Evaluation of vessel wall enhancement in vasculitis with myocardial delayed enhancement sequences: feasibility and preliminary results

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Purpose

Current techniques to evaluate vasculitis include computed tomography (CT), MRI, PET and conventional angiography. CT provides high resolution images of vessel wall thickening and vascular stenosis or occlusion, but also involves use of iodinated contrast media and ionizing radiation. Conventional angiography is an invasive technique also requiring iodinated contrast and radiation, with superb spatial resolution but no depiction of the vessel wall. Common MRI techniques include 3D contrast-enhanced MRA, black blood imaging of vessel walls, and post contrast T1-weighted images to demonstrate vessel wall enhancement. Myocardial delayed enhancement techniques have recently been applied to vessel wall imaging. These sequences generally include an inversion recovery preparation pulse to null the signal of normal myocardium. The inversion time (TI) can also be chosen to null the signal of the normal vessel wall, thereby emphasizing enhancement in patients with vasculitis. We evaluated the feasibility of this technique in 11 patients with known or suspected vasculitis involving the thoracic aorta, performing single shot myocardial delayed enhancement sequences following contrast administration for 3D contrast enhanced MRA.

Methods

Single shot MDE (sshmde) is a cardiac gated inversion recovery fast gradient recalled echo technique in which all data for a single slice is acquired in 3 R/R intervals (1 R/R to bring the slice to steady state and 2 R/R to acquire all of the lines in k-space). TI was selected using a multi TI cine sequence (CINE IR) performed in a sagittal oblique or axial projection through the thoracic aorta and then reviewed to determine the optimal TI (which typically ranged between 175-225 msec). Axial black blood imaging was performed using either a single shot or fast spin echo cardiac gated double inversion recovery sequence. 3D MRA was then performed and followed by delayed enhancement acquisitions 5-15 minutes following contrast injection. Post-contrast axial fat-saturated 3D SPGR images were also obtained.

Results

Mild vessel wall thickening without enhancement was seen in 4 patients, and vessel wall thickening with enhancement in the remaining 7 patients. Subjective evaluation of patients with vessel wall enhancement revealed a preference for sshmde images in 3 patients, no preference in 3 patients, and a preference for ungated 3D SPGR images in 1 patient. Single shot MDE images generally provided greater image contrast in depicting vessel wall enhancement, but at a cost in reduced SNR, longer acquisition times, and reduced spatial resolution (Fig. 1).

Discussion

Preliminary results are promising using sshmde to evaluate vasculitis. Improved conspicuity of vessel wall enhancement may allow detection of subtle vascular inflammation, and more accurate assessment of the activity of treated vasculitis.

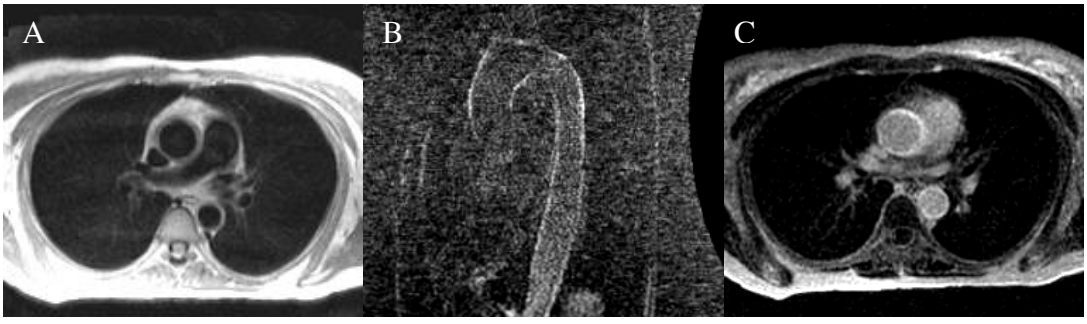

Fig. 1. 28 yo female with Takayasu's arteritis. The inter-volume black blood FSE (A) technique demonstrates vessel wall thickening while the CineIR (B) and sshmde (C) signal enhancement in the ascending and descending aorta vessel wall.