Performance of non-contrast MR enterography to localize and predict disease activity in Crohn's disease.

S. Yalamanchili[1], M. Macari[1], R. Rivera[1], D. Kim[1], A. Megibow[1], J. Babb[1], J. Levy[1], K. Zabriskie[1], and S. Kim[2]

[1]New York University, [2]New York University, New York, NY, United States

Introduction: Patients with Crohn's disease, a chronic inflammatory bowel disease, are often young and they may undergo repeated imaging examinations to assess their disease status. Previous studies have shown that MR enterography has a diagnostic effectiveness comparable to that of CT enterography.[1-3] Specific findings at MR imaging- for example, mural T2 high signal intensity and contrast enhancement patterns- have been proposed as accurate markers of disease activity. [4-6] However, diagnostic accuracy of MR enterography using only non-contrast imaging sequences has not been evaluated to date. Thus, the purpose of our study is to assess the performance using conventional non-contrast MR imaging sequences as a tool to localize and predict disease activity in Crohn's disease in comparison to post-contrast images.

Methods: Thirty patients (mean age 22 years, F=16, M=14) referred for MR enterography for evaluation of Crohn's disease were included. After standard oral preparation using VoLumen (E-Z-Em), patients underwent MR imaging at 1.5 T (Avanto, Siemens Medical Solutions) using steady state free precession (true FISP), single shot fast spin echo (HASTE), fat suppressed T2-weighted, and pre- and post dynamic contrast enhanced T1-weighted (VIBE) sequences. Images were reviewed by two radiologists in two separate sessions; the readers interpreted non-contrast images of MRI during the first session and whole images including post contrast sequences during the second session. The intestine was divided into 10 segments that included the proximal jejunum, distal jejunum, proximal ileum, distal ileum, terminal ileum, cecum, ascending colon, transverse colon, descending colon, and rectosigmoid. The readers were asked to evaluate the presence or absence of disease in regard to the presence of active inflammation using a six-point grading system (0, No evidence of disease; 1, definite absence of active inflammation; 2, probable absence of active inflammation; 3, equivocal; 4, probable presence of active inflammation; and 5, definite presence of active inflammation). Inter-reader agreement was assessed using simple kappa coefficients. Logistic regression for correlated data was used to compare the contrast and non-contrast images with respect to the percentage of times two readers exhibited perfect agreement and the sensitivity, specificity and overall accuracy of detecting abnormal segments showing definitive active inflammation (Score = 5). Statistical significance was defined as $p<0.05$. Reference standard was constructed by combining surgical, endoscopy, physical, and all available imaging findings.

Results: There were 34 bowel segments with active inflammation on reference standard in 18 subjects (proximal ileum, n=1, distal ileum, n=4; terminal ileum, n=16; cecum, n=6; ascending colon, n=1; rectosigmoid, n=2). Inter-reader agreement was significantly higher for whole imaging including post-contrast images relative to non-contrast images (Kappa 0.31 for non-contrast and 0.41 for whole images). There was no significant difference (p=1.0) in sensitivity, specificity and overall accuracy of each reader for the localization of abnormal segments (Score of 1 or higher) between non-contrast and post-contrast images. Sensitivity and accuracy of non-contrast images for the grading of active inflammation were lower than post-contrast images (Table 1).

Discussion: Although there is no significant difference localizing abnormal bowel segment involved with Crohn's disease using non-contrast images, inter-reader agreement, sensitivity, and accuracy are significantly higher in the assessment of active disease adding post-contrast images to non-contrast images for MRI interpretation.
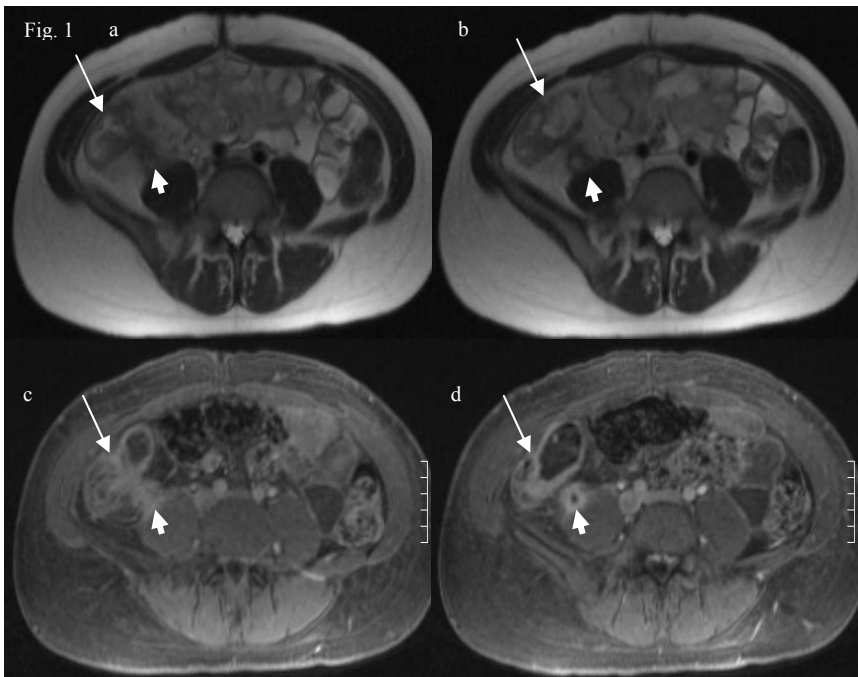

Fig. 1: A patient with active Crohn's disease involving cecum and terminal ileum. Both axial HASTE images (a,b) and post-contrast T1 VIBE images (c,d) show thick-walled cecum and terminal ileum (long arrows) associated with a small abscess in mesentery (short arrows).

Table. 1: The sensitivity, specificity and overall accuracy of each reader for the detection of segments showing definitive inflammation (Score=5) relative to the reference standard.

	Reader	Non-Contrast	Post-Contrast	P
Sensitivity	1	52.9% (18/34)	76.5% (26/34)	**0.0078**
	2	55.9% (19/34)	79.4% (27/34)	**0.0078**
Specificity	1	94.7% (18/19)	100% (19/19)	1.0
	2	100% (19/19)	94.7% (18/19)	1.0
Accuracy	1	67.9% (36/53)	84.9% (45/53)	**0.0038**
	2	71.7% (38/53)	84.9% (45/53)	**0.039**

References
1). Lee SS, et al. Radiology 2009 ;251:751-761. 2). Koh DM, et al. AJR 2001; 177:1325-1332. 3). Sempere GA, et al. AJR 2005; 184:1829-1835.
4). Gourtsoyiannis N, et al. Eur Radiol 2004; 14:1017-1024. 5). Malago R, et al. Abdom Imaging 2008; 33:669-675. 6). Punwani S, et al. Radiology 2009; 525:712-720.