

SPECIAL REPORT

Consensus Recommendations for Evaluation, Interpretation, and Utilization of Computed Tomography and Magnetic Resonance Enterography in Patients With Small Bowel Crohn's Disease

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Computed tomography and magnetic resonance enterography have become routine small bowel imaging tests to evaluate patients with established or suspected Crohn's disease, but the interpretation and use of these imaging modalities can vary widely. A shared understanding of imaging findings, nomenclature, and utilization will improve the utility of these imaging techniques to guide treatment options, as well as assess for treatment response and complications. Representatives from the Society of Abdominal Radiology Crohn's Disease-Focused Panel, the Society of Pediatric Radiology, the American Gastroenterological Association, and other experts, systematically evaluated evidence for imaging findings associated with small bowel Crohn's disease enteric inflammation and established recommendations for the evaluation, interpretation, and use of computed tomography and magnetic resonance enterography in small bowel Crohn's disease. This work makes recommendations for imaging findings that indicate small bowel Crohn's disease, how inflammatory small bowel Crohn's disease and its complications should be described, elucidates potential extra-enteric findings that may be seen at imaging, and recommends that cross-sectional enterography should be performed at diagnosis of Crohn's disease and considered for small bowel Crohn's disease monitoring paradigms. A useful morphologic construct describing how imaging findings evolve with disease progression and response is described, and standard impressions for radiologic reports that convey meaningful information to gastroenterologists and surgeons are presented.

Computed tomography enterography (CTE) and magnetic resonance enterography (MRE) have emerged as the most effective methods for imaging the small bowel in patients with Crohn's disease.^{1,2} Cross-sectional enterography techniques complement ileocolonoscopy and can visualize intramural or proximal small bowel inflammation in approximately 50% of Crohn's disease patients who have endoscopically normal examinations.^{3–5} CTE and MRE are useful tools for Crohn's disease diagnosis, determining distribution of disease involvement, and

detecting complications of the disease.^{1,2} Recent data suggest that cross-sectional imaging may be useful in determining response to therapy, assessing bowel healing, and monitoring disease progression.⁶ The Society of Abdominal Radiology (SAR) formed a Crohn's Disease-Focused Panel, which has established standards for the technical performance of these examinations^{7–9} (Appendix 1). CTE and MRE are now performed across a range of institutions, with the radiologic literature focusing on the technical aspects of diagnosis and identification of mural inflammation or penetrating complications, such as fistula and abscess, using various acquisition methods and imaging findings. Important prior consensus statements, including those of the European Crohn's and Colitis Organization and European Society of Gastrointestinal and Abdominal Radiology and SAR recommendations for the performance of CTE and MRE establish critical and necessary rationale for when and how imaging of inflammatory bowel disease patients should be performed, respectively.^{2,7,8} To date, however, there are no agreed-upon expectations for structures that should be evaluated at cross-sectional enterography, no standardized nomenclature for describing imaging findings in Crohn's disease, no guidance for how to describe severity and burden of different Crohn's disease imaging findings to best guide medical and surgical management, and no consensus between US gastroenterology and radiology societies on when these tests should be performed. The purpose of this work is to establish a common system for mapping specific imaging findings to clinically useful impressions and for description of Crohn's disease phenotypes that can guide gastroenterologists and surgeons in making important

Abbreviations used in this paper: AGA, American Gastroenterological Association; CTE, computed tomography enterography; MRE, magnetic resonance enterography; SAR, Society for Abdominal Radiology.

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Table 1. Imaging Findings Associated With Small Bowel Crohn's Disease Inflammation

Imaging findings	Description/definition	DDX considerations/comments	Conclusions (level of evidence)
Segmental mural hyperenhancement	Increased attenuation/signal intensity on contrast-enhanced scan in noncontracted segment in comparison to nearby normal small bowel segments	Predictive but nonspecific sign ^{36,41} Causes include Crohn's disease-related mural inflammation, backwash ileitis, infectious enteritis, mucositis, graft-vs-host disease, contraction or underdistension, radiation enteritis, NSAID enteropathy, angioedema, vasculitis, and ischemia Altered enhancement in Crohn's disease can also reflect processes other than inflammation, such as fibrosis or chronic mesenteric venous occlusion More likely indicates Crohn's disease when asymmetric and combined with other mural and mesenteric findings below Contrast-enhanced imaging is performed in enteric to portal phases of enhancement ^{7,8}	1. Segmental mural hyperenhancement and wall thickening have a moderately high sensitivity and specificity for small bowel Crohn's disease at CTE or MRE. ³⁷⁻⁴⁰ (Moderate) 2. Mural hyperenhancement without wall thickening is a nonspecific imaging sign, and may reflect inflammation or other processes. ^{24,37,40,41} (Moderate) 3. CTE and MRE may detect small bowel inflammation not seen at ileocolonoscopy. ^{3,5,75} (Moderate) 4. CTE and MRE with only oral contrast will not detect or stage colonic inflammation as well as ileocolonoscopy. ⁷⁵⁻⁷⁷ (Moderate) 5. Hyperintense T2-weighted signal and restricted diffusion at MR enterography is correlated with moderate to severe endoscopic inflammation. ^{25,37,78-80} (Moderate) 6. Unenhanced MR enterography with diffusion-weighted imaging has a moderate sensitivity and specificity for detection of ileal Crohn's disease. ^{25,49,81,82} (Moderate)
Asymmetric	Asymmetric in cross-sectional or longitudinal direction compared to the lumen Mesenteric border is often more affected than antimesenteric border	Specific finding for Crohn's disease ⁴¹ Can refer to morphologic pattern of hyperenhancement, wall thickening or stratification	
Stratified (bi- or tri- laminar)	Inner-wall hyperenhancement or halo sign	In Crohn's disease, can be due to submucosal edema, intramural fat deposition or inflammatory infiltration Can also be due to other causes of segmental mural hyperenhancement above "Mucosal hyperenhancement" is erroneous descriptor as mucosa is often absent at endoscopy in inflamed loops with stratified segmental hyperenhancement Intramural fat indicates chronicity and is unrelated to whether inflammation is present or not Intramural edema indicates active inflammation if due to Crohn's disease At this time, no clinical significance is attributed to either the bi- or tri-laminar pattern; the tri-laminar pattern is more often identified on contrast enhanced MR, likely owing to its superior contrast resolution vis-à-vis CT	
Homogeneous, symmetric	Transmural hyperenhancement	Can be due to many other causes including edema, collagen deposition, infiltration, ischemia, shock bowel	
Wall thickening		Only measured or estimated in bowel loops distended by enteric contrast Measure the thickest portion of most distended segment or site of most severe inflammation	

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