Patients with Histologically Abnormal Left Atrial Myocardium Demonstrate Greater Left Atrial Late Gadolinium Enhancement

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Introduction: Detection of the arrhythmic substrate in patients with atrial fibrillation (AF) is important and the presence of pre-existing scar may predict recurrence for patients undergoing pulmonary vein (PV) isolation (1,2). While the gold standard for detecting fibrosis is histology (3), voltage mapping is a standard clinical tool (4), in which low voltage indicates fibrosis. Recently, late gadolinium enhancement (LGE) cardiovascular magnetic resonance (CMR)(5) has also been used to detect fibrosis in the left atrium (LA)(1,2). Pre-existing scar in AF patients may be less apparent than scar resulting from an infarction or ablation, having only partial enhancement. Here we sought to compare the enhancement patterns of healthy subjects and AF patients prior to minimally invasive maze (a surgical procedure to isolate PVs). For the pre-maze patients, resection of the LA appendage (LAA) provided a histological sample of the LA.

Methods: The LA in 9 healthy young subjects (controls) and 13 pre-maze patients were imaged with a 3D LGE sequence (6), 15-25 minutes after injection of 0.2mmol/kg Gd-DTPA. The blood-wall contrast-to-noise ratio (CNR) in the LA posterior wall (LA PW), left inferior PV (LIPV) ostia, right inferior PV (RIPV) ostia, and in the region of brightest enhancement on the LA wall ("bright point"- LA BP) was measured by a blinded observer. Blood pool signal was measured using a large region of interest, with noise measured in the air-space adjacent to the anterior wall. In patients undergoing minimally invasive maze, the LAA was resected and a sample was sent for histological analysis using gross inspection and hematoxylin and eosin stain. Differences were tested using a paired two-tailed t-test without Bonferroni correction.

Results: Figure 1 compares LA images from pre-maze subjects with (A) and without (B) LAA fibrosis. CNRs were similar in pre-maze patients and healthy controls, except for LA BP CNR (p=0.04), which was higher in controls (Figure 2). By histology, 4 pre-maze patients were determined to have fibrosis, 5 additional patients had other non-normal findings (myocyte hypertrophy or fibroadipose tissue), and 4 patients had unremarkable normal myocardium. The LA PW CNR trended higher (p=0.06) in patients with LAA fibrosis (N=4) by histology, compared to patients without (N=9). The RIPV (p=0.003), LA PW (p=0.006), and LA BP (p=0.04) CNRs were all higher in patients with abnormal findings (N=9) vs. those with normal myocardium (N=4) (Figure 3).