

Contrast-enhanced MR enterography as a stand-alone tool to evaluate Crohn's disease in pediatric population.

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Introduction: Patients with Crohn's disease often present at a young age and may undergo multiple follow-up imaging examinations to assess disease status. MR imaging of the pediatric abdomen can be challenging, most often secondary to small size, inability to tolerate long scan times and increased hemodynamic status. It is therefore paramount to acquire diagnostic images as efficiently as possible. One way in which to do this is by limiting the number of overall sequences. The diagnostic effectiveness of MR enterography has been shown to be comparable to that of CT enterography, however, scanning time of MR takes longer than CT, and diagnostic accuracy of MR enterography using only post contrast imaging sequences has not been evaluated to date. Thus, the purpose of our study is to assess the performance using post-contrast MR imaging sequences as a stand-alone tool to localize and predict disease activity in Crohn's disease in comparison to all images sequences together in an attempt to suggest limitation of the number of overall non-contrast images sequences need for the follow-up evaluation of Crohn's disease.¹⁻³

Methods: Twenty five pediatric patients (mean age 11.2 years, M=12, F=13) with Crohn's disease who referred for MR enterography for evaluation disease status were included. After standard oral preparation, 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) with and without fat suppression, fat suppressed T2-weighted, and pre- and post-contrast enhanced T1-weighted (VIBE) sequences. Two radiologists reviewed images separately; post-contrast images were reviewed during an independent session and whole images including non-contrast sequences during a consensus session. The intestine was divided into 10 segments (proximal jejunum, distal jejunum, proximal ileum, distal ileum, terminal ileum, cecum, ascending colon, transverse colon, descending colon, and rectosigmoid). The readers evaluated the presence or absence of disease in regard to the presence of active inflammation using a five-point grading system (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 kappa coefficients. Sensitivity, specificity and overall accuracy were calculated for detecting abnormal segments which both readers agreed showed definitive active inflammation (Score = 5) on the limited post-contrast study. The complete MRI examination including non-contrast and post-contrast images were used as a reference standard.

Results: There were 53 bowel segments with active inflammation on reference standard in 25 subjects (proximal jejunum (LUQ), n=7, distal jejunum (RUQ), n=1; proximal ileum (LLQ), n=3, distal ileum (RLQ), n=5; terminal ileum (<20cm from the ICV), n=20; cecum, n=7; ascending colon, n=2; transverse colon, n=1; descending colon, n=2; rectosigmoid, n=4). Inter-reader agreement for evaluation of active inflammation on post contrast imaging had a Kappa 0.622. 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 post-contrast images alone and reference standard of all image sequences together. Sensitivity, specificity, PPV, NPV, and accuracy for diagnosing definite active inflammation using post contrast images alone were 83.3%, 86.9%, 89.3%, 80%, and 84.9%, respectively for agreement of definite active inflammation (score 5) using post-contrast images alone (Table 1).

Discussion: Sensitivity, specificity, and overall accuracy for predicting areas of definite activity in Crohn's disease using post contrast MR images alone as compared to reference whole image standard is high, mitigating for a decrease in number of non-contrast sequences for surveillance of activity of Crohn's disease in the pediatric population. However, in all five of the false negative cases (meaning that there was disagreement using post contrast images alone, when definite active disease was clearly present on the reference standard) there was a disagreement in at least one bowel segment with respect to the presence or absence of abscess and/or sinus tracts which was confirmed on the consensus read using HASTE images without fat suppression. In conclusion, follow-up MRI in pediatric Crohn's patients monitoring for disease activity can be performed by decreased number of sequences while maintaining diagnostic accuracy using post-contrast T1 VIBE and non-contrast HASTE sequences.

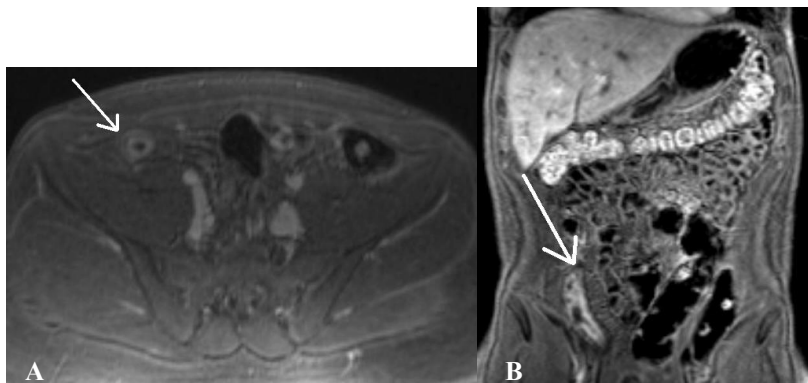


Figure 1: Axial (A) and coronal (B) post-contrast T1 weighted 3D gradient echo images showing wall thickening with layered mural enhancement of the distal ileum (arrow) in an 8 year old male with active Crohn's disease. Luminal narrowing and proliferation of surrounding fat and mesenteric vasculature "comb sign" is also noted. Two readers agreed upon presence of definite active disease (score 5) both on post-contrast images only and complete MRI examination including non-contrast and post-contrast images.

Table 1: Two reader consensus using post-contrast images only on evaluation of definite active inflammation.

Sensitivity	83.3%
Specificity	86.9 %
PPV	89.3 %
NPV	80%
Accuracy	84.9%

References

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- 2) Darge K, et al. Magn Reson Imaging Clin N Am 2008; 16, 467-478.
- 3) Messaris E, et al. Arch Surg. 2010;145 (5):471-475.