

Is Fat-suppression Necessary to Evaluate Remodeling in the Left Atrium with Late Gadolinium Enhancement?

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Target Audience: The MR-Electrophysiology community.

Introduction: High spatial resolution late gadolinium enhancement (LGE) cardiovascular magnetic resonance (CMR) is currently used to evaluate left atrial (LA) remodeling and post pulmonary vein isolation (PVI) scar of patients with atrial fibrillation (AF) (1,2). LGE uses fat-suppression, which is considered necessary for visualizing enhancement due to scar/remodeling, since the thin LA wall is covered in fat. Without fat-suppression, partial-voluming of opposed-phase fat and scar could result in less conspicuous scar enhancement. To understand the impact of fat-suppression on image quality and identification of LGE, we compared water-only and water-fat opposed-phased LGE images, obtained from dual-echo Dixon LGE scans of patients prior to a 1st PVI.

Methods: CMR imaging was performed on a 1.5T scanner (Achieva, Philips Medical Systems, The Netherlands). Twelve pre-PVI subjects were imaged, after providing informed consent. A 3D ECG-triggered, NAV-gated, two-point Dixon LGE sequence was used, without a fat-suppression pulse, with the following parameters: TR/TE1/ Δ TE/ θ =6.3ms/2.3ms/2.3ms/25°, bipolar readouts without flyback, sequential ky-order, 176ms window, 340 mm FOV, 1.5 x 1.4 x 4mm³, zero-filled to 0.625 x 0.625 x 2 mm³. Water-only images were reconstructed using methods described by Ma et al (3). An 18 segment model of the LA (4 quadrants around each pulmonary vein (PV), the posterior LA wall, and the inter-atrial septum) was used to evaluate enhancement by a blinded observer (1=prominent enhancement, 0=mild or absent enhancement). Agreement on enhancement per region was assessed.

Results Figure 1 compares opposed-phase and water-only images. Table 1 shows agreement by blinded analysis. Agreement between water-only and opposed-phase LGE was found in 87% of PV regions. Using water-only as the gold standard, 1st echo Dixon had a sensitivity and specificity of 61% and 93%. Of 28 discordant sectors, 9 (32%) were judged to be equivalently enhanced in both image sets upon re-inspection, while 19 showed true discordance (agreement of 91% upon un-blinded re-inspection). The majority of disagreements (11/19) upon re-inspection were caused by underestimation of enhancement by opposed-phase LGE.

Conclusion: Surprisingly, opposed-phase LGE (i.e. LGE without fat-sat) and water-only Dixon LGE agreed well. However, some sectors showed true discordance, and further study is necessary in a larger group, and with inclusion of post-PVI patients. Fat-suppression may not be an absolute requirement for LA LGE. **References:** 1) Peters, D.C., et al. Radiology, 2007. 243(3): p. 690-5. 3) Ma J, Magn Reson Med, 2004. 52(2): p. 415.

Table 1: Agreement on presence of enhancement.

	Water-only	
Opposed-Phase	Yes	No
Yes	23	13
No	15	165

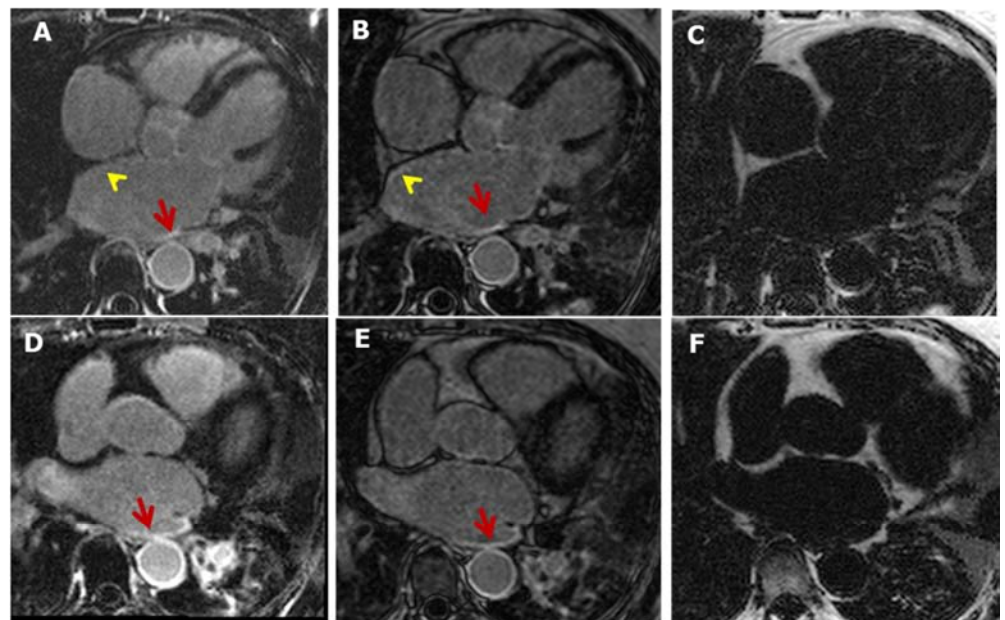


Figure 1: Comparison of water-only LGE (A,D), opposed-phase Dixon LGE (B,E), and fat-only LGE (C,F) in two subjects. Agreement in enhancement pattern is shown by red arrows, with discordance shown by yellow arrow-head.