Novel imaging approach may assist in predicting success of treatment for atrial fibrillation

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University of Utah researchers have developed a magnetic resonance imaging (MRI)-based method for detecting and quantifying injury to the wall of the heart's left atrium in patients who have undergone a procedure to treat atrial fibrillation. The results of the study are published in the Oct. 7, 2008, issue of the *Journal of the American College of Cardiology*.

Atrial fibrillation (AF) is an arrhythmia, or abnormal heart rhythm, that involves the heart's two upper chambers, or atria. One effective method of treating AF is radiofrequency (RF) ablation. In RF ablation, mild, painless radiofrequency energy is used to destroy carefully selected heart muscle cells to stop them from conducting extra electrical impulses. Previous research suggested scar formation within the left atrium (LA) after RF ablation helps to predict the success of the procedure in preventing the recurrence of atrial fibrillation.

"Until now, there has not been an accurate, non-invasive way to assess LA scar formation," said lead author Nassir F. Marrouche, M.D., assistant professor of internal medicine in the University of Utah School of Medicine and director of the Atrial-Fibrillation Program. "We have developed a novel MRI-based method to detect and measure the extent of LA wall scarring and, potentially, predict the success of RF ablation in patients with atrial fibrillation."

MRI is a medical imaging technique that utilizes a powerful magnetic field to create detailed images of the body. In this study, Marrouche and his University of Utah colleagues developed a technique for using a non-invasive method called delayed-enhancement cardiovascular MRI (DE-CMRI) to create 3-D images of the left atrium both before and after RF ablation in patients with atrial fibrillation. They processed and analyzed these images using custom software tools and then used computer algorithms to calculate the extent of LA wall injury.

Marrouche and his colleagues found that all patients who underwent RF ablation showed evidence of left atrium wall injury on MRI three months after the procedure. The pattern of tissue injury correlated with the areas where the radiofrequency energy was applied during RF ablation, and thus, was presumed to reflect tissue scarring. Marrouche and his colleagues also found patients with a higher percentage of LA wall injury were more likely to be free of arrhythmia than patients with lower percentages, suggesting the degree of scarring is linked to the likelihood of success in the RF ablation procedure.

"DE-CMRI is an established method for evaluating the tissues of the heart after a heart attack," said Marrouche. "But performing DE-CMRI to detect left atrium wall injury is challenging because the wall of the left atrium is so thin."

The 3-D technique used by Marrouche and his colleagues achieves a much greater imaging resolution than the two-dimensional technique typically used to evaluate the extent of tissue damage after a heart attack or in other cardiac disease processes. Marrouche and his colleagues also developed methods of processing the MRI images in order to visualize the entire volume of left atrium wall injury in 3-D.

The novel visualization technique and analysis developed by Marrouche and his colleagues potentially could help doctors improve planning for

RF ablation procedures by making it easier to identify the heart muscle cells that need to be destroyed. Improved localization and isolation of these heart muscle cells would likely lead to a reduction in the recurrence rate of AF.

"The benefit of 3-D MRI is that it visualizes the entire LA wall," said Marrouche. "And, it is safe and non-invasive, so it can be repeated without significant risk to the patient."

Source: University of Utah