The dual-IR sequence improves the inter-observer correlation in post-ablation atrial scar size measurements compared to the traditional IR sequence.

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Target Audience: Sequence developers, electrophysiologists and cardiologists with an interest in LGE.

Introduction: The extent of late gadolinium enhancement (LGE) has been correlated with clinical outcome in patients who have undergone radiofrequency (RF) ablation for atrial fibrillation (AF) (1). However, the standard inversion recovery (IR) sequence can exhibit high blood signal which hampers scar visualization and causes poor inter-observer correlation of scar size measurements. The dual-IR sequence has been previously shown to improve blood suppression in LGE images of ventricular and atrial wall scar (2,3).

Purpose: To test whether the superior blood suppression in dual-IR images improves the inter-observer correlation of scar measurements compared with IR images.

Methods: The dual-IR pre-pulse consists of two non-selective inversion pre-pulses separated by time delays TI1 and TI2 (Fig 1). TI1 and TI2 were optimized to achieve signal suppression in the T1-range 250-1400ms. Whereas the IR sequence can only null one T1 species (e.g. normal myocardium), the dual-IR pre-pulse simultaneously suppresses both the blood and normal myocardium whilst maintaining high signal in the scar.

11 patients underwent MR imaging on a 1.5T scanner (Philips, NL) ~3 months after RF ablation for AF. Dual-IR imaging was performed at 20 mins and standard IR imaging at 25 mins after 0.2 mmol/kg of Magnevist (Bayer Schering, DE) was administered. For each 3D image set, two experienced readers manually segmented areas of LGE around the pulmonary veins and left atrium.

Results & Discussion: Dual-IR images achieved superior blood suppression at an earlier time point compared to IR images (Fig. 2). There was no significant difference between the scar size on IR and dual-IR images for either observer. The Pearson's correlation coefficient (R) for total scar measurements in the dual-IR images was however two-fold higher than that in the IR images (Fig. 3). R = 0.86 for dual-IR and R = 0.39 for IR images.

Conclusions: The dual-IR technique improves blood suppression and definition of the boundaries of LGE areas. This leads to improved inter-observer correlation in scar size quantification. As imaging can be performed earlier, it also has the potential to reduce the overall scan time.

References: 1) Peters DC et al, JACC 2:308-16 (2009), 2) Peel SA et al Radiology Jul;264(1):242-9 (2012), 3) Peel SA et al. Proc. ISMRM 2011 E-poster 3387.

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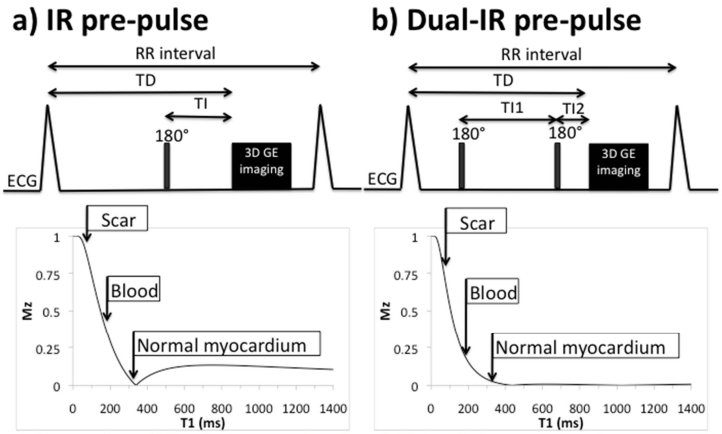

Fig. 1: IR (a) and dual-IR (b) pre-pulses with corresponding Mz vs T1 plots.

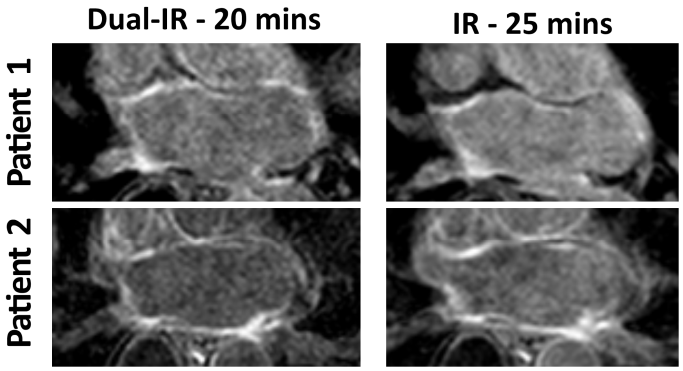

Fig. 2: LGE images using the dual-IR and IR sequence.

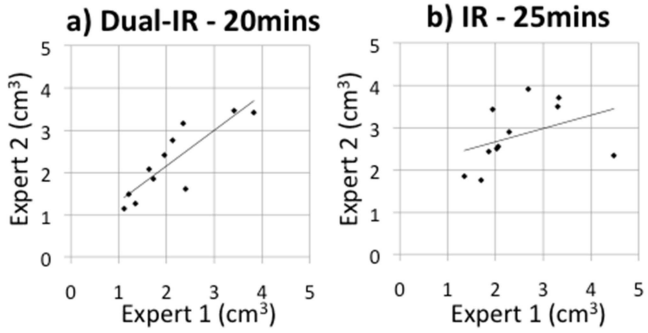

Fig. 3: Correlation plots for total scar measurements (cm^3) for dual-IR (a) and IR images (b).