Left Atrial Volume Measurements Before and After Left Atrial Ablation for the Treatment of Atrial Fibrillation

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Introduction: Recent studies have demonstrated the usefulness of CMR imaging in the management of patients with cardiac arrhythmia [1,2]. CMR imaging allows for more accurate measurement of various cardiac dimensions [3]. Radio-frequency (RF) ablation is effective in symptomatic, drug refractory Atrial Fibrillation (AF). Reported success rates of the procedure vary significantly with AF recurrences ranging from 25-40%. Significant changes in left atrium (LA) volumes have previously been documented in patients who have undergone ablation therapy.[4] However, these studies have relied on simple two dimensional measurement techniques and did not specify how much time post ablation the volumes were measured. More accurate three-dimensional measurement techniques and the serial follow up of LA volume have been lacking and need further investigation. **Thus the aim of this study is to evaluate LA volume measurements using CMR based angiography before and after left atrial RF ablation therapy for treatment of atrial fibrillation in order to assess LA reverse remodeling over time.**

Methods: 53 patients (45 of whom underwent a single RF ablation procedure and stayed in sinus rhythm and 8 of whom went back into AF and had to undergo repeat ablation procedures) underwent CMR evaluation before and after ablation procedure. Contrast enhanced MR angiography (MRA) with 0.1mmol/kg of Multihance contrast agent (Bracco Diagnostics) was performed in each of these patients on a 3T MR scanner (Verio, Siemens Healthcare, Erlangen, Germany). Typical scan parameters were - axial image volume, TR/TE: 2.8/1.0ms, FOV: 400x400x110, voxel size: 1.25x1.25x2.5mm, bandwidth=800 Hz/pixel, GRAPPA with R=2. LA volumes were accurately calculated using a novel software program (Corview), which allows for segmentation and single slice analysis of individual MRA images as seen in Figure 1. The segmentations were then used to compute the three-dimensional volume of the LA. Data from different acquisitions of MRA at the following time-points were used – Pre-ablation, Immediately Post ablation (<30 hours post), 3 months and 6 months post ablation. The volumes of the LA at various time points were normalized to the volumes measured pre-ablation.

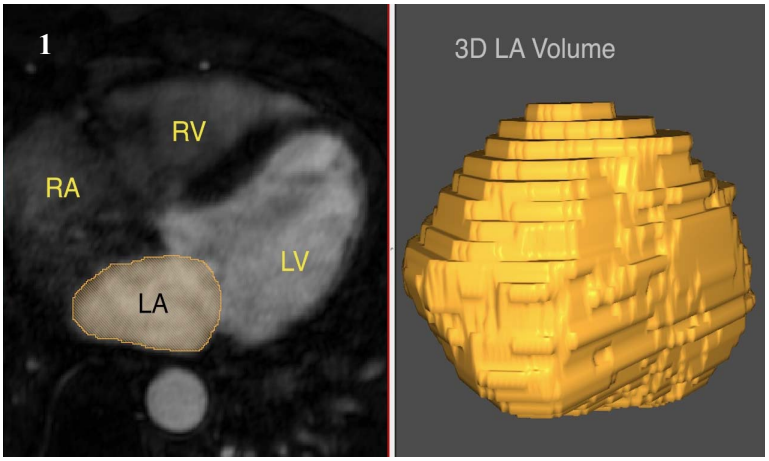

Figure 1. Corview segmentation software and volume computations.

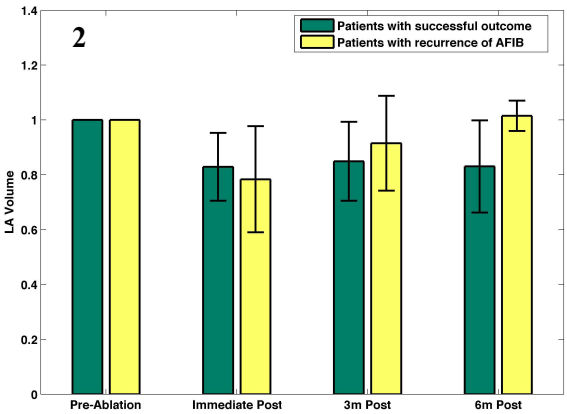

Figure 2. Left atrial volumes measured at various time intervals and normalized to the baseline volumes. The green bars represent patients who remained in sinus rhythm and yellow bars represent patients who experienced recurrent atrial fibrillation.

Results: Accurate LA volumes were estimated using the Corview software program over multiple time points post ablation. It was observed that the LA volume reduced in the patients that were in sinus rhythm after the procedure and stayed the same even 6 months post ablation. However, for the patients that went back into AF, the LA volume increased to higher than the pre-ablation value by the time 6 months had passed since the ablation procedure, as seen in Figure 2.

Conclusions/Discussion: CMR imaging in conjunction with newer software capabilities can more accurately measure cardiac chamber volumes. It is interesting to note that the LA volume as a function of time post ablation procedure may be used as a predictor for procedure outcome.

References: 1) Vergara GR, et.al., J Cardiovasc Electrophysiology 2011; 22: 481-7. 2) Daccarett M, et.al., Expert Rev Cardiovasc Ther, 9(1), 105-11. 3) Bellenger N, et.al., European Heart J 2000; 21: 1387-1396, 4) Jahnke C, et.al., Int J of Cardiol 2010 Sep 7.

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