac Arrhythmias /MRI in Atrial Fibrillation

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Highlights

- ☑ Skeletal muscle contains two types, Type I (red) and Type II (white).
- ☑ Intramyocellular lipids (IMCL) are metabolically active 'droplets' near the mitochondria of skeletal muscle cells.
- ☑ Extramyocellular lipids (EMCL) are arranged uniformly distributed in muscle tissue, but their spectral pattern signal increase disproportionately in the presence of adipocytes.

Target Audience: Individuals interested in visualizing the applicability of CMR in cardiac arrhythmia treatment.

Objectives: Demonstrate the advantages of using CMR in helping treat patients with Atrial Fibrillation (AF).

Purpose: Use CMR to help identify structurally remodeled diseased tissue (SRM) in the left atrium (LA) of patients who have AF. Techniques, such as LGE-MRI, can also be utilized to identify and quantify scar formation in the LA post radiofrequency ablation (RFA).

Methods: Patients with AF undergo a 3D LGE-MRI prior to and post RFA. In all DE-MRI images, the epicardial and endocardial LA borders were manually contoured with image display and analysis software in Corview (Marrek, Inc., Salt Lake City, UT). The relative extent of contrast enhancement was quantified within the LA wall using a threshold-based algorithm based on pixel intensity distribution. Qualitative confirmation of LA fibrosis was quantified as a percentage of LA wall enhancement on LGE-MRI and stratified into 4 stages (Class I = <10%, Class II = 10-<20%, Class III = 20-<30%, Class IV = >30%).

Results: Advanced SRM stage was associated with increased LA volume, and a trend towards higher prevalence of female gender. The prevalence of hypertension was similar across the four stages whereas diabetes was more prevalent in stages III and IV compared to stages I and II. Recurrent arrhythmias (failed ablations) occurred in patients with higher SRM scores.

Discussion: We report that LGE-MRI can detect SRM in patients with AF as healthy atrial myocardium becomes fibrotic. For catheter ablation of AF, restoration of sinus rhythm is shown significantly less likely as the remodeling process advances.

Conclusion: These findings suggest that MRI can improve the selection process and outcome for patients being considered for AF ablation procedures.