

Evaluation of Crohn's Disease Activity Using MRI: Correlation with T2 Signal Intensity on Fat-Suppressed Single Shot Imaging

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Introduction

Crohn's disease is an inflammatory process of the bowel with frequent remissions and relapses. MRI has been shown to be valuable for evaluation of patients with Crohn's disease (1). One important criterion is the assessment of disease activity because of different therapeutic strategies for active versus quiescent inflammation. Currently, no established non-invasive techniques have been widely accepted to monitor disease activity in Crohn's disease. Most trials in the past have focused on perfusion characteristics of the bowel wall after intravenous gadolinium administration to assess disease activity (2). Although being feasible, this evaluation algorithm is technically demanding and this may have impact on clinical utility. Our experience has led us to propose a relatively simpler approach for evaluation of Crohn's disease activity using fat-suppressed (FS) T2 weighted (T2W) single shot fast spin echo (SSFSE): The aim of this study was to compare FS T2W MRI with gadolinium enhanced T1W sequences to assess activity in Crohn's disease.

Methods

Out of 102 subjects with a clinically proven diagnosis of Crohn's disease who underwent dedicated MR imaging of the bowel from November 2004 to October 2006, 7 subjects (age range, 28-42; mean age 34; M:F = 3:4) with clinical and laboratory evidence of active disease process were identified (group A). These patients were matched for age and gender with 7 subjects presenting no clinical features of active disease (group B). Prior to MR imaging, patients ingested 1500 ml of a contrast solution containing 2.5 % of Mannitol and 0.2 % of Locust Bean Gum over 45 minutes at a steady, evenly distributed rate. MR-examinations were performed on a 1.5T MR scanner (Gyrosan Intera, Philips Medical Systems, Best, Netherlands). A torso phased-array surface coil was used for signal reception. To ensure sufficient colonic distension, a rectal enema consisting of 500ml of warm tap water was administered through a Foley catheter. Routine imaging included a T2-weighted half-Fourier acquisition single-shot turbo spin echo sequence with fat saturation (TR/TE/Flip: 1200ms/90ms/90°; slice thickness: 7 mm; matrix: 192x256). Gadolinium was administered as a power injected (Medrad, Pittsburgh, PA) bolus of 0.1 mmol/kg of gadolinium chelate (Omniscan; Amersham Health, New York, NY, USA) at 2 mL/s. Four sets of breath hold serial axial 3D SGE fat-suppressed (TR/TE/Flip: 3.4ms/1.7ms/10°; slice thickness: 2.5 mm; matrix: 204x256) images were acquired pre-contrast, then during post-contrast hepatic arterial dominant phase, venous phase, and delayed interstitial phase.

For data analysis, small and large bowel was divided into eight segments: jejunum and proximal ileum, terminal ileum, cecum, ascending, transverse / descending / sigmoid colon and rectum. Two experienced board certified radiologists retrospectively evaluated the images and assessed the number of inflamed bowel segments on a digital picture archiving workstation. Furthermore, each affected bowel segment was ranked regarding T2 signal intensity and gadolinium enhancement using a four-point scale (1=normal; 4=severely abnormal). A Kruskal-Wallis test was used to statistically analyse the differences in T2 signal intensity and level of gadolinium enhancement between both patient groups.

Results

Fourteen bowel segments in group A showed evidence of Crohn's disease versus 15 bowel segments in group B. T2 signal intensity in group A was significantly higher ($p<0.01$) than in control group B with a modal values of 3 versus 1. However, there was no significant difference in signal intensities of T1W post-gadolinium 3D GRE images ($p=0.32$). Bowel segments with elevated T2 SSFSE showed anatomic agreement with enhancement on T1W images. There was no difference in T2W and enhanced T1 3D GRE sequences in identifying diseased segments and determining disease extent. There was substantial inter-observer agreement between two readers ($\kappa=0.75$)

Discussion

MR imaging is an accurate method for evaluation of Crohn's disease activity. Our data suggests that signal increase on FS T2W images strongly correlates with inflammatory activity while gadolinium enhanced late vascular phase 3D GRE does not discriminate between chronic disease and acutely active disease. This study supports the possibility of using FS T2 SSFSE examination for monitoring disease activity. Additional benefits of the FS T2 SSFSE technique include speed of examination, resistance to motion related image degradation, and easily interpreted images.

References

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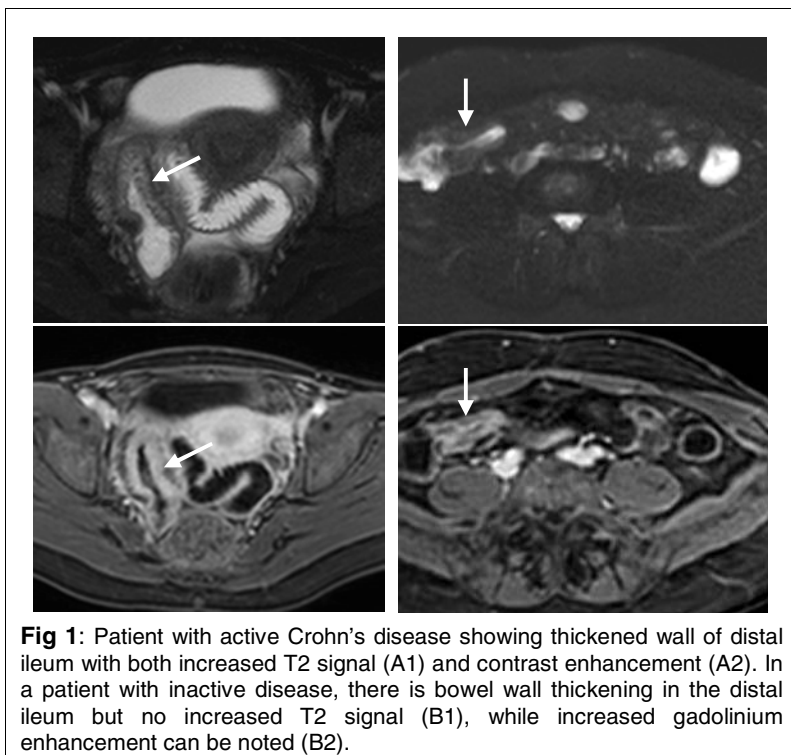


Fig 1: Patient with active Crohn's disease showing thickened wall of distal ileum with both increased T2 signal (A1) and contrast enhancement (A2). In a patient with inactive disease, there is bowel wall thickening in the distal ileum but no increased T2 signal (B1), while increased gadolinium enhancement can be noted (B2).