# Atrial Tissue Response to Radio Frequency Ablation: MRI Based Characterization of Injury

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Introduction

Atrial fibrillation (AF) can be treated via percutaneous catheter ablation. However, when ablation does fail the cause can be difficult to determine. Recent advances in late gadolinium enhanced (LGE) MR imaging can aid the assessment of ablation induced lesions non-invasively. To capitalize on the information available in these images, lesions must be accurately detected and displayed in a manner that will allow interpretation of lesion extent and continuity. Our group and others have found that mapping the 3D MRI data onto a surface model of the left atrium (LA) provides an intuitive visualization for clinical interpretation. However, detection of ablation injury has largely depended on pixel intensity thresholding strategies that do not account well for noise and are subject to the arbitrary selection of thresholds. We sought to generalize the detection of scar by characterizing the shape of profiles transverse to the LA tissue in the LGE-MRI images.

Methods

The LA endocardial border was defined in 3 LGE-MRI scans acquired 3 months post ablation. These segmentations were used to generate triangulated surface models of the LA in the MRI coordinate space. A line profile of the LA tissue was generated at each node of the models by sampling the MRI at regularly space intervals orthogonal to the surface (+/- 4 mm). Additionally, an experienced reader manually segmented regions of scar in the LA wall. Applying Principal Component Analysis (PCA), we projected each profile onto the first and second components in order to identify those profiles that crossed regions of scar.

Results and Discussion

The projection of profiles onto the first PCA component showed a significant difference ($p < 0.05$) between scar profiles and the entire population of profiles. Early evidence indicates that PCA of line profiles can effectively categorize scar and normal tissue.