

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Cosnes J, Gower-Rousseau C, Seksik P, Cortot A. Epidemiology and natural history of inflammatory bowel diseases. <i>Gastroenterology</i> . 2011;140(6):1785-1794.	Review/Other-Dx	N/A	To determine the epidemiology of IBDs.	No results stated in abstract.	4
2. Molodecky NA, Soon IS, Rabi DM, et al. Increasing incidence and prevalence of the inflammatory bowel diseases with time, based on systematic review. <i>Gastroenterology</i> . 2012;142(1):46-54 e42; quiz e30.	Review/Other-Dx	260 studies	A systematic review to determine changes in the worldwide incidence and prevalence of UC and CD in different regions and with time.	The highest annual incidence of UC was 24.3 per 100,000 person-years in Europe, 6.3 per 100,000 person-years in Asia and the Middle East, and 19.2 per 100,000 person-years in North America. The highest annual incidence of CD was 12.7 per 100,000 person-years in Europe, 5.0 person-years in Asia and the Middle East, and 20.2 per 100,000 person-years in North America. The highest reported prevalence values for IBD were in Europe (UC, 505 per 100,000 persons; CD, 322 per 100,000 persons) and North America (UC, 249 per 100,000 persons; CD, 319 per 100,000 persons). In time-trend analyses, 75% of CD studies and 60% of UC studies had an increasing incidence of statistical significance (P<.05).	4
3. Loftus CG, Loftus EV, Jr., Harmsen WS, et al. Update on the incidence and prevalence of Crohn's disease and ulcerative colitis in Olmsted County, Minnesota, 1940-2000. <i>Inflamm Bowel Dis</i> . 2007;13(3):254-261.	Review/Other-Dx	1940–2000; 308 residents diagnosed with CD and 372 with UC	An update on the incidence and prevalence of CD and UC in Olmsted County, Minnesota.	From 1990-2000 the adjusted annual incidence rates for UC and CD were 8.8 cases per 100,000 (95% CI, 7.2–10.5) and 7.9 per 100,000 (95% CI, 6.3–9.5), respectively, not significantly different from rates observed in 1970-1979. On January 1, 2001, there were 220 residents with CD, for an adjusted prevalence of 174 per 100,000 (95% CI, 151–197), and 269 residents with UC, for an adjusted prevalence of 214 per 100,000 (95% CI, 188–240). Although incidence rates of CD and UC increased after 1940, they have remained stable over the past 30 years. Since 1991 the prevalence of UC decreased by 7%, and the prevalence of CD increased about 31%. Extrapolating these figures to U.S. Census data, there were approximately 1.1 million people with IBD in the U.S. in 2000.	4

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4. Scharl M, Rogler G. Inflammatory bowel disease pathogenesis: what is new? <i>Curr Opin Gastroenterol.</i> 2012;28(4):301-309.	Review/Other-Dx	N/A	To summarize the pathophysiology of IBD.	Further genetic risk factors for IBD have been identified and confirmed. Novel studies analyzing the function of these susceptibility factors have improved our understanding of specific pathophysiological pathways. Both the innate and the adaptive immune systems appear to be deregulated. The current notion that only about 25% of genetic heritability is explained by the published findings is being challenged. Epigenetic changes triggered by environmental factors probably contribute to heritability. Such environmental factors have been shown not only to influence immunological function and the intestinal barrier, but they also affect the composition of the gut microbiome and its interaction with the mucosal immune system. The gut microbiome, innate defense mechanisms and barrier function regulate each other, contributing to a balance that determines physiological or pathological inflammation.	4
5. Gollop JH, Phillips SF, Melton LJ, 3rd, Zinsmeister AR. Epidemiologic aspects of Crohn's disease: a population based study in Olmsted County, Minnesota, 1943-1982. <i>Gut.</i> 1988;29(1):49-56.	Review/Other-Dx	N/A	To determine the epidemiologic aspects of CD in patients.	The overall age and sex adjusted incidence of CD among Olmsted County, Minnesota, residents was 4.0 per 100,000 person-year in the period 1943–1982. Ileitis, ileocolitis, and colitis each accounted for about one third of the 103 incidence cases. Incidence rates were greater in woman than men, were higher in the urban portions of the county, and rose over time. Overall, the natural history of CD in the community may be milder than that reported for patients at referral centers, as over half of all patients had no complications and only a third required surgery for CD. Only 1 developed adenocarcinoma of the colon (relative risk = 2.0, NS). Survival was relatively unimpaired for the cohort, but CD may have played a role in half of the deaths. The prevalence of CD was 90.5/100,000 population on 1 January 1980.	4

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6. Henriksen M, Jahnsen J, Lygren I, et al. Clinical course in Crohn's disease: results of a five-year population-based follow-up study (the IBSEN study). <i>Scand J Gastroenterol.</i> 2007;42(5):602-610.	Review/Other-Dx	416 patients	To analyze disease phenotypes and progression of childhood-onset disease and compared them with characteristics of adult-onset disease in patients in Scotland.	At the time of diagnosis in children, CD involved small bowel and colon (L3) in 51% (138/273), colon (L2) in 36%, and ileum (L1) in 6%; the UGI tract (L4) was also affected in 51%. In 39%, the anatomic extent increased within 2 years. Behavioral characteristics progressed; 24% of children developed stricturing or penetrating complications within 4 years (vs 9% at diagnosis; P<.0001; OR, 3.32; 95% CI, 1.86–5.92). Compared with adults, childhood-onset disease was characterized by a “panenteric” phenotype (ileocolonic plus UGI [L3+L4]; 43% vs 3%; P<.0001; OR, 23.36; 95% CI, 13.45–40.59) with less isolated ileal (L1; 2% vs 31%; P<.0001; OR, 0.06; 95% CI, 0.03–0.12) or colonic disease (L2; 15% vs 36%; P<.0001; OR, 0.31; 95% CI, 0.21–0.46). UC was extensive in 82% of the children at diagnosis, vs 48% of adults (P<.0001; OR, 5.08; 95% CI, 2.73–9.45); 46% of the children progressed to develop extensive colitis during follow-up. 46% of children with CD and 35% with UC required immunomodulatory therapy within 12 months of diagnosis. The median time to first surgery was longer in childhood-onset than adult-onset patients with CD (13.7 vs 7.8 years; P<.001); the reverse was true for UC.	4

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7. Van Limbergen J, Russell RK, Drummond HE, et al. Definition of phenotypic characteristics of childhood-onset inflammatory bowel disease. <i>Gastroenterology</i> . 2008;135(4):1114-1122.	Observational-Dx	416 patients	To analyze disease phenotypes and progression of childhood-onset disease and compared them with characteristics of adult-onset disease in patients in Scotland.	At the time of diagnosis in children, CD involved small bowel and colon (L3) in 51% (138/273), colon (L2) in 36%, and ileum (L1) in 6%; the UGI tract (L4) was also affected in 51%. In 39%, the anatomic extent increased within 2 years. Behavioral characteristics progressed; 24% of children developed stricturing or penetrating complications within 4 years (vs 9% at diagnosis; P<.0001; OR, 3.32; 95% CI, 1.86–5.92). Compared with adults, childhood-onset disease was characterized by a "panenteric" phenotype (ileocolonic plus UGI [L3+L4]; 43% vs 3%; P<.0001; OR, 23.36; 95% CI, 13.45–40.59) with less isolated ileal (L1; 2% vs 31%; P<.0001; OR, 0.06; 95% CI, 0.03–0.12) or colonic disease (L2; 15% vs 36%; P<.0001; OR, 0.31; 95% CI, 0.21–0.46). UC was extensive in 82% of the children at diagnosis, vs 48% of adults (P<.0001; OR, 5.08; 95% CI, 2.73–9.45); 46% of the children progressed to develop extensive colitis during follow-up. 46% of children with CD and 35% with UC required immunomodulatory therapy within 12 months of diagnosis. The median time to first surgery was longer in childhood-onset than adult-onset patients with CD (13.7 vs 7.8 years; P<.001); the reverse was true for UC.	4
8. Silverberg MS, Satsangi J, Ahmad T, et al. Toward an integrated clinical, molecular and serological classification of inflammatory bowel disease: report of a Working Party of the 2005 Montreal World Congress of Gastroenterology. <i>Can J Gastroenterol</i> . 2005;19 Suppl A:5A-36A.	Review/Other-Dx	N/A	To review current clinical classification systems in CD, UC and indeterminate colitis, and provided recommendations for clinical classification in practice.	No results stated in abstract.	4

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9. Louis E, Van Kemseke C, Reenaers C. Necessity of phenotypic classification of inflammatory bowel disease. <i>Best Pract Res Clin Gastroenterol</i> . 2011;25 Suppl 1:S2-7	Review/Other-Dx	N/A	To review the classification of IBDs classically divided in CD and UC.	UC and CD represent heterogeneous entities. A further classification in various sub-phenotypes, allows to identifying subgroup of patients with more homogeneous pathophysiology, natural history and response to treatment. Particularly, the location of the disease, both in UC and CD, are clearly associated with different risks of complications. Extensive colitis in UC has been associated with increased risk of cancer, colectomy and mortality. In CD, ileal disease has been associated with increased risk of complications and surgery and may also correspond to a specific pathophysiologic mechanism different from the one of colonic disease, involving specific genetic background such as CARD15 mutations. These purely phenotypic classification are certainly not perfect and do not represent the ultimate classifications of IBD. In the future, they will most probably be completed or partly replaced by biologic and molecular classification. However, for the time being, they represent a readily available and easy-to-use tool for the clinician.	4

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10. Samuel S, Bruining DH, Loftus EV, Jr., et al. Endoscopic skipping of the distal terminal ileum in Crohn's disease can lead to negative results from ileocolonoscopy. <i>Clin Gastroenterol Hepatol.</i> 2012;10(11):1253-1259.	Observational-Dx	189 consecutive patients	To analyze advanced cross-sectional images to determine how frequently this occurs.	Of the patients evaluated, 153 underwent TI intubation during endoscopy; 67 of these (43.8%) had normal results from ileoscopy, based on endoscopic appearance. Despite their normal results from ileoscopy, 36 of these patients (53.7%) had active, small-bowel CD. The ileum appeared normal at ileoscopy because the disease had skipped the distal ileum of 11 patients (30.6%), developed only in the intramural and mesenteric distal ileum of 23 patients (63.9%), and appeared only in the UGI region of 2 patients (5.6%). These patients had a shorter duration of disease (61.1% for <5 years) compared with those found to have CD based on ileoscopy (41.1% for <5 years; P<.05). CT enterography detected extracolonic CD in 26% of patients; 14% of patients were found to have disorders unrelated to IBD that warranted further investigation or consultation (including 4 cancers).	4
11. Sandborn WJ, Feagan BG, Lichtenstein GR. Medical management of mild to moderate Crohn's disease: evidence-based treatment algorithms for induction and maintenance of remission. <i>Aliment Pharmacol Ther.</i> 2007;26(7):987-1003.	Review/Other-Dx	N/A	To review evidence from randomized, controlled, clinical trials on medical therapies for inducing and maintaining remission in patients with mild-to-moderate CD, and to suggest the best evidence-based approaches for induction and maintenance therapies.	Randomized, controlled trials demonstrated that sulfasalazine, budesonide, and conventional corticosteroids are effective for inducing remission of mild-to-moderate CD when administered for a period of 8–16 weeks. An ideal maintenance therapy does not currently exist. Selection of maintenance therapy is based on a combination of evidence from controlled trials and patient features including disease severity and location, comorbidities, previous response to treatment, and previous surgical resection. The options for maintenance therapy include therapy cessation and patient observation following successful induction, budesonide, or immunosuppressive therapy.	4

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12. Louis E, Collard A, Oger AF, Degroote E, Aboul Nasr El Yafi FA, Belaiche J. Behaviour of Crohn's disease according to the Vienna classification: changing pattern over the course of the disease. <i>Gut</i> . 2001;49(6):777-782.	Observational-Dx	297 CD patients	To assess the stability over the course of the disease of its location and behavior, as determined according to the Vienna classification.	The location of the disease remained relatively stable over the course of the disease. Although the proportion of patients who had a change in disease location became statistically significant after 5 years (P=0.01), over 10 years only 15.9% of patients had a change in location (P<0.001). We observed a more rapid and prominent change in disease behavior, which was already statistically significant after 1 year (P=0.04). Over 10 years, 45.9% of patients had a change in disease behavior (P<0.0001). The most prominent change was from nonstricturing nonpenetrating disease to either stricturing (27.1%; P<0.0001) or penetrating (29.4%; P<0.0001) disease. Age at diagnosis had no influence on either location or behavior of disease. Ileal CD was more often stricturing, and colonic or ileocolonic CD was more often penetrating: this was already the case at diagnosis and became more prominent after 10 years (P<0.05).	4
13. Levine A, Griffiths A, Markowitz J, et al. Pediatric modification of the Montreal classification for inflammatory bowel disease: the Paris classification. <i>Inflamm Bowel Dis</i> . 2011;17(6):1314-1321.	Review/Other-Dx	N/A	To develop evidence-based consensus recommendations for a pediatric modification of the Montreal criteria.	Important modifications developed include classifying age at diagnosis as A1a (0 to <10 years), A1b (10 to <17 years), A2 (17 to 40 years), and A3 (>40 years), distinguishing disease above the distal ileum as L4a (proximal to ligament of Treitz) and L4b (ligament of Treitz to above distal ileum), allowing both stenosing and penetrating disease to be classified in the same patient (B2B3), denoting the presence of growth failure in the patient at any time as G(1) vs G(0) (never growth failure), adding E4 to denote extent of UC that is proximal to the hepatic flexure, and denoting ever severe UC during disease course by S1.	4

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14. Beaugerie L, Seksik P, Nion-Larmurier I, Gendre JP, Cosnes J. Predictors of Crohn's disease. <i>Gastroenterology</i> . 2006;130(3):650-656.	Observational-Dx	1,188 patients	To identify at diagnosis factors predictive of a subsequent 5-year disabling course.	Among the 1,123 patients with follow-up data allowing full 5-year course classification, the rate of disabling disease was 85.2%. Independent factors present at diagnosis and significantly associated with subsequent 5-year disabling were the initial requirement for steroid use (OR 3.1 [95% CI: 2.2-4.4]), an age below 40 years (OR 2.1 [95% CI: 1.3-3.6]), and the presence of perianal disease (OR 1.8 [95% CI: 1.2-2.8]). The PPV of disabling disease in patients with 2 and 3 predictive factors of disabling disease was 0.91 and 0.93, respectively. These values were 0.84 and 0.91, respectively, when tested prospectively in an independent group of 302 consecutive patients seen at our institution from 1998.	3
15. Erturk SM, Mortelet KJ, Oliva MR, et al. Depiction of normal gastrointestinal anatomy with MDCT: comparison of low- and high-attenuation oral contrast media. <i>Eur J Radiol</i> . 2008;66(1):84-87	Observational-Dx	90 consecutive patients	To compare low- and high-attenuation oral contrast media for depiction of normal gastrointestinal anatomy with MDCT.	Duodenal, jejunal and ileal distention ($P < 0.05$, < 0.001 , < 0.001 , respectively) and wall visualization ($P < 0.05$, < 0.01 , < 0.05 , respectively) scores with low-attenuation contrast medium were significantly higher than those with high-attenuation barium sulphate preparation, for reader 1. Duodenal and jejunal wall visualization scores with low-attenuation contrast medium ($P < 0.05$, < 0.01 , respectively) were significantly higher than those with high-attenuation contrast medium, for reader 2. Interobserver agreement was fair to good for both distention (kappa-range: 0.41-0.74) and wall visualization (kappa-range: 0.48-0.71).	2
16. Huprich JE, Fletcher JG. CT enterography: principles, technique and utility in Crohn's disease. <i>Eur J Radiol</i> . 2009;69(3):393-397.	Review/Other-Dx	N/A	To discuss the essential principles of the exam and its use in the evaluation of CD of the small bowel.	The benefit of CT enterography is recognized at many institutions where it has become a primary diagnostic tool in CD. The application of the principles outlined herein will hopefully encourage more widespread use of this robust technique in the clinical evaluation of small bowel disease.	4

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17. Guidi L, Minordi LM, Semeraro S, et al. Clinical correlations of small bowel CT and contrast radiology findings in Crohn's disease. <i>Eur Rev Med Pharmacol Sci.</i> 2004;8(5):215-217.	Observational-Dx	35 patients	Compare CT with positive oral contrast with barium small bowel exams and correlated with CDAI.	Sensitivity of small bowel CT vs endoscopy was 88% while sensitivity of barium studies was 77% vs endoscopic findings, and reached 100% for the combination of both exams. Small bowel CT is a useful adjunct to conventional barium studies and CT findings correlate with CDAI.	3
18. Maglinte DD, Sandrasegaran K, Lappas JC. CT enteroclysis: techniques and applications. <i>Radiol Clin North Am.</i> 2007;45(2):289-301.	Review/Other-Dx	N/A	To examine the techniques of CT-E and present an overview of its clinical applications relative to other methods of small bowel imaging.	CT-E overcomes the individual deficiencies of both barium enteroclysis and conventional CT and combines the advantages of both into 1 technique whose clinical applicability has been simplified and made more reliable with MDCT technology.	4
19. Paulsen SR, Huprich JE, Fletcher JG, et al. CT enterography as a diagnostic tool in evaluating small bowel disorders: review of clinical experience with over 700 cases. <i>Radiographics.</i> 2006;26(3):641-657; discussion 657-662.	Review/Other-Dx	756 patients	Review methods for performing CT enterography and illustrate CT enterographic findings in CD.	Characteristic findings in CD can be detected using CT enterography technique.	4
20. Dillman JR, Adler J, Zimmermann EM, Strouse PJ. CT enterography of pediatric Crohn disease. <i>Pediatr Radiol.</i> 2010;40(1):97-105.	Review/Other-Dx	N/A	To provide a contemporary review of CT enterography technique as well as the spectrum of intestinal and extraintestinal findings in pediatric CD.	No results stated in abstract.	4
21. Vandembroucke F, Mortelet KJ, Tatli S, et al. Noninvasive multidetector computed tomography enterography in patients with small-bowel Crohn's disease: is a 40-second delay better than 70 seconds? <i>Acta Radiol.</i> 2007;48(10):1052-1060.	Observational-Dx	26 patients	To determine the optimal delay time to image patients with small-bowel CD during MDCT enterography.	No statistically significant difference was present between the enteric and the parenchymal phase for each reader in each segment regarding the presence or absence of CT features of CD. The interobserver agreement for the presence of 5 main features of active CD in the terminal ileum ranged from poor to excellent. The sensitivity, specificity, NPV, PPV, and accuracy for active CD in the terminal ileum ranged from 40% to 90%, 88% to 100%, 70% to 94%, 44% to 100%, and 69% to 96%, respectively. There was no statistical difference between the 2 phases for each reader.	2
22. Boudiaf M, Jaff A, Soyer P, Bouhnik Y, Hamzi L, Rymer R. Small-bowel diseases: prospective evaluation of multi-detector row helical CT enteroclysis in 107 consecutive patients. <i>Radiology.</i> 2004;233(2):338-344.	Observational-Dx	107 consecutive patients	To prospectively evaluate MDCT enteroclysis for the depiction of small-bowel diseases.	Sensitivity, specificity, accuracy, PPV, and NPV of MDCT enteroclysis were 100%, 95%, 97%, 94%, and 100%, respectively. MDCT enteroclysis allows depiction of a variety small bowel diseases in patients suspected of having small bowel disease.	3

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23. Negaard A, Sandvik L, Berstad AE, et al. MRI of the small bowel with oral contrast or nasojejunal intubation in Crohn's disease: randomized comparison of patient acceptance. <i>Scand J Gastroenterol.</i> 2008;43(1):44-51.	Observational-Dx	38 patients	Randomized study to evaluate the compliance of CD patients examined with MRI of the small bowel with an oral contrast (MRI per os) or installation of the contrast in a nasojejunal catheter.	Abdominal pain and discomfort were lower with MRI per os than with contrast in a nasojejunal catheter (mean visual analogue scale pain score immediately after: 10 mm and 33 mm, respectively, $P<0.001$; mean visual analogue scale discomfort score 24 hours after: 18 mm and 62 mm, respectively, $P<0.001$). Nausea and abdominal pain were correlated with overall discomfort after MRI per os ($r=0.56$ for both, $P<0.001$). No symptoms were significantly correlated with discomfort experienced with contrast in a nasojejunal catheter. More patients accepted repeat MRI per os examination ($n=36$) than contrast in a nasojejunal catheter ($n=22$, $P=0.001$). Patients preferred and experienced less abdominal pain and discomfort with MRI per os than with contrast in a nasojejunal catheter.	3
24. Wold PB, Fletcher JG, Johnson CD, Sandborn WJ. Assessment of small bowel Crohn disease: noninvasive peroral CT enterography compared with other imaging methods and endoscopy--feasibility study. <i>Radiology.</i> 2003;229(1):275-281.	Observational-Dx	23 patients	Comparative study to evaluate 2 biphasic CT enterography protocols, a noninvasive CT technique with water administered perorally and CT-E with methylcellulose administered through a nasojejunal tube.	Arterial phase imaging was noncontributory in 22/23 cases. Noninvasive per-oral water CT enterography protocol had similar accuracy (12/15 cases, 80%) for enabling the detection of active CD in comparison with CT-E with nasojejunal tube (7/8, 88%) and fluoroscopic small bowel examination (17/23, 74%). No fistulas were missed with use of either CT technique. Noninvasive per-oral portal venous phase CT enterography with use of water is accurate and feasible.	2
25. Bodily KD, Fletcher JG, Solem CA, et al. Crohn Disease: mural attenuation and thickness at contrast-enhanced CT Enterography--correlation with endoscopic and histologic findings of inflammation. <i>Radiology.</i> 2006;238(2):505-516.	Observational-Dx	96 patients	Retrospective study to determine if quantitative measures of small bowel mural attenuation and thickness at CT enterography correlate with endoscopic and histologic findings in CD.	Quantitative measures of mural attenuation and wall thickness at CT enterography correlate highly with ileoscopic and histologic findings of inflammatory CD.	2

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26. Solem CA, Loftus EV, Jr., Fletcher JG, et al. Small-bowel imaging in Crohn's disease: a prospective, blinded, 4-way comparison trial. <i>Gastrointest Endosc.</i> 2008;68(2):255-266.	Observational-Dx	41 patients	To assess the sensitivity and specificity of capsule endoscopy, CT enterography, ileocolonoscopy, and SBFT in the diagnosis of small bowel CD.	41 CT enterography examinations were performed. 7 patients (17%) had an asymptomatic partial small-bowel obstruction. 40 patients underwent colonoscopy, 38 had SBFT studies, and 28 had capsule endoscopy examinations. Small-bowel CD was active in 51%, absent in 42%, inactive in 5%, and suspicious in 2% of patients. The sensitivity of capsule endoscopy for detecting active small-bowel CD was 83%, not significantly higher than CT enterography (83%), ileocolonoscopy (74%), or SBFT (65%). However, the specificity of capsule endoscopy (53%) was significantly lower than the other tests (P<.05). 1 patient developed a transient partial small-bowel obstruction due to capsule endoscopy, but no patients had retained capsules.	1
27. Booya F, Fletcher JG, Huprich JE, et al. Active Crohn disease: CT findings and interobserver agreement for enteric phase CT enterography. <i>Radiology.</i> 2006;241(3):787-795.	Observational-Dx	42 patients	To retrospectively evaluate small-bowel enhancement characteristics and the sensitivity, specificity, and interobserver agreement of CT findings in patients undergoing enteric phase CT enterography. Reference standard were histologic and endoscopic results.	Distended jejunal loops had significantly greater attenuation than distended ileal loops (113 HU vs 72 HU; P<.001). Attenuation of collapsed jejunal (134 HU) and ileal (108 HU) loops was greater than that of distended jejunal and ileal loops. Mural hyper-enhancement and increased mural thickness are the most sensitive CT findings of active CD.	2
28. Lee SS, Kim AY, Yang SK, et al. Crohn disease of the small bowel: comparison of CT enterography, MR enterography, and small-bowel follow-through as diagnostic techniques. <i>Radiology.</i> 2009;251(3):751-761.	Observational-Dx	30 patients with CD, 2 independent readers	To prospectively compare the accuracy of CT and MR enterography and SBFT examination for detection of active small-bowel inflammation and extraenteric complications in patients with CD. Ileocolonoscopy findings served as the reference standard. Readers were blinded to clinical findings, findings at ileocolonoscopy assessment, and results of other imaging examinations.	Differences in areas under the ROC curves for CT enterography (0.900 and 0.894), MR enterography (0.933 and 0.950), and SBFT (0.883 and 0.928) for readers 1 and 2, respectively, in the detection of active terminal ileitis were not significant (P>.017). Sensitivity values for detection of extraenteric complications were significantly higher for CT and MR enterography (100% for both) than they were for SBFT (32% for reader 1 and 37% for reader 2) (P<.001). Because MR enterography has a diagnostic effectiveness comparable to that of CT enterography, this technique has potential to be used as a radiation-free alternative for evaluation of patients with CD.	1

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29. Ozturk E, Cakir O, Mutlu H, et al. Diagnostic value of CTE in patients with Crohn's disease. <i>Clin Imaging</i> . 2007;31(3):185-188.	Observational-Dx	43 total patients: 35 patients with CD of the ileum, 8 controls	To compare the accuracy of CT-E to that of biopsy in detecting bowel wall alterations of the terminal ileum in CD.	Overall sensitivity and specificity of CT-E in detecting the severity of CD were 89% and 100%, respectively. PPV was 100%; NPV was 89%. Results indicate that CT-E can reveal CD involvement of small bowel accurately and allow assessment of the degree of disease activity.	3
30. Horsthuis K, Bipat S, Bennink RJ, Stoker J. Inflammatory bowel disease diagnosed with US, MR, scintigraphy, and CT: meta-analysis of prospective studies. <i>Radiology</i> . 2008;247(1):64-79	Review/Other-Dx	33 studies	To compare, by performing a meta-analysis, the accuracies of US, MRI, scintigraphy, CT, and PET in the diagnosis of IBD.	33 studies, from a search that yielded 1,406 articles, were included in the final analysis. Mean sensitivity estimates for the diagnosis of IBD on a per-patient basis were high and not significantly different among the imaging modalities (89.7%, 93.0%, 87.8%, and 84.3% for US, MRI, scintigraphy, and CT, respectively). Mean per-patient specificity estimates were 95.6% for US, 92.8% for MRI, 84.5% for scintigraphy, and 95.1% for CT; the only significant difference in values was that between scintigraphy and US (P=.009). Mean per-bowel-segment sensitivity estimates were lower: 73.5% for US, 70.4% for MRI, 77.3% for scintigraphy, and 67.4% for CT. Mean per-bowel-segment specificity estimates were 92.9% for US, 94.0% for MRI, 90.3% for scintigraphy, and 90.2% for CT. CT proved to be significantly less sensitive and specific compared with scintigraphy (P=.006) and MRI (P=.037).	4

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31. Bruining DH, Siddiki HA, Fletcher JG, Tremaine WJ, Sandborn WJ, Loftus EV, Jr. Prevalence of penetrating disease and extraintestinal manifestations of Crohn's disease detected with CT enterography. <i>Inflamm Bowel Dis.</i> 2008;14(12):1701-1706.	Review/Other-Dx	357 consecutive patients	To determine the prevalence of penetrating disease and extraintestinal manifestations of CD identified by CT enterography. Study also examined the percentage of clinically significant new non-IBD related findings in these patients.	Of 357 patients identified (51% female) the median age was 41.6 years and median disease duration was 9.9 years. Of this cohort, 20.7% had penetrating disease (new finding in 58.1%) and 18.8% had extraintestinal IBD manifestations (new finding in 67.2%). 6 patients had primary sclerosing cholangitis and portal/mesenteric vein thrombosis, respectively. 45.1% had non-IBD findings including 2 unsuspected malignancies. Most of these extraenteric non-IBD abnormalities were benign, with only 13.0% requiring urgent follow-up. CT enterography is a valuable diagnostic modality for detecting both penetrating disease and extraintestinal IBD manifestations. These data add to a growing body of evidence that supports the use of CT enterography in CD diagnostic and management algorithms.	4
32. Doerfler OC, Ruppert-Kohlmayr AJ, Reittner P, Hinterleitner T, Petritsch W, Szolar DH. Helical CT of the small bowel with an alternative oral contrast material in patients with Crohn disease. <i>Abdom Imaging.</i> 2003;28(3):313-318.	Observational-Dx	38 patients	Assess usefulness of helical CT with negative oral contrast compared to tube enteroclysis in detecting CD.	Sensitivity of CT for detection of CD was superior to tube enteroclysis (89% vs 78%). CT is a simple, rapid, noninvasive, and accurate method of evaluating extramucosal manifestations of CD.	3

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33. Higgins PD, Caoili E, Zimmermann M, et al. Computed tomographic enterography adds information to clinical management in small bowel Crohn's disease. <i>Inflamm Bowel Dis.</i> 2007;13(3):262-268.	Observational-Dx	67 consecutive patients, 2 blinded reviewers	Retrospective, blinded evaluation study to test the following hypotheses: 1) CT enterography findings correlate well with clinical ratings of inflammation ($r > 0.7$); 2) CT enterography detects additional strictures beyond those suspected by clinicians; 3) CT enterography results lead to changes in the clinical likelihood of benefit from steroids; and 4) CT enterography findings correlate ($r > 0$) with objective laboratory markers of inflammation (erythrocyte sedimentation rate and CRP).	Individual CT enterography findings correlated poorly (Spearman's rho < 0.30) with clinical assessment; clinicians did not suspect 16% of radiologic strictures, and more than half the cases of clinically suspected strictures did not have them on CT enterography; CT enterography data changed clinicians' perceptions of the likelihood of steroid benefit in 41/67 cases; Specific CT enterography findings correlated with CRP, and a distinct set of CT enterography findings correlated with erythrocyte sedimentation rate in the subset of patients who had these biomarkers measured. CT enterography seems to add unique information to clinical assessment, both in detecting additional strictures and in changing clinicians' perceptions of the likelihood of steroids benefiting patients. The biomarker correlations suggest that CT enterography is measuring real biologic phenomena that correlate with inflammation, providing information distinct from that in a standard clinical assessment.	2
34. Minordi LM, Vecchioli A, Guidi L, Mirk P, Fiorentini L, Bonomo L. Multidetector CT enteroclysis versus barium enteroclysis with methylcellulose in patients with suspected small bowel disease. <i>Eur Radiol.</i> 2006;16(7):1527-1536.	Observational-Dx	52 patients	Prospective study to determine value of MDCT enteroclysis vs barium enteroclysis with methylcellulose in small bowel disease.	Sensitivity, specificity and diagnostic accuracy of MDCT enteroclysis vs barium enteroclysis was 83%, 100% and 89%, respectively. CT-E provides good representation of pathological patterns of CD.	3
35. Elsayes KM, Al-Hawary MM, Jagdish J, Ganesh HS, Platt JF. CT enterography: principles, trends, and interpretation of findings. <i>Radiographics.</i> 2010;30(7):1955-1970.	Review/Other-Dx	N/A	To discuss the technique of CT enterography and its utility in the evaluation of small bowel diseases.	CT enterography is particularly useful for differentiating between active and fibrotic bowel strictures in patients with CD, thus enabling selection of the most appropriate treatment (medical management or intervention) for an improved outcome. CT enterography allows excellent visualization of the entire thickness of the bowel wall and depicts extraenteric involvement as well, providing more detailed and comprehensive information about the extent and severity of the disease process.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
36. Baker ME, Walter J, Obuchowski NA, et al. Mural attenuation in normal small bowel and active inflammatory Crohn's disease on CT enterography: location, absolute attenuation, relative attenuation, and the effect of wall thickness. <i>AJR Am J Roentgenol.</i> 2009;192(2):417-423.	Observational-Dx	227 CT enterography exams (191 were normal and 36 had active inflammatory CD in the terminal ileum)	Case-control study. To measure relative and absolute wall attenuations and wall thickness in normal small bowel on contrast-enhanced CT enterography and to study the efficacy of relative attenuation, absolute attenuation, and wall thickness in distinguishing normal from active inflammatory CD of the terminal ileum.	Relative attenuation and absolute attenuation in the normal distended and collapsed duodenum and left upper quadrant were significantly greater than in all other segments (P<0.001 and <0.048 for relative attenuation and P<0.001 and <0.032 for absolute attenuation, respectively). Relative attenuation and wall thickness models and absolute attenuation and wall thickness models discriminated normal from active terminal ileum CD significantly better than the same measurements without wall thickness (P=0.017 and 0.001, respectively). When the bowel wall is >3 mm, a relative attenuation cutoff of 0.5 is 89% sensitive and 81% specific. In normal small bowel, when wall measurement is taken into account, the duodenum and jejunum have a greater relative attenuation and absolute attenuation than other segments. Relative attenuation and absolute attenuation with wall thickness models discriminate normal from active terminal ileum CD better than the same measurements without wall thickness.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
37. Chiorean MV, Sandrasegaran K, Saxena R, Maglinte DD, Nakeeb A, Johnson CS. Correlation of CT enteroclysis with surgical pathology in Crohn's disease. <i>Am J Gastroenterol.</i> 2007;102(11):2541-2550.	Observational-Dx	44 patients had 44 surgical interventions generating 47 bowel segments	Retrospective study to determine the accuracy of CT-E compared with surgical pathology in patients with CD and to assess the association of CT-E variables with inflammatory or fibrostenotic pathological lesions.	The accuracy of CT-E for inflammatory and fibrostenotic lesions was 76.6% and 78.7% using a four- and three-point grading system, respectively. There was good correlation between CT-E and pathology in regards to inflammation (Spearman's $r=0.7$, $P<0.0001$) and fibrostenosis (Spearman's $r=0.6$, $P<0.0001$) scores. The pathological inflammation score was significantly associated with the CT-E variables mucosal enhancement, wall thickness, comb sign, and adenopathy (Mantel-Haenszel χ^2 P values 0.04, 0.04, <0.0001 , and 0.016, respectively). The pathological fibrostenosis score was significantly associated with the presence and severity of stenosis on CT-E ($P=0.001$ and 0.007, respectively). By logistic regression analysis, the strongest association was seen with the comb sign (OR 5.52, $P<0.001$) for inflammation and the presence of stenosis (OR 5.87, $P=0.006$) for fibrostenosis. There was no interaction between the time interval from CT-E to surgery and the strength of these associations. CT-E may reliably differentiate between inflammatory and fibrostenotic lesions and may have an important role in the management of CD.	3
38. Choi D, Jin Lee S, Ah Cho Y, et al. Bowel wall thickening in patients with Crohn's disease: CT patterns and correlation with inflammatory activity. <i>Clin Radiol.</i> 2003;58(1):68-74.	Review/Other-Dx	53 patients 58 CT scans	Retrospective review to compare CT patterns of bowel wall thickening in known CD with pathological and clinical data.	55 (95%) of 58 CT examinations showed bowel wall thickening. Of these, 55 CT scans, type A pattern was found in 33 (60%), type B in 10 (18%), type C in 5 (9%), and type D in 7 (13%). CT patterns correlated with disease activity.	4
39. Colombel JF, Solem CA, Sandborn WJ, et al. Quantitative measurement and visual assessment of ileal Crohn's disease activity by computed tomography enterography: correlation with endoscopic severity and C reactive protein. <i>Gut.</i> 2006;55(11):1561-1567.	Observational-Dx	143 patients	Retrospective study to examine whether small bowel inflammation at CT enterography correlates with endoscopic severity and CRP in CD.	Quantitative measures of bowel enhancement at CT enterography correlate with endoscopic and histological severity. CRP correlates with radiological finding of perienteric inflammation.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
40. Soyer P, Boudiaf M, Sirol M, et al. Suspected anastomotic recurrence of Crohn disease after ileocolic resection: evaluation with CT enteroclysis. <i>Radiology</i> . 2010;254(3):755-764.	Observational-Dx	40 consecutive patients, 2 independent readers	To determine the utility of CT-E for characterization of the status of the anastomotic site in patients with CD who had previously undergone ileocolic resection. Written informed consent was prospectively obtained from all patients. Readers were blinded.	In the diagnosis of anastomotic recurrence, severe anastomotic stenosis was the most sensitive finding (95% [20/21 patients]; 95% CI, 76.18%, 99.88%), both comb sign and stratification had 95% specificity (18/19 patients; 95% CI, 73.97%, 99.87%), and stratification was the most accurate finding (92% [37/40 patients]; 95% CI, 79.61%, 98.43%). In the diagnosis of fibrostenosis, both severe anastomotic stenosis and anastomotic wall thickening were 100% sensitive (8/8 patients; 95% CI, 63.06%, 100.00%), and using an association among 5 categorical variables, including severe anastomotic stenosis, anastomotic wall thickening with normal or mild mucosal enhancement, absence of comb sign, and absence of fistula, yielded 88% sensitivity (7/8 patients; 95% CI, 47.35%, 99.68%), 97% specificity (31/32 patients; 95% CI, 83.78%, 99.92%), and 95% accuracy (38/40 patients; 95% CI, 83.08%, 99.39%). CT-E yields objective and relatively specific morphologic criteria that help differentiate between recurrent disease and fibrostenosis at the anastomotic site after ileocolic resection for CD.	1
41. Schmidt S, Guibal A, Meuwly JY, et al. Acute complications of Crohn's disease: comparison of multidetector-row computed tomographic enterography with magnetic resonance enterography. <i>Digestion</i> . 2010;82(4):229-238.	Observational-Dx	57 patients	To compare MDCT enterography with MR enterography performed upon acute exacerbation of CD.	MDCT enterography demonstrated fewer artifacts than MR enterography (P<0.0001). In 48 MDCT/MR enterography examinations, active disease was demonstrated: abscesses (n = 11), fistulas (n = 13), stenoses (n = 23) and/or intestinal inflammation (n = 38). Observers' agreement (range 0.56–0.87) was not significantly different between MDCT and MR enterography, neither in terms of sensitivity (range 58%–95%) nor specificity (range 67%–100%) for each of the 8 pathological features.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Vogel J, da Luz Moreira A, Baker M, et al. CT enterography for Crohn's disease: accurate preoperative diagnostic imaging. <i>Dis Colon Rectum</i> . 2007;50(11):1761-1769.	Observational-Dx	36 patients	Retrospective study to correlate CT enterography findings with operative findings in patients with CD.	In 36 patients, the presence or absence of stricture, fistula, abscess, or inflammatory mass was correctly determined by CT enterography in 100%, 94%, 100%, and 97%, respectively. Accuracy for stricture or fistula number was 83% and 86%, respectively. There were 9 patients with multiple disease phenotypes identified on CT enterography of which 8 were confirmed at surgery. CT enterography overestimated or underestimated the extent of disease in 11 patients (31%). CT enterography is an accurate preoperative diagnostic imaging study for small-bowel CD. The ability of this imaging study to detect both luminal and extraluminal pathology is a distinct advantage of CT enterography compared with small-bowel contrast studies.	3
43. Booya F, Akram S, Fletcher JG, et al. CT enterography and fistulizing Crohn's disease: clinical benefit and radiographic findings. <i>Abdom Imaging</i> . 2009;34(4):467-475.	Review/Other-Dx	56 patients	Retrospective study to estimate the clinical benefit of CT enterography in patients with fistulizing CD and describe the appearance of fistulas at CT enterography.	There was no or remote suspicion of fistula or abscess at pre-imaging clinical assessment in 50% of patients. 34 patients (61%) required a change in or initiation of medical therapy and another 10 (18%) underwent an interventional procedure based on CT enterography findings. Among 37 fistulas with reference standard confirmation, 30 (81%) were extraenteric tracts, and 32 (86%) were hyperenhancing compared to adjacent bowel loops. Most fistulas (68%) contained no internal air or fluid. CT enterography detects clinically occult fistulas and abscesses, resulting in changes in medical management and radiologic or surgical intervention. Most fistulas appear as hyperenhancing, extraenteric tracts, usually without internal air or fluid.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
44. Fidler JL, Fletcher JG, Bruining DH, Trenkner SW. Current status of CT, magnetic resonance, and barium in inflammatory bowel disease. <i>Semin Roentgenol.</i> 2013;48(3):234-244.	Review/Other-Dx	N/A	To explain the clinical benefits and appropriate utilization of cross-sectional enterography, review the technique and performance of CT enterography and MR enterography, and discuss the findings and approaches to interpretation.	Imaging plays a major role in the evaluation of patients with CD. Cross-sectional techniques provide valuable complementary information that cannot be obtained with endoscopic techniques. Their utilization will likely continue to increase in the future as they are used to monitor new therapies. Barium fluoroscopic studies can provide valuable dynamic information and remain useful for problem solving.	4
45. Orel SG, Rubesin SE, Jones B, Fishman EK, Bayless TM, Siegelman SS. Computed tomography vs barium studies in the acutely symptomatic patient with Crohn disease. <i>J Comput Assist Tomogr.</i> 1987;11(6):1009-1016.	Review/Other-Dx	43 patients	To assess the ability of gastrointestinal contrast studies and CT to define the location and extent of CD.	In 39/43 (91%) patients the contrast studies and CT agreed on the location of active disease. However, in 15/43 (35%) patients, contrast studies demonstrated additional areas of mucosal disease remote from the major area of activity that were not suggested by CT. In addition to demonstrating more extensive mucosal disease, contrast studies proved superior in demonstrating enteroenteric fistulae, sinus tracts, strictures, postsurgical anatomy, and relation of recurrence to anastomosis. CT proved superior in demonstrating mesenteric inflammation, abscesses, enterovesical and enterocutaneous fistulae, fistula to iliopsoas muscle and to sacrum.	4
46. Florie J, Horsthuis K, Hommes DW, et al. Magnetic resonance imaging compared with ileocolonoscopy in evaluating disease severity in Crohn's disease. <i>Clin Gastroenterol Hepatol.</i> 2005;3(12):1221-1228.	Observational-Dx	31 patients	Retrospective, blinded study to assess the value of MRI in measuring disease activity in CD compared to ileocolonoscopy.	Correlation between severity rated at MRI and Crohn's Disease Endoscopic Index of Severity (CDEIS) was moderate to strong with $r = 0.61$ ($P < .001$) for observer 1 and $r = 0.63$ ($P < .001$) for observer 2. Per segment, best correlation was seen in the terminal ileum ($r = 0.63$; $P < .001$, for both observers). Wall thickness correlated moderately to strongly with CDEIS ($r = 0.57$, $P < .001$ and $r = 0.50$, $P < .001$ for observers 1 and 2), whereas enhancement correlated weakly to moderately ($r = 0.45$, $P < .001$ and $r = 0.42$, $P < .001$). MRI can correctly identify disease severity in CD.	3

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
47. Florie J, Wasser MN, Arts-Cieslik K, Akkerman EM, Siersema PD, Stoker J. Dynamic contrast-enhanced MRI of the bowel wall for assessment of disease activity in Crohn's disease. <i>AJR Am J Roentgenol.</i> 2006;186(5):1384-1392.	Observational-Dx	48 patients	To evaluate the role of MR enterography in predicting disease activity of CD.	Bowel wall enhancement characteristics and bowel wall thickness correlated with objective measures of disease activity.	2
48. Fidler J. MR imaging of the small bowel. <i>Radiol Clin North Am.</i> 2007;45(2):317-331.	Review/Other-Dx	N/A	Review MRI of the small bowel with enterography and enteroclysis techniques. Article reviews the advantages, limitations, technique, and indications and the results that have been obtained in evaluating different disease processes.	Cross-sectional imaging techniques such as CT and MRI have advantages over traditional barium fluoroscopic techniques in their ability to visualize superimposed bowel loops better and to improve visualization of extraluminal findings and complications.	4
49. Del Vescovo R, Sansoni I, Caviglia R, et al. Dynamic contrast enhanced magnetic resonance imaging of the terminal ileum: differentiation of activity of Crohn's disease. <i>Abdom Imaging.</i> 2008;33(4):417-424.	Observational-Dx	16 consecutive patients	To prospectively investigate a new high resolution MRI technique for dynamic evaluation of the enhancement kinetics of bowel parietal layers and to correlate it with CDAI, CRP, endoscopic activity and histologic features.	About 9 patients showed a layered enhancement of bowel wall (8 active, 1 inactive), whereas inactive (7 cases) group presented a homogeneous pattern. In active patients, the study found a significant difference in parietal layered enhancement curves (M-SM vs Ms-S, P<0.03) not observed in inactive disease and controls (intra-group analysis). M-SM and Ms-S enhanced curves in clinically active patients were significantly different respect to those of patients with inactive CD (P<0.001) (inter-group analysis). Parietal DCE-MRI pattern well correlated with histologic features (r = 0.8; P<0.001, Spearman test). DCE-MRI can be a useful tool for clinical follow-up and in the treatment strategies in CD patients.	2
50. Gourtsoyiannis N, Papanikolaou N, Grammatikakis J, Papamastorakis G, Prassopoulos P, Roussomoustakaki M. Assessment of Crohn's disease activity in the small bowel with MR and conventional enteroclysis: preliminary results. <i>Eur Radiol.</i> 2004;14(6):1017-1024.	Observational-Dx	19 consecutive patients	Conventional enteroclysis and MR enteroclysis correlated with CDAI. Patients had colon endoscopy and both conventional and MR enteroclysis examinations.	Combination of bowel wall changes seen on conventional and MR enteroclysis can discriminate active from inactive CD.	3

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
51. Lawrance IC, Welman CJ, Shipman P, Murray K. Correlation of MRI-determined small bowel Crohn's disease categories with medical response and surgical pathology. <i>World J Gastroenterol.</i> 2009;15(27):3367-3375.	Experimental-Dx	55 patients; 2 blinded reviewers	To determine whether MRI can be used to categorize small bowel CD into groups that correlate with response to medical therapy and surgical pathology. Response to medical therapy was determined prospectively.	Females and category "2" patients were more likely, and patients with luminal narrowing and hold-up less likely, to respond to medical therapy (P<0.05). 17 patients underwent surgery. The surgical pathological findings of fibrosis and the severity of inflammation correlated with the MRI category in all cases. Findings suggest that small bowel CD can be grouped by the MRI findings and that these groups are associated with patients more likely to respond to continued medical therapy. The MRI categories also correlated with the presence and level of intestinal inflammation and fibrosis on surgical pathology, and may be of prognostic use in the management of CD patients.	1

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
52. Martinez MJ, Ripolles T, Paredes JM, Blanc E, Marti-Bonmati L. Assessment of the extension and the inflammatory activity in Crohn's disease: comparison of ultrasound and MRI. <i>Abdom Imaging</i> . 2009;34(2):141-148.	Observational-Dx	30 patients; 119 bowel segments	Prospective study to: examine the efficacy of MRI and US in the assessment of CD activity in comparison with clinical scoring and biologic tests, compare both techniques in the evaluation of extension and transmural complications.	About 53/119 (45%) bowel segments showed pathological changes in gold standard tests. US was superior to MRI in the localization of affected bowel segments (sensitivity: US 91%; MRI 83%; intertechniques agreement, kappa: 0.905) and in recognizing transmural complications (sensitivity: US 80%; MRI 72%), although significant differences were not found (P>0.05). A statistically significant correlation between color Doppler flow and MR bowel wall enhancement (segment-by-segment analysis and per patient analysis; P>0.5), and between perienteric changes in both techniques (P>0.5) were found. Wall thickness measured on US was significantly greater in the group of patients with clinical activity (P=0.023) or with clinical-biologic activity (P=0.024). Grades of hyperemia and MR contrast enhancement of patients with clinical-biologic activity was higher than in patients without clinical-biologic activity (P=0.019; P=0.023). Both US and MRI are sensitive to localize the affected bowel segments and to detect transmural complications. A significant correlation between color Doppler flow and bowel wall enhancement on MRI was found. US wall thickness, color Doppler flow, and bowel wall enhancement on MRI are related with clinical or biologic activity.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
53. Oto A, Fan X, Mustafi D, et al. Quantitative analysis of dynamic contrast enhanced MRI for assessment of bowel inflammation in Crohn's disease pilot study. <i>Acad Radiol.</i> 2009;16(10):1223-1230.	Observational-Dx	11 patients	Retrospective study. To evaluate the feasibility of quantitative analysis of DCE-MRI data in the detection of bowel inflammation in patients with CD.	51 bowel segments (19 with inflammation, 32 normal) were included in the analyses. Inflamed bowel segments had faster K(trans) values, larger v(e) values, increased contrast uptake, larger initial areas under the contrast concentration curve, and steeper initial enhancement slopes than normal bowel segments (P<.05). The areas under the ROC curve for these parameters ranged from 0.70 to 0.86. Results demonstrate that the quantitative analysis of DCE-MRI data is possible for the assessment of bowel inflammation in patients with CD. Future studies need be performed on larger numbers of patients to correlate the severity and type of inflammation with kinetic parameters.	2
54. Punwani S, Rodriguez-Justo M, Bainbridge A, et al. Mural inflammation in Crohn disease: location-matched histologic validation of MR imaging features. <i>Radiology.</i> 2009;252(3):712-720.	Observational-Dx	18 consecutive patients	Retrospective study. To validate proposed MRI features of CD activity against a histopathologic reference.	Acute inflammatory score was positively correlated with mural thickness and mural/CSF signal intensity ratio on T2-weighted fat-saturated images (P<.001 and P=.003, respectively) but not with mural enhancement at 30 and 70 seconds (P=.50 and P=.73, respectively). Acute inflammatory score was higher with layered mural enhancement (P<.001), a pattern also commonly associated with coexisting fibrostenosis (75%). Mural/CSF signal intensity ratio on T2-weighted fat-saturated images was higher in histologically edematous bowel than in nonedematous bowel (P=.04). There was no correlation between any lymph node characteristic and acute inflammatory score. Increasing mural thickness, high mural signal intensity on T2-weighted fat-saturated images, and a layered pattern of enhancement reflect histologic features of acute small-bowel inflammation in CD.	3

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
55. Rimola J, Rodriguez S, Garcia-Bosch O, et al. Magnetic resonance for assessment of disease activity and severity in ileocolonic Crohn's disease. <i>Gut</i> . 2009;58(8):1113-1120.	Observational-Dx	50 patients with clinically active (n=35) or inactive (n=15) CD	To determine the accuracy of MR for assessment of disease activity and severity in ileocolonic CD. Ileocolonoscopy used as the reference standard.	MR index had a high accuracy for the detection of disease activity (area under the ROC curve 0.891, sensitivity 0.81, specificity 0.89) and for the detection of ulcerative lesions (area under the ROC curve 0.978, sensitivity 0.95, specificity 0.91) in the colon and terminal ileum. Accuracy of MR for detecting disease activity and assessing severity brings about the possibility of using MR as an alternative to endoscopy in the evaluation of ileocolonic CD.	2
56. Rottgen R, Grandke T, Grieser C, Lehmkuhl L, Hamm B, Ludemann L. Measurement of MRI enhancement kinetics for evaluation of inflammatory activity in Crohn's disease. <i>Clin Imaging</i> . 2010;34(1):29-35.	Observational-Dx	26 patients; 2 reviewers	Retrospective study to investigate the feasibility of determining local inflammatory activity of CD by measurement of bowel wall perfusion kinetics using contrast-enhanced MRI.	The slope of the contrast enhancement curve significantly correlated with local inflammatory activity determined by endoscopy (R=0.594, P=.007). No significant correlation was found for area under the curve and peak maximum (R=0.411, P=.08 and R=0.334, P=.15, respectively). Determination of the perfusion kinetics of the bowel wall by MRI enables quantitative evaluation of local inflammatory activity in patients with CD.	3
57. Rottgen R, Herzog H, Lopez-Haninnen E, Felix R. Bowel wall enhancement in magnetic resonance colonography for assessing activity in Crohn's disease. <i>Clin Imaging</i> . 2006;30(1):27-31.	Observational-Dx	42 consecutive patients	To examine whether there is a correlation between MR colonography and pathological findings in colonoscopy.	Significant correlation between change of the signal intensity and colonoscopically assessed inflammatory activity. The degree of contrast enhancement of the colonic wall may be a criterion for the degree of enhancement in CD.	3
58. Sailer J, Peloschek P, Reinisch W, Vogelsang H, Turetschek K, Schima W. Anastomotic recurrence of Crohn's disease after ileocolic resection: comparison of MR enteroclysis with endoscopy. <i>Eur Radiol</i> . 2008;18(11):2512-2521.	Review/Other-Dx	30 patients; 3 reviewers	To assess the accuracy of MR enteroclysis in patients with CD recurrence after ileocolic resection and to establish an MR scoring system.	The endoscopic Rutgeerts score defines changes at the ileum on a scale from I0 to I4. In 3/30 (10%) patients, evaluation was not possible. The mean overall image quality was rated as 1.7 (kappa 0.78). Comparing MR and Rutgeerts score, the mean observer agreement for the total score rating was 77.8% (kappa 0.67). When comparing only scores below or above MR2—the threshold indicative of the necessity of medical treatment—there was a total agreement of 95.1% (kappa 0.84). MR enteroclysis allows assessment of CD recurrence after ileocolic resection. The MR score is reproducible and shows high agreement with the approved endoscopic Rutgeerts score.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
59. Schreyer AG, Geissler A, Albrich H, et al. Abdominal MRI after enteroclysis or with oral contrast in patients with suspected or proven Crohn's disease. <i>Clin Gastroenterol Hepatol.</i> 2004;2(6):491-497.	Observational-Dx	21 patients	Prospective study to evaluate the diagnostic efficacy of abdominal MRI of the small bowel after drinking contrast agent only compared with conventional enteroclysis and abdominal MRI performed after enteroclysis in patients with suspected or proven CD.	All pathological findings on conventional enteroclysis were shown correctly on MR after enteroclysis and MR after oral contrast only. Additional information by MR was obtained in 6/21 patients.	1
60. Sempere GA, Martinez Sanjuan V, Medina Chulia E, et al. MRI evaluation of inflammatory activity in Crohn's disease. <i>AJR Am J Roentgenol.</i> 2005;184(6):1829-1835.	Observational-Dx	20 patients 10 controls 40 MRI studies	Prospective study to assess the capability of MRI to quantitatively evaluate pathologic changes in CD relapse compared to ileocolonoscopy and histological changes.	MRI has ability to detect pathologic bowel segments in CD—it allows the measurement of significant variations in wall thickness and contrast enhancement on changing from the active phase of the disease to remission.	1
61. Taylor SA, Punwani S, Rodriguez-Justo M, et al. Mural Crohn disease: correlation of dynamic contrast-enhanced MR imaging findings with angiogenesis and inflammation at histologic examination--pilot study. <i>Radiology.</i> 2009;251(2):369-379.	Observational-Dx	11 consecutive patients	Prospective pilot study to determine mural perfusion dynamics in CD by using DCE-MRI and to correlate these with histopathologic markers of inflammation and angiogenesis.	Disease chronicity was positively correlated with enhancement ratio (correlation coefficient, 0.82; P=.002). Slope of enhancement demonstrated a significant negative correlation with microvascular density (correlation coefficient, -0.86; P<.001). There was a negative correlation between CRP level and slope of enhancement (correlation coefficient, -0.77; P=.006). Neither acute nor chronic inflammation score correlated with any other parameter. Certain MRI-derived mural hemodynamic parameters correlate with disease chronicity and angiogenesis in CD, but not with histologic and clinical markers of inflammation. Data support the working hypothesis that microvessel permeability increases with disease chronicity and that tissue microvascular density is actually inversely related to mural blood flow.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
62. Levi Z, Fraser E, Krongrad R, et al. Factors associated with radiation exposure in patients with inflammatory bowel disease. <i>Aliment Pharmacol Ther.</i> 2009;30(11-12):1128-1136.	Observational-Dx	199 CD and 125 UC patients	To estimate total and abdominal radiation exposure from diagnostic X-ray investigations in IBD patients and the associated risk factors.	A total of 199 CD and 125 UC patients were included. The mean cumulative estimated doses for CD and UC were 21.1 19.5 and 15.1 20.4 mSv respectively (P<0.001). 23 patients (7.1%) had an estimated cumulative estimated doses of ≥50 mSv. In multivariate analyses, predictors of increased cumulative estimated doses were: surgery (OR 5.68, 95% CI: 2.73–11.8, P<0.001), CD (OR 2.56, 95% CI: 1.29–5.07, P=0.007), prednisone use (OR 2.0, 95% CI: 1.11–3.67, P=0.02), first year of disease (OR 6.4, 95% CI: 1.3–32, P=0.02) and age in the upper quartile (OR 3.26, 95% CI: 1.68–6.3, P=0.001).	4
63. Desmond AN, O'Regan K, Curran C, et al. Crohn's disease: factors associated with exposure to high levels of diagnostic radiation. <i>Gut.</i> 2008;57(11):1524-1529.	Observational-Dx	409 patients with CD; complete data available for 399 patients	To: 1) examine patterns of use of imaging in CD; 2) quantify the cumulative effective dose of diagnostic radiation received by patients; and 3) identify patients at greatest risk of exposure to high levels of diagnostic radiation.	Use of CT increased significantly and accounted for 77.2% of diagnostic radiation. Mean cumulative effective dose was 36.1 mSv and exceeded 75 mSv in 15.5% of patients. Factors associated with high cumulative exposure were: age <17 years at diagnosis (HR 2.1, CI 1.1 to 4.1), UGI tract disease (OR 2.4, CI 1.2 to 4.9), penetrating disease (OR 2.0, CI 1.0 to 3.9) and requirement for intravenous steroids (OR 3.7, CI 2.0 to 6.6); infliximab (OR 2.3, CI 1.2 to 4.4); or multiple (>1) surgeries (OR 2.7, CI 1.4 to 5.4). Identifiable subsets of patients with CD are at risk of exposure to significant amounts of diagnostic radiation.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
64. Borthne AS, Abdelnoor M, Rugtveit J, Perminow G, Reisetter T, Klow NE. Bowel magnetic resonance imaging of pediatric patients with oral mannitol MRI compared to endoscopy and intestinal ultrasound. <i>Eur Radiol.</i> 2006;16(1):207-214.	Observational-Dx	43 patients	To assess the sensitivity, specificity, and diagnostic accuracy of MRI in pediatric patients with clinical suspicion of IBD by comparing MRI and US to endoscopy, the gold standard.	A median volume of 300 mL of mannitol in a 4.5% watery solution were ingested by 43 children prior to examination. The 53 MRI examinations were compared with 20 endoscopies and 41 US of the terminal ileum. The outcomes were MRI quality; pathologic findings; level of adverse events; and concordance between endoscopy, MRI, and US estimated by kappa statistics. The ileum and terminal ileum were very good or excellently imaged in approximately 80% of cases. Wall thickening and enhancement were most frequent in the terminal ileum. MRI compared with endoscopy had a sensitivity of 81.8% [95% CI], specificity of 100%, diagnostic accuracy of 90%, and kappa value of 0.80 (95% CI), indicating a good degree of concordance.	2
65. Pilleul F, Godefroy C, Yzebe-Beziat D, Dugougeat-Pilleul F, Lachaux A, Valette PJ. Magnetic resonance imaging in Crohn's disease. <i>Gastroenterol Clin Biol.</i> 2005;29(8-9):803-808.	Observational-Dx	62 patients	To evaluate the value of gadolinium enhanced MRI with oral opacification using a 5% mannitol solution (CE-Mannitol-MRI) to reveal bowel inflammation in pediatric patients with known or suspected CD.	The sensitivity and specificity of CE-Mannitol-MRI for the diagnosis of CD were 83% and 100%, respectively. Bowel wall enhancement was higher in the group of patients with abnormal small bowel loops vs control group (P=0.001). In patients with known CD, there was a positive correlation between wall thickness and PCDAI (P=0.003). However, no significant correlation was demonstrated between parietal contrast enhancement and PCDAI (P=0.497). CE-Mannitol-MRI enabled identification of complications in 18 patients (9 fistulae, 8 strictures and 1 intussusception).	2
66. Albert JG, Martiny F, Krummenerl A, et al. Diagnosis of small bowel Crohn's disease: a prospective comparison of capsule endoscopy with magnetic resonance imaging and fluoroscopic enteroclysis. <i>Gut.</i> 2005;54(12):1721-1727.	Observational-Dx	52 consecutive patients	Prospective study to compare capsule endoscopy, MR enterography and fluoroscopic enteroclysis in suspected and established CD.	Small bowel CD was diagnosed in 41/52 patients (79%). Capsule endoscopy was slightly more sensitive than MRI (12 vs 10 of 13 in suspected CD and 13 vs 11 of 14 in established CD). MR and capsule endoscopy are complimentary tools for diagnosing CD.	3

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
67. Fiorino G, Bonifacio C, Peyrin-Biroulet L, et al. Prospective comparison of computed tomography enterography and magnetic resonance enterography for assessment of disease activity and complications in ileocolonic Crohn's disease. <i>Inflamm Bowel Dis.</i> 2011;17(5):1073-1080.	Observational-Dx	44 patients	To prospectively compare the sensitivity, specificity, and accuracy of abdominal MR enterography and CT enterography to assess disease activity and complications (fistulas, strictures) in ileocolonic CD.	No significant differences in sensitivity, specificity, and accuracy were observed between MR enterography and CT enterography regarding the following parameters at the patient level: localization of CD (P=1.0), bowel wall thickening (P=1.0), bowel wall enhancement (P=1.0), enteroenteric fistulas (P=0.08), detection of abdominal nodes (P=1.0), and perivisceral fat enhancement (P=0.31). MR was significantly superior compared to CT in detecting strictures (P=0.04). Per segment analysis showed that MR enterography was significantly superior to CT enterography in detecting ileal wall enhancement (P=0.02).	2
68. Jensen MD, Kjeldsen J, Rafaelsen SR, Nathan T. Diagnostic accuracies of MR enterography and CT enterography in symptomatic Crohn's disease. <i>Scand J Gastroenterol.</i> 2011;46(12):1449-1457.	Observational-Dx	35 patients	To determine and compare the sensitivities and specificities of MR enterography and CT enterography for detection of small bowel lesions with emphasis on stenoses in this group of patients.	A total of 35 patients had active small bowel CD (jejunum 0, ileum 1, (neo)-terminal ileum 34) and 20 had small bowel stenosis. The sensitivity and specificity of MR enterography for detection of small bowel CD was 74% and 80% compared to 83% and 70% with CT enterography (p ‡ 0.5). MR enterography and CT enterography detected small bowel stenosis with 55% and 70% sensitivities, respectively (P=0.3) and 92% specificities.	1
69. Jensen MD, Ormstrup T, Vagn-Hansen C, Ostergaard L, Rafaelsen SR. Interobserver and intermodality agreement for detection of small bowel Crohn's disease with MR enterography and CT enterography. <i>Inflamm Bowel Dis.</i> 2011;17(5):1081-1088.	Observational-Dx	50 patients	To determine the interobserver and intermodality agreement for detection of small bowel CD.	The image quality was better with CT enterography than MR enterography (P<0.001) but the diagnostic yields were comparable (P=0.4). For detection of small bowel CD, the interobserver agreement was substantial in CT enterography (kappa = 0.64) and moderate in MR enterography (kappa = 0.48). The intermodality agreement was fair to substantial (kappa = 0.40–0.64) for different observers. 2 abscesses were detected and confirmed at subsequent surgery. 1 abscess was not detected with MR enterography and only recorded by 2 observers in CT enterography. A total of 10 fistulas were detected: 3 were confirmed at subsequent surgery and 4 were false-positive findings.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
70. Schmidt S, Lepori D, Meuwly JY, et al. Prospective comparison of MR enteroclysis with multidetector spiral-CT enteroclysis: interobserver agreement and sensitivity by means of "sign-by-sign" correlation. <i>Eur Radiol.</i> 2003;13(6):1303-1311.	Observational-Dx	50 patients	A prospective comparison of MR enteroclysis with multidetector spiral-CT enteroclysis.	Sensitivities and specificities resulted from comparison with pathological results (n=29) and patient's clinical evolution (n=21). Most pathological signs, such as bowel wall thickening, bowel wall enhancement and lymphadenopathy, showed better interobserver agreement on multidetector spiral-CT enteroclysis than on MR enteroclysis (bowel wall thickening: 0.65 vs 0.48; bowel wall enhancement: 0.51 vs 0.37; lymphadenopathy: 0.52 vs 0.15). Sensitivity of multidetector spiral-CT enteroclysis was higher than that of MR enteroclysis in detecting bowel wall thickening (88.9% vs 60%), bowel wall enhancement (78.6% vs 55.5%) and lymphadenopathy (63.8% vs 14.3%). Wilcoxon signed-rank test revealed significantly better sensitivity of multidetector spiral-CT enteroclysis than that of MR enteroclysis for each observer (P=0.028, P=0.046, P=0.028, respectively).	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
71. Siddiki HA, Fidler JL, Fletcher JG, et al. Prospective comparison of state-of-the-art MR enterography and CT enterography in small-bowel Crohn's disease. <i>AJR Am J Roentgenol.</i> 2009;193(1):113-121.	Observational-Dx	33 patients, 4 independent reviewers: 2 for MR enterography 2 for CT enterography	Blinded prospective study. To obtain pilot data on the accuracy of MR enterography for detecting small-bowel CD compared with CT enterography and with a clinical reference standard based on imaging, clinical information, and ileocolonoscopy.	All 33 patients underwent CT enterography and ileocolonoscopy, 30 of whom also underwent MR enterography. Sensitivities of MR enterography and CT enterography for detecting active small-bowel CD were similar (90.5% vs 95.2%, respectively; P=0.32). The image quality scores for MR enterography examinations were significantly lower than those for CT enterography (P=0.005). MR enterography and CT enterography identified 8 cases (24%) with a final diagnosis of active small-bowel inflammation in which the ileal mucosa appeared normal at ileocolonoscopy. Furthermore, enterography provided the only available imaging in 3 additional patients who did not have ileal intubation. MR enterography and CT enterography have similar sensitivities for detecting active small-bowel inflammation, but image quality across the study cohort was better with CT. Cross-sectional enterography provides complementary information to ileocolonoscopy.	2
72. Maccioni F, Bruni A, Viscido A, et al. MR imaging in patients with Crohn disease: value of T2- versus T1-weighted gadolinium-enhanced MR sequences with use of an oral superparamagnetic contrast agent. <i>Radiology.</i> 2006;238(2):517-530.	Observational-Dx	59 patients	To prospectively compare oral contrast-enhanced T2-weighted half-Fourier rapid acquisition with relaxation enhancement MRI with T1-weighted gadolinium-enhanced fast low-angle shot MR and standard examinations in the evaluation of CD.	T2-weighted MR was 95% accurate, 98% sensitive, and 78% specific for detection of ileal lesions. Agreement between T1- and T2-weighted images ranged from 0.77 for ileal lesions to 1.00 for colic lesions. T2-weighted MR enabled detection of 26/29 severe strictures, 17/24 enteroenteric fistulas, and all adhesions and abscesses; T1-weighted MR enabled detection of 20/29 severe strictures, 16/24 enteroenteric fistulas, and all adhesions and abscesses. Complications leading to surgery were found in 12 (20%) patients; these were assessed correctly with either T1- or T2-weighted images. T2-weighted signal intensities of the wall and mesentery correlated with biologic activity (P<.001, r of 0.774 and 0.712, respectively). Interobserver agreement was 0.642-1.00 for T2-weighted and 0.711-1.00 for T1-weighted images.	1

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
73. Bell SJ, Halligan S, Windsor AC, Williams AB, Wiesel P, Kamm MA. Response of fistulating Crohn's disease to infliximab treatment assessed by magnetic resonance imaging. <i>Aliment Pharmacol Ther.</i> 2003;17(3):387-393.	Review/Other-Dx	12 patients	To assess Crohn's fistula healing after infliximab treatment using MRI. MRI and clinical evaluation were performed before and after 3 infliximab infusions given over a 6-week period.	Pretreatment MRI detected abscesses in 3 (2 not treated) of 12 patients. MRI can identify clinically silent sepsis and fistulas may persist despite clinical remission.	4
74. Horsthuis K, Lavini C, Bipat S, Stokkers PC, Stoker J. Perianal Crohn disease: evaluation of dynamic contrast-enhanced MR imaging as an indicator of disease activity. <i>Radiology.</i> 2009;251(2):380-387.	Observational-Dx	33 patients	To prospectively determine clinical value of DCE-MRI in the evaluation of disease activity in perianal CD.	Significant correlations were found between the absolute amounts of the time-intensity curves shape types and Perianal Disease Activity Index (PDAI) and between ROI volume and PDAI. The ratio of quickly enhancing vs slowly enhancing pixels correlated with higher MRI scores as did the ROI volume. The absolute amounts of pixels displaying time-intensity curves types 2, 3, 4, and 5 correlated significantly with MRI score. CRP level showed a significant correlation with mean maximum enhancement. Larger numbers of quickly enhancing pixels were observed in patients who needed medication changes or developed new abscesses during follow-up. DCE-MRI can help determine disease activity in perianal CD and might be helpful in selecting a subpopulation of patients who should be monitored more closely for development of more extensive disease.	3

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
75. Ng SC, Plamondon S, Gupta A, et al. Prospective evaluation of anti-tumor necrosis factor therapy guided by magnetic resonance imaging for Crohn's perineal fistulas. <i>Am J Gastroenterol</i> . 2009;104(12):2973-2986.	Review/Other-Dx	34 consecutive patients	To prospectively evaluate anti-tumor necrosis factor therapy guided by MRI for Crohn's perineal fistulas.	34 consecutive patients with perineal fistulas were treated with infliximab (19), adalimumab (7; all infliximab failures) and thalidomide (8). Median follow-up was 110 weeks (range, 74–161). Baseline MRI: 38% ≥ 2 tracks, 21% anolabial/rectovaginal. At latest follow-up, clinical fistula 'response' and 'closure' were seen in 50% and 46% of antibody-treated patients, respectively. All patients stopped thalidomide early due to side effects. Of 26 antibody-treated patients, at 6 (n=25), 12 (n=25), and 18 (n=20) months, respectively, MRI showed complete healing (20%, 28%, and 30%, respectively), improvement (68%, 72%, and 65%), no change (12%, 0%, and 0%) or worsening (0%, 0%, and 5%). MRI healing at 6 months (n=5) persisted at 12 and 18 months, including in 2 patients who stopped treatment at 6 months. Fistula history length and complexity did not influence the outcome. The only surgical intervention was set on insertion in 1 patient. The PDAI and CDAI scores decreased and quality of life improved significantly at last follow-up. MRI fistula resolution was variable and slower than clinical healing. Prolonged treatment is often required for internal track resolution.	4
76. Van Assche G, Vanbeckevoort D, Bielen D, et al. Magnetic resonance imaging of the effects of infliximab on perianal fistulizing Crohn's disease. <i>Am J Gastroenterol</i> . 2003;98(2):332-339.	Observational-Dx	18 patients	Prospective study to assess the behavior of perianal fistulas as measured by MRI before and after infliximab treatment.	The MRI score was reliable in assessing the fistula tracks, with good interobserver concordance ($P < 0.001$). Fistula tracks with signs of active inflammation were found in all 18 patients at baseline and collections in 7.	3
77. Rodgers PM, Verma R. Transabdominal ultrasound for bowel evaluation. <i>Radiol Clin North Am</i> . 2013;51(1):133-148.	Review/Other-Dx	N/A	To review US bowel evaluation including imaging for suspected acute appendicitis and acute diverticulitis, as well as the role of US in a multimodality approach for the diagnosis and management of IBD and associated complications.	No results stated in abstract.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
78. Strobel D, Goertz RS, Bernatik T. Diagnostics in inflammatory bowel disease: ultrasound. <i>World J Gastroenterol.</i> 2011;17(27):3192-3197.	Review/Other-Dx	N/A	To focus on the current clinical practice of US in IBD, describing the current technologies used in transabdominal intestinal US and the characteristic sonographic findings in Crohn's disease and UC.	No results stated in abstract.	4
79. Fraquelli M, Colli A, Casazza G, et al. Role of US in detection of Crohn disease: meta-analysis. <i>Radiology.</i> 2005;236(1):95-101.	Review/Other-Dx	N/A	To evaluate the accuracy of US in the detection of CD in adults by systematically reviewing both cohort studies (those including patients whose clinical characteristics were consistent with those caused by an IBD) and case-control studies (those in which patients with CD were compared with patients with other bowel diseases or healthy control subjects).	The ranges of US sensitivity and specificity for the diagnosis of CD reported for the included series were 75%–94% and 67%–100%, respectively; the heterogeneity of these values prevented the calculation of a cumulative value. The summary ROC curve revealed a clear cutoff effect that depended on the chosen bowel wall thickness threshold. Sensitivity and specificity of 88% and 93%, respectively, were achieved when a bowel wall thickness threshold >3 mm was used, and sensitivity and specificity of 75% and 97%, respectively, were achieved when a threshold >4 mm was used.	4
80. Parente F, Greco S, Molteni M, et al. Role of early ultrasound in detecting inflammatory intestinal disorders and identifying their anatomical location within the bowel. <i>Aliment Pharmacol Ther.</i> 2003;18(10):1009-1016.	Observational-Dx	487 patients	To investigate the accuracy of bowel US compared with barium X-ray studies, CT, endoscopy and bowel surgery in the initial assessment of inflammatory bowel disorders.	336 patients had pathological findings of the bowel detectable at US as the final diagnosis. The main organic disorders found were CD (56%), ulcerative/indeterminate colitis (30%), bowel tumors (5%), appendicitis/diverticulitis (2%) and other inflammatory conditions (8%). The overall sensitivity and specificity of bowel US were 85% and 95%, respectively, whereas the PPV and NPV were 98% and 75%, respectively. Comparisons of US with X-ray or endoscopic results by disease localization showed that the diagnostic performance of US was higher for inflammatory conditions of the ileum and sigmoid/descending colon (sensitivity of 92% and 87%, respectively), whereas abnormalities localized in the rectum, duodenum and proximal jejunum were often missed by US.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
81. Calabrese E, Petruzzello C, Onali S, et al. Severity of postoperative recurrence in Crohn's disease: correlation between endoscopic and sonographic findings. <i>Inflamm Bowel Dis.</i> 2009;15(11):1635-1642.	Experimental-Dx	72 patients: 2 independent investigators	To examine the accuracy of small intestine contrast US in assessing CD recurrence after ileocolonic resection when using ileocolonoscopy as a gold standard. The correlation between the bowel wall thickness measured by small intestine contrast US and the endoscopic score of recurrence was also assessed. Patients were prospectively enrolled.	Ileocolonoscopy detected recurrence in 67/72 (93%) patients. Small intestine contrast US detected findings compatible with recurrence in 62/72 (86%) patients (5 false negative, 4 false positive, 1 true negative, 62 true positive), showing a 92.5% sensitivity, 20% specificity, and 87.5% accuracy for detecting CD recurrence. The median bowel wall thickness, the extent of the ileal lesions, and the prestenotic dilation were higher in patients with an endoscopic degree of recurrence ≥ 3 vs ≤ 2 ($P < 0.001$) and the lumen diameter was lower in patients with a Rutgeerts' score ≥ 3 vs ≤ 2 ($P < 0.0001$). Although small intestine contrast US and ileocolonoscopy provide different views of the small bowel, small intestine contrast US shows a significant correlation with the endoscopic findings. Small intestine contrast US may represent an alternative noninvasive technique for assessing CD recurrence after ileocolonic resection.	1
82. Novak KL, Wilson SR. The role of ultrasound in the evaluation of inflammatory bowel disease. <i>Semin Roentgenol.</i> 2013;48(3):224-233.	Review/Other-Dx	N/A	To review the role of US in the evaluation of IBD.	No results stated in abstract.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
83. Rigazio C, Ercole E, Laudi C, et al. Abdominal bowel ultrasound can predict the risk of surgery in Crohn's disease: proposal of an ultrasonographic score. <i>Scand J Gastroenterol.</i> 2009;44(5):585-593.	Observational-Dx	147 total patients: 49 cases operated on within 30 days after US and 98 matched nonoperated controls	To evaluate the prognostic role of bowel-wall US morphology on the short-term risk of surgery.	Wall thickness and US patterns were significantly different between cases and controls (P<0.0001). A wall thickness >4.5 mm was observed in 45/49 cases and 47/98 controls (OR = 12.21), while “disrupted stratification” was observed in 34/49 cases and 12/98 controls (OR = 16.24). Among the clinical and US characteristics recorded only 4 US variables were independently associated with surgery (pattern, thickness, presence of fistulae/abscesses and stenoses) and considered for the US score=(2.5*US pattern)+(1.5*Bowel thickness)+(3*Presence of fistulae/abscesses)+(1.5*Presence of stenoses). Based on this score, up to 84% of patients were correctly classified according to actual status (operated/nonoperated). Proposed score seems to be a reliable prognostic marker for the short-term risk of surgery in CD. Further prospective validation needed.	3
84. Ripolles T, Martinez MJ, Barrachina MM. Crohn's disease and color Doppler sonography: response to treatment and its relationship with long-term prognosis. <i>J Clin Ultrasound.</i> 2008;36(5):267-272	Observational-Dx	28 patients	Prospective study to evaluate the ability of US to detect changes in patients undergoing treatment for CD and whether these findings are related to the patient's long-term outcome.	Initial baseline US revealed at least 1 thickened segment of the bowel wall in all of the patients. In this initial examination, 18/22 patients (81%) with clinically active disease had moderate or marked parietal vascularity. A statistically significant reduction in the vascularity of the affected bowel was observed on the third US examination (P<0.05). 17 patients who were in clinical remission had relapse and were treated with immunosuppressive therapy or surgery during the follow-up. 86% of the patients with residual hyperemia on US examination after treatment had an unfavorable clinical course compared with only 30% of the patients with no, or barely visible, residual hyperemia (P<0.01). US can identify bowel inflammation and its changes during treatment.	2
85. Di Sabatino A, Armellini E, Corazza GR. Doppler sonography in the diagnosis of inflammatory bowel disease. <i>Dig Dis.</i> 2004;22(1):63-66.	Review/Other-Dx	N/A	Review current status of Doppler US in evaluation of CD.	Doppler US appears to be an effective noninvasive tool in diagnosis and follow-up of CD and UC.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
86. Girlich C, Jung EM, Iesalnieks I, et al. Quantitative assessment of bowel wall vascularisation in Crohn's disease with contrast-enhanced ultrasound and perfusion analysis. <i>Clin Hemorheol Microcirc.</i> 2009;43(1-2):141-148	Review/Other-Dx	4 volunteers and 20 patients; MRI (19 patients) and CT (1 patient)	To assess the perfusion pattern of inflamed bowel walls in CD compared with healthy volunteers quantitatively using specific quantification software.	Patients had significant higher peak values (median 46.86, lower quartile 37.91, and upper quartile 53.20) and significant higher regional blood volume (median 2133.65, lower quartile 1202.90, and upper quartile 2820.44) than volunteers. Considering the very low peak value of the healthy, it is easy to understand that the time-to-peak was significantly shorter in the volunteers (median 4.45, lower quartile 1.82, and upper quartile 6.88) than in the patients (median 12.15, lower quartile 9.18, and upper quartile 15.74). Study showed clear differences between inflamed and normal bowel wall vascularity regarding all perfusion parameters. Results show that a quantitative assessment of the bowel wall vascularization and inflammation, respectively, is possible.	4
87. Migaleddu V, Quaia E, Scano D, Virgilio G. Inflammatory activity in Crohn disease: ultrasound findings. <i>Abdom Imaging.</i> 2008;33(5):589-597.	Review/Other-Dx	N/A	Review role of CE-US in CD inflammatory activity.	In CD, CE-US may characterize the bowel wall thickness by differentiating fibrosis from edema and may grade the inflammatory disease activity by assessing the presence and distribution of vascularity within the layers of the bowel wall (submucosa alone or the entire bowel wall). Peri-intestinal inflammatory involvement can be also characterized. CE-US can provide prognostic data concerning clinical recurrence of the inflammatory disease and evaluate the efficacy of drugs treatments.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
88. Migaleddu V, Scanu AM, Quaia E, et al. Contrast-enhanced ultrasonographic evaluation of inflammatory activity in Crohn's disease. <i>Gastroenterology</i> 2009; 137(1):43-52.	Observational-Dx	47 consecutive patients, 3 blinded investigators	To test the diagnostic accuracy of US, color Doppler US, and CE-US in the evaluation of inflammatory activity in patients with CD, and to correlate the findings of these sonographic studies with inflammatory activity, as scored by the CDAI.	CE-US showed the highest performance, with 93.5% sensitivity, 93.7% specificity, and 93.6% overall accuracy. CE-US revealed 3 bowel wall perfusion patterns after microbubble injection: submucosal enhancement and inward and outward transperietal enhancement. The linear correlation coefficient for CE-US vs CDAI was 0.74 (P<.0001); for baseline US (assessing thickness, length, and multilayer appearance of the diseased bowel) vs the CDAI, the coefficients were 0.68 (P<.0001), 0.47 (P=.0009), and 0.60 (P<.0001), respectively; and for color Doppler US vs CDAI the coefficient was 0.73 (P<.0001). CE-US has a high sensitivity and specificity in detecting inflammatory activity and a strong correlation with the CDAI.	1
89. Paredes JM, Ripolles T, Cortes X, et al. Abdominal sonographic changes after antibody to tumor necrosis factor (anti-TNF) alpha therapy in Crohn's Disease. <i>Dig Dis Sci.</i> 2010;55(2):404-410.	Observational-Dx	24 consecutive patients	Prospective study performed on patients with CD, using US to assess changes caused by biological therapy and its relationship with the clinical-biological response.	The biological therapy induced remission or a partial response in 46% and 25% of the patients, respectively. It also caused a significant reduction in the thickness of the bowel wall (P=0.005) and Doppler flow (P=0.02), leading to the disappearance of complications in 50% of the patients. US changes were significantly more marked in patients who achieved some type of clinical-biological response, in such a way that sonograms were improved in 65% (P=0.001) and complications disappeared in 100% of patients (P=0.005) compared to those patients who did not respond to treatment. However, sonographic normality was only achieved in 5/17 (29%) reactive patients (P=0.27). This fact may support the use of US as a technique for optimizing the biological treatment of CD.	3

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
90. Ripolles T, Martinez MJ, Paredes JM, Blanc E, Flors L, Delgado F. Crohn disease: correlation of findings at contrast-enhanced US with severity at endoscopy. <i>Radiology</i> . 2009;253(1):241-248.	Observational-Dx	61 patients	To evaluate prospectively the effectiveness of visualization of vascularization at contrast material-enhanced US for assessment of the activity of CD, with severity grade determined at endoscopy as the reference standard.	Colonoscopy showed inflammatory lesions in 53 patients (mild disease, 7; moderate disease, 12; and severe disease, 34). Bowel wall thickness and grade at color Doppler US (P=.019 and .002, respectively) correlated with severity grade at endoscopy. Mural contrast enhancement in patients with active disease at endoscopy was markedly increased in comparison with enhancement in patients with inactive disease (P<.001). Multivariate logistic regression analysis revealed that an increase in wall brightness was a significant and independent variable predictive of severity grade at endoscopy. A threshold brightness value of percentage of increase of 46% had a sensitivity and specificity of 96% and 73%, respectively, in the prediction of moderate or severe grade for inflammation at endoscopy. Quantitative measurements of bowel enhancement obtained by using CE-US correlate with severity grade determined at endoscopy. CE-US could be a useful technique to monitor the activity of CD.	2
91. Robotti D, Cammarota T, Debani P, Sarno A, Astegiano M. Activity of Crohn disease: value of Color-Power-Doppler and contrast-enhanced ultrasonography. <i>Abdom Imaging</i> . 2004;29(6):648-652	Observational-Dx	52 patients	Compared power Doppler and contrast enhanced B-mode US with clinical and lab findings and follow-up.	Bowel US exam associated with color power Doppler, especially US contrast medium injection can be used to detect CD activity and modulate therapy and follow-up.	3

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
92. Sjekavica I, Barbaric-Babic V, Krznaric Z, Molnar M, Cukovic-Cavka S, Stern-Padovan R. Assessment of Crohn's disease activity by doppler ultrasound of superior mesenteric artery and mural arteries in thickened bowel wall: cross-sectional study. <i>Croat Med J.</i> 2007;48(6):822-830.	Observational-Dx	138 patients with CD (74 with active, 64 with inactive disease) and 67 healthy volunteers	To define sensitive and reliable Doppler parameters for measurements in the superior mesenteric artery and mural arteries of affected bowel loops used in the assessment of CD activity.	The measurements in the superior mesenteric artery showed statistically and clinically significant difference in flow volume in active group, compared with inactive and control groups (C+/-Q=564+/-263 ml/min for active, 421+/-157 for inactive and 416+/-248 for control group). Affected bowel loops analysis showed significant difference between inactive and active CD group in wall thickness (3.1+/-1.4 vs 5.0+/-1.8 mm, P<0.001, Mann-Whitney test) while all participants from control group had thickness below 2mm. Intensity of color Doppler signals was different for all groups (P<0.001, chi(2) test) with the highest level of hyperemia in the active group. Resistance index measurements of mural arteries in bowel wall revealed differences between all 3 groups (0.61+/-0.05 in active group, 0.71+/-0.05 in the inactive group and 0.80+/-0.11 in the control group, P<0.001, Kruskal-Wallis test). Intensity of color Doppler signals and resistance index measurements of mural arteries in the thickened bowel wall can be used as quantitative diagnostic tool in the assessment of CD activity.	3
93. Maconi G, Ardizzone S, Greco S, Radice E, Bezzio C, Bianchi Porro G. Transperineal ultrasound in the detection of perianal and rectovaginal fistulae in Crohn's disease. <i>Am J Gastroenterol.</i> 2007;102(10):2214-2219.	Observational-Dx	46 patients	Prospective study to examine CD perianal and rectovaginal fistulae using transperineal US and compare the findings with results of endoanal US as reference standard.	52 fistulae (3 intra-sphincteric, 28 transsphincteric, 8 suprasphincteric, 2 extrasphincteric, 9 rectovaginal, and 2 anovulvar) were detected by transperineal US. Endoanal US confirmed the correct classification of 45 fistulae (PPV: 86.5%). Of the 53 fistulae detected by endoanal US, 45 were correctly classified by transperineal US (sensitivity 84.9%). Transperineal US showed 10 perianal abscesses: 2 horseshoe, 4 deep, and 4 superficial. Endoanal US confirmed all horseshoe, 3 deep, and 2 superficial abscesses and did not find further abscesses. Transperineal US is a simple, painless, real-time method to detect and classify perianal and rectovaginal fistulae and/or abscesses in CD.	1

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
94. Panes J, Bouzas R, Chaparro M, et al. Systematic review: the use of ultrasonography, computed tomography and magnetic resonance imaging for the diagnosis, assessment of activity and abdominal complications of Crohn's disease. <i>Aliment Pharmacol Ther.</i> 2011;34(2):125-145.	Review/Other-Dx	68 publications	To perform an assessment of the diagnostic accuracy of cross-sectional imaging techniques for diagnosis of CD, evaluation of disease extension and activity and diagnosis of complications, and to provide recommendations for their optimal use.	US is an accurate technique for diagnosis of suspected CD and for evaluation of disease activity (sensitivity 0.84, specificity 0.92), is widely available and noninvasive, but its accuracy is lower for disease proximal to the terminal ileum. MRI has a high diagnostic accuracy for the diagnosis of suspected CD and for evaluation of disease extension and activity (sensitivity 0.93, specificity 0.90), and is less dependent on the examiner and disease location compared with US. CT has a similar accuracy to MRI for assessment of disease extension and activity. The 3 techniques have a high accuracy for identification of fistulas, abscesses and stenosis (sensitivities and specificities >0.80), although US has false positive results for abscesses. As a result of the lack of radiation, US or MRI should be preferred over CT, particularly in young patients.	4
95. Masselli G, Casciani E, Poletini E, Lanciotti S, Bertini L, Gualdi G. Assessment of Crohn's disease in the small bowel: Prospective comparison of magnetic resonance enteroclysis with conventional enteroclysis. <i>Eur Radiol.</i> 2006;16(12):2817-2827.	Observational-Dx	66 consecutive patients	To assess the diagnostic value of ME enteroclysis compared with conventional enteroclysis in patients with CD and to evaluate the diagnostic accuracy of each different MR sequence.	The sensitivity, specificity and accuracy of ME enteroclysis were 90%–87% and 83% for the depiction of parietal ulcers, 84%–88% and 86% for pseudopolyps, 100%–94% and 96% for mural stenosis, 93%–100% and 94% for fistulae. The number of detected extraluminal findings was significantly higher with ME enteroclysis (P<0.01). The accuracy of fast imaging employing steady-state acquisition sequence was statistically higher in the depiction of wall ulcers and fistulae than that of 3D-fast spoiled gradient echo (P<0.01) and single-shot fast spin-echo (P<0.05) sequences. Contrast-enhanced 3D-fast spoiled gradient echo R was superior for mural stenosis visualization compared to single-shot fast spin-echo (P<0.05) and fast imaging employing steady-state acquisition (P<0.05).	2

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
96. Maconi G, Sampietro GM, Parente F, et al. Contrast radiology, computed tomography and ultrasonography in detecting internal fistulas and intra-abdominal abscesses in Crohn's disease: a prospective comparative study. <i>Am J Gastroenterol.</i> 2003;98(7):1545-1555	Observational-Dx	128 patients	To compare US and contrast radiography in detecting intestinal fistulae and abscesses complicating CD.	Internal fistulae and intra-abdominal abscesses were identified intraoperatively in 56 (43.7%) and 26 (20.3%) patients, respectively. Diagnostic accuracy of US and radiography studies in detecting internal fistulae was comparable (85.2% vs 84.8%), with sensitivity of 71.4% for US and 69.6% for radiography studies, and specificity of 95.8% for both. Combination of radiographic techniques and US significantly improved diagnostic accuracy in detection of internal fistulae. In severe cases of CD with clinical suspicion of septic complications such as abdominal mass or fever, the accuracy of US, barium studies, and CT was 88.5%, 80.3%, and 77%, respectively (P=NS). The presence of abscesses was correctly detected in 90.9% of cases by means of US and in 86.4% by CT (P=NS), although accuracy was higher for CT (91.8%) than for US (86.9%) because of false positive results in US studies.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
97. Triester SL, Leighton JA, Leontiadis GI, et al. A meta-analysis of the yield of capsule endoscopy compared to other diagnostic modalities in patients with non-stricturing small bowel Crohn's disease. <i>Am J Gastroenterol.</i> 2006;101(5):954-964.	Review/Other-Dx	9 studies	To evaluate the yield of capsule endoscopy compared with other modalities in symptomatic patients with suspected or established CD using meta-analysis.	9 studies (n = 250) compared the yield of capsule endoscopy with small bowel barium radiography for the diagnosis of CD. The yield for capsule endoscopy vs barium radiography for all patients was 63% and 23%, respectively (incremental yield = 40%, P<0.001, 95% CI = 28%–51%). 4 trials compared the yield of capsule endoscopy to colonoscopy with ileoscopy (n = 114). The yield for capsule endoscopy vs ileoscopy for all patients was 61% and 46%, respectively (incremental yield = 15%, P=0.02, 95% CI = 2%–27%). 3 studies compared the yield of capsule endoscopy to CT enterography/CT-E (n = 93). The yield for capsule endoscopy vs CT for all patients was 69% and 30%, respectively (incremental yield = 38%, P=0.001, 95% CI = 15–60%). 2 trials compared capsule endoscopy to push enteroscopy (incremental yield = 38%, P<0.001, 95% CI = 26%–50%) and 1 trial compared capsule endoscopy to small bowel MRI (incremental yield = 22%, P=0.16, 95% CI = -9% to 53%). Subanalysis of patients with a suspected initial presentation of CD showed no statistically significant difference between the yield of capsule endoscopy and barium radiography (P= 0.09), colonoscopy with ileoscopy (P=0.48), CT enterography (P=0.07), or push enteroscopy (P= 0.51). Subanalysis of patients with established CD with suspected small bowel recurrence revealed a statistically significant difference in yield in favor of capsule endoscopy compared with all other modalities (barium radiography (P<0.001), colonoscopy with ileoscopy (P=0.002), CT enterography (P<0.001), and push enteroscopy (P<0.001)).	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
98. Bernstein CN, Greenberg H, Boulton I, Chubey S, Leblanc C, Ryner L. A prospective comparison study of MRI versus small bowel follow-through in recurrent Crohn's disease. <i>Am J Gastroenterol.</i> 2005;100(11):2493-2502.	Review/Other-Dx	30 patients	Prospective study. MR enterography compared to SBFT in established CD to detect complications and assess extent of disease.	MRI is superior to SBFT in evaluating CD complications and extent of disease.	4
99. Eliakim R, Suissa A, Yassin K, Katz D, Fischer D. Wireless capsule video endoscopy compared to barium follow-through and computerised tomography in patients with suspected Crohn's disease--final report. <i>Dig Liver Dis.</i> 2004;36(8):519-522.	Observational-Dx	35 patients	Prospective blinded study to compare capsule endoscopy with barium follow-through and CT enterography in patients with suspected CD.	Diagnostic yield of capsule endoscopy was 77% vs 23% and 20% of barium and CT, respectively (P<0.05). Wireless capsule endoscopy is more sensitive than with barium follow-through and CT enterography in detecting CD.	4
100. Hara AK, Leighton JA, Heigh RI, et al. Crohn disease of the small bowel: preliminary comparison among CT enterography, capsule endoscopy, small-bowel follow-through, and ileoscopy. <i>Radiology.</i> 2006;238(1):128-134.	Observational-Dx	17 patients	To prospectively compare 4 diagnostic small bowel imaging techniques in CD.	CD was depicted by capsule endoscopy in 12 patients (71%), ileoscopy in 11 (65%), CT enterography in 9 (53%), and SBFT in 4 (24%). Capsule endoscopy and CT enterography may depict CD when ileoscopy and SBFT are negative.	2
101. Sailer J, Peloschek P, Schober E, et al. Diagnostic value of CT enteroclysis compared with conventional enteroclysis in patients with Crohn's disease. <i>AJR Am J Roentgenol.</i> 2005;185(6):1575-1581.	Observational-Dx	50 consecutive patients	Prospective study to assess the diagnostic value of CT-E compared with conventional enteroclysis in patients with CD.	CD-associated radiographic changes were found in 44 patients (88%) using CT-E and in 42 patients (84%) using conventional enteroclysis. CT-E proved to be significantly superior to conventional enteroclysis in depicting intramural and extramural CD.	2
102. Stathaki MI, Koukouraki SI, Karkavitsas NS, Koutroubakis IE. Role of scintigraphy in inflammatory bowel disease. <i>World J Gastroenterol.</i> 2009;15(22):2693-2700.	Review/Other-Dx	N/A	To review the current data and future prospects on the role of scintigraphy in diagnosis and evaluation of disease activity in patients with IBD.	Although nuclear medicine in IBD has no primary role in the diagnosis, it might be considered when colonoscopy is not completed successfully or other imaging modalities are negative. However, its contribution to the assessment of disease extent and activity, monitoring treatment response, and differentiating between active CD and UC is well established. Tc-99m HMPAO WBC have gained widespread clinical use while Tc-99m (V) DMSA seems to provide an accurate scintigraphic variant and a complementary technique to colonoscopy for follow up and assessment of disease activity.	4

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
103. Griffiths AM. Specificities of inflammatory bowel disease in childhood. <i>Best Pract Res Clin Gastroenterol.</i> 2004;18(3):509-523.	Review/Other-Dx	N/A	To review epidemiologic and genetic information pertaining to IBD occurring during childhood and adolescence, acknowledging the similarities with adult onset disease but emphasizing—in particular—the recognized differences.	In parallel with overall population trends, the incidence of pediatric UC has remained stable, whereas that of pediatric CD has increased in recent decades. Still rare among preschool children, the incidence of both UC and CD rises steadily from middle childhood through adolescence. There is an unexplained preponderance of males with early-onset CD, and an equal gender distribution in pediatric UC. Observations on the familiarity of pediatric IBD suggest that genetic susceptibility is particularly important to disease pathogenesis in young patients. In comparison to adult-onset disease, childhood UC is usually extensive but the anatomic localization of pediatric CD varies, as in adults. UC manifests uniformly as bloody diarrhea whereas the symptomatology of pediatric CD is much more diverse. Linear growth impairment frequently complicates chronic intestinal inflammation in pediatric CD.	4
104. Brenner DJ. Should computed tomography be the modality of choice for imaging Crohn's disease in children? The radiation risk perspective. <i>Gut.</i> 2008;57(11):1489-1490.	Review/Other-Dx	N/A	Commentary on the use of CT for imaging CD in children.	No results stated in abstract.	4
105. Hall EJ, Brenner DJ. Cancer risks from diagnostic radiology. <i>Br J Radiol.</i> 2008;81(965):362-378.	Review/Other-Dx	N/A	A review to address the benefit/risk balance associated with the use of X-rays as a diagnostic tool.	No results stated in abstract.	4
106. Rice HE, Frush DP, Farmer D, Waldhausen JH. Review of radiation risks from computed tomography: essentials for the pediatric surgeon. <i>J Pediatr Surg.</i> 2007;42(4):603-607.	Review/Other-Dx	N/A	Medline based clinical review of current medical literature of the risks for the induction of cancers by CT.	Review of scientific evidence demonstrates varied opinions, but consensus suggests there may be a potential for an increased risk of cancer from low level radiation exposure such as from CT. These calculations suggest that there may be as high as 1 fatal cancer for every 1,000 CT scans performed in a young child.	4

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
107. Dillman JR, Ladino-Torres MF, Adler J, et al. Comparison of MR enterography and histopathology in the evaluation of pediatric Crohn disease. <i>Pediatr Radiol</i> . 2011;41(12):1552-1558.	Observational-Dx	31 subjects	To assess the ability of MR enterography to identify segments of small bowel and colon affected by pediatric CD using histopathology as the reference standard.	32 pediatric MR enterography examinations were identified with correlative histopathology. MR enterography had an overall sensitivity of 94% for detecting the presence of CD, in general. At the bowel segmental level, MR enterography had a sensitivity of 66%, specificity of 90%, PPV of 85% and NPV of 76%. The terminal ileum was abnormal by MR enterography in 11/15 (73%) subjects lacking a diagnostic biopsy of this bowel segment.	3
108. Gee MS, Nimkin K, Hsu M, et al. Prospective evaluation of MR enterography as the primary imaging modality for pediatric Crohn disease assessment. <i>AJR Am J Roentgenol</i> . 2011;197(1):224-231.	Observational-Dx	21 patients	A prospective evaluation of MR enterographic accuracy for detecting CD imaging features in pediatric patients, compared with a CT reference standard, as well as determination of MR enterographic accuracy for detecting active bowel inflammation and fibrosis using a histologic reference standard.	All 21 subjects underwent MR enterography and histologic sampling, 18 of whom also underwent CT. MR enterography had high sensitivity for detecting CD imaging features (eg, bowel wall thickening, mesenteric inflammation, lymphadenopathy, fistula, and abscess) compared with CT, with individual sensitivity values ranging from 85.1% to 100%. Of a total of 53 abnormal bowel segments with correlation of MRI and histologic findings, MR enterography showed 86.7% accuracy (90.0% sensitivity and 82.6% specificity) for detecting active inflammation (P<0.001). The accuracy of MR enterography for detecting mural fibrosis overall was 64.9%, compared with histology, but increased to 83.3% (P<0.05) for detecting fibrosis without superimposed active inflammation.	1

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
109. Wallihan DB, Towbin AJ, Denson LA, Salisbury S, Podberesky DJ. Inflammatory bowel disease in children and adolescents: assessing the diagnostic performance and interreader agreement of magnetic resonance enterography compared to histopathology. <i>Acad Radiol.</i> 2012;19(7):819-826.	Observational-Dx	91 patients	To determine the accuracy of MR enterography compared to histopathology in the evaluation of pediatric IBD and to assess interreader reliability for image interpretation.	A total of 91 MR enterography studies were reviewed. Of these, 45 had comparison histopathology within 45 days. The overall sensitivity of MR enterography for detecting active inflammation compared to ileocolonoscopy was 92% for both readers, while specificity was 100% for reader 1 and 75% for reader 2. Of the individual parameters evaluated, mucosal hyperenhancement and bowel wall thickening were the most sensitive indicators of active inflammation, each having sensitivity of 86% and specificity of 88%. Cohen's kappa coefficient was 0.59, indicating moderate agreement between the readers.	2
110. Laghi A, Borrelli O, Paolantonio P, et al. Contrast enhanced magnetic resonance imaging of the terminal ileum in children with Crohn's disease. <i>Gut.</i> 2003;52(3):393-397.	Observational-Dx	75 consecutive patients	Prospective study to evaluate the diagnostic value of gadolinium-enhanced MR using polyethylene glycol as enteric contrast in revealing CD changes in terminal ileum in children.	There is high correlation of contrast enhanced polyethylene glycol MRI with ileal endoscopy and histology as well as the CDAI.	4
111. Canani RB, de Horatio LT, Terrin G, et al. Combined use of noninvasive tests is useful in the initial diagnostic approach to a child with suspected inflammatory bowel disease. <i>J Pediatr Gastroenterol Nutr.</i> 2006;42(1):9-15.	Observational-Dx	27 patients	To assess the effectiveness of the combined use of fecal calprotectin, anti-Saccharomyces cerevisiae antibody, perinuclear staining antineutrophil antibody, small intestinal permeability test, and bowel wall US measurement in the diagnostic workup of children with suspected IBD.	A final diagnosis of IBD was made in 27 patients: 17 CD and 10 UC. 18 children had other gastrointestinal diagnoses (8 functional bowel disorders, 5 food allergy-mediated diseases, 4 infectious enterocolitis, 1 familial Mediterranean fever). In patients with simultaneous abnormal values of fecal calprotectin, bowel wall US, and anti-Saccharomyces cerevisiae antibody, perinuclear staining antineutrophil antibody, the estimated probability of having IBD was 99.47%. Patients with negative results on all tests had a 0.69% of probability of IBD.	2
112. Alison M, Kheniche A, Azoulay R, Roche S, Sebag G, Belarbi N. Ultrasonography of Crohn disease in children. <i>Pediatr Radiol.</i> 2007;37(11):1071-1082.	Review/Other-Dx	N/A	Review role and limitations of US in CD. Diagnostic accuracy of US is discussed and compared to other imaging modalities.	US is currently used for screening in children with the suspicion of IBD with a good NPV. In follow-up, US has a role in monitoring medical treatment by evaluating disease activity, extent of disease and for detecting complications.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
113. Jamieson DH, Shipman PJ, Israel DM, Jacobson K. Comparison of multidetector CT and barium studies of the small bowel: inflammatory bowel disease in children. <i>AJR Am J Roentgenol.</i> 2003;180(5):1211-1216.	Observational-Dx	18 patients	To compare barium studies of the small bowel with MDCT in the evaluation of the small bowel during the initial presentation of IBD in a pediatric population.	In 13/18 children, the findings of MDCT and barium studies of the small bowel concurred in the evaluation of terminal ileum disease. In 3 of these children, MDCT detected skip segments of small-bowel disease not detected on barium studies of the small bowel. In 2/18 children, the terminal ileum was not visualized on barium studies of the small bowel, whereas MDCT showed substantial terminal ileum disease in both children. In 3/18 children, there was discordance between the 2 tests regarding terminal ileum disease. However, these discordant imaging findings were all subtle. In addition, MDCT revealed extraenteric abnormalities, clinically relevant in 2 children (ureteric obstruction and perirectal abscess), and showed the colon in all children, 7 of whom had incomplete colonoscopy. The questionnaire revealed that 16/18 patients preferred MDCT to small-bowel barium studies. The reasons given were poor tolerance of oral barium and the long duration of barium studies of the small bowel.	1
114. Duigenan S, Gee MS. Imaging of pediatric patients with inflammatory bowel disease. <i>AJR Am J Roentgenol.</i> 2012;199(4):907-915.	Review/Other-Dx	N/A	To examine the current imaging literature and develop basic imaging guidelines for evaluation of children with IBD.	Imaging of pediatric patients with IBD must balance considerations of diagnostic accuracy against concerns about patient exposure to ionizing radiation and tolerance of the imaging technique. The imaging modality chosen depends on the clinical presentation and expected pathologic finding.	4
115. Gaca AM, Jaffe TA, Delaney S, et al. Radiation doses from small-bowel follow-through and abdomen/pelvis MDCT in pediatric Crohn disease. <i>Pediatr Radiol.</i> 2008;38(3):285-291.	Observational-Dx	30 patients	To compare effective dose for SBFT and abdomen/pelvis MDCT in pediatric CD.	A total of 176 children with CD underwent imaging, averaging 1.2 SBFTs and 1.1 CT scans. On average SBFT took 5.1 min with 3.3 abdominal radiographs. The effective doses (mSv) for a 5-min fluoroscopy were 0.15 for the central abdomen, 0.35 for the right lower quadrant, and 0.56 for the pelvis, yielding an average effective dose for SBFT (5-min fluoroscopy, 3.3 abdominal radiographs) of 1.8–2.2 mSv. The effective dose for MDCT was 3.48 mSv.	3

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
116. Gunn ML, Kohr JR. State of the art: technologies for computed tomography dose reduction. <i>Emerg Radiol.</i> 2010;17(3):209-218.	Review/Other-Dx	N/A	To discuss the utilization of CT in emergency radiology.	No results stated in abstract.	4
117. Kaza RK, Platt JF, Al-Hawary MM, Wasnik A, Liu PS, Pandya A. CT enterography at 80 kVp with adaptive statistical iterative reconstruction versus at 120 kVp with standard reconstruction: image quality, diagnostic adequacy, and dose reduction. <i>AJR Am J Roentgenol.</i> 2012;198(5):1084-1092.	Observational-Dx	133 CT enterography examinations of 127 patients	To evaluate the image quality and diagnostic adequacy of the following 2 CT enterography protocols in patients weighing less than 160 lb (72 kg): 80-kVp imaging with the adaptive statistical iterative reconstruction in comparison with 120-kVp imaging with the filtered back projection reconstruction.	There was a statistically significant decrease in the mean image quality scores for 80-kVp examinations compared with 120-kVp examinations for evaluation of the bowel wall (3.19 vs 3.70, respectively) and liver (3.12 vs 3.81) and for overall image quality (3.23 vs 3.68), but there was no significant decrease in score for evaluation of the mesenteric vessels (3.63 vs 3.67). None of the 80-kVp examinations was graded as poor, and all were considered to be of acceptable quality. Both techniques had comparable diagnostic accuracy for the detection of IBD. Interobserver agreement was fair to moderate for qualitative image grading and was substantial for the detection of features of IBD. The mean CT dose index (vol) and effective dose for the 80-kVp examinations were 6.15 mGy and 4.60 mSv, respectively, and for the 120-kVp examinations, 20.79 mGy and 15.81 mSv.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
118. Allen BC, Baker ME, Einstein DM, et al. Effect of altering automatic exposure control settings and quality reference mAs on radiation dose, image quality, and diagnostic efficacy in MDCT enterography of active inflammatory Crohn's disease. <i>AJR Am J Roentgenol.</i> 2010;195(1):89-100.	Observational-Dx	2,310 MDCT enterography procedures, 3 independent readers	Prospective cohort study to determine whether the MDCT enterography dose can be reduced by changing automatic exposure control setting and quality reference mAs without altering subjective image quality or efficacy in active inflammatory CD.	For 16-MDCT, CT dose index (vol) decreased from 12.82 to 10.14 mGy and 10.14 to 8.7 mGy between original to intermediate and intermediate to final dose levels. For 64-MDCT, the CT dose index (vol) decreased from 15.72 to 11.42 mGy and 11.42 to 9.25 mGy between original to intermediate and intermediate to final dose levels. Images were rated suboptimal or nondiagnostic more often in the intermediate dose level (P<0.05) but not in the final. There was no reduction in diagnostic efficacy as measured by area under the ROC curve for all readers at the intermediate and final dose levels (P>0.0738); for 1 comparison with 1 reader there was improvement in efficacy between the original and intermediate dose P=0.0249). Substantial dose reduction can be achieved using weight-based quality reference mAs and altering automatic exposure control settings without affecting diagnostic efficacy in active inflammatory CD of the terminal ileum. However, subjective image quality can be compromised at these dose settings, depending on radiologist preference.	2
119. Kambadakone AR, Prakash P, Hahn PF, Sahani DV. Low-dose CT examinations in Crohn's disease: Impact on image quality, diagnostic performance, and radiation dose. <i>AJR Am J Roentgenol.</i> 2010;195(1):78-88.	Observational-Dx	35 MDCT exams from 25 patients, 2 independent readers	To retrospectively evaluate the image quality and diagnostic performance of simulated low-dose MDCT exams in patients with CD. 175 MDCT image data sets generated randomized and reviewed by readers. The image quality, diagnostic performance, and radiation dose from the original MDCT examinations served as a reference standard for comparison.	Processed MDCT images with the introduction of noise to simulate low-dose MDCT examinations with NI levels of 18-25 allows substantial dose reduction for CT examinations in CD without compromising diagnostic information.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
120. Voderholzer WA, Beinhoelzl J, Rogalla P, et al. Small bowel involvement in Crohn's disease: a prospective comparison of wireless capsule endoscopy and computed tomography enteroclysis. <i>Gut</i> . 2005;54(3):369-373.	Observational-Dx	41 patients	To validate the gain in information and therapeutic impact of wireless capsule endoscopy in patients with CD.	In 15 patients (27%), wireless capsule endoscopy could not be performed due to strictures detected by CT enteroclysis. From the other 41 patients, jejunal or ileal lesions were found in 25 patients by wireless capsule endoscopy compared with 12 by CT enteroclysis (P=0.004). This gain in information was mainly due to detection of small mucosal lesions such as villous denudation, aphthoid ulcerations, or erosions. Both methods were not significantly different in the detection of lesions in the terminal/neoterminal ileum (wireless capsule endoscopy 24 patients, CT enteroclysis 20 patients). Therapy was changed due to wireless capsule endoscopy findings in 10 patients. Consecutively, all of them improved clinically.	3
121. Jaffe TA, Gaca AM, Delaney S, et al. Radiation doses from small-bowel follow-through and abdominopelvic MDCT in Crohn's disease. <i>AJR Am J Roentgenol</i> . 2007;189(5):1015-1022.	Review/Other-Dx	30 consecutive patients	To compare organ and effective doses for SBFT and abdominopelvic MDCT in adults with CD, to retrospectively evaluate the number of radiographic examinations performed for CD indications, and to identify those patients undergoing serial examinations to better delineate the use of radiology in the diagnosis and clinical management of CD.	The highest fluoroscopic organ doses were as follows: in the right lower quadrant, right kidney (0.78 cGy) and marrow (0.66 cGy); in the central abdomen, kidneys (1.5 and 1.6 cGy) and marrow (0.76 cGy); and in the pelvis, marrow (0.67–0.95 cGy). Effective doses for the right lower quadrant, central abdomen, and pelvis were 1.37, 2.02, and 3.83 mSv, respectively. For MDCT, the highest organ doses were to the liver (2.95–3.33 cGy). The effective dose for abdominopelvic MDCT was 16.1 mSv. 373 patients underwent imaging for CD. The average number of SBFT and CT examinations was 1.8 and 2.3, respectively. 34 (9%) of 373 patients underwent more than 5 CT examinations and 11 (3%) had more than 10. Organ and effective doses are up to 5 times higher with MDCT than with SBFT. CD is more frequently imaged with CT. For a subset of patients who undergo numerous CT examinations, efforts should be made to minimize the number of CT examinations, decrease the CT dose, or consider MR enterography.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
122. Peloquin JM, Pardi DS, Sandborn WJ, et al. Diagnostic ionizing radiation exposure in a population-based cohort of patients with inflammatory bowel disease. <i>Am J Gastroenterol.</i> 2008;103(8):2015-2022.	Observational-Dx	215 patients	To determine the extent of diagnostic ionizing radiation in a population-based cohort of patients with IBD.	The number of patients with CD and UC was 103 and 112, with a mean age at diagnosis of 38.6 and 39.4 years, respectively. Mean follow-up was 8.9 years for CD and 9.0 years for UC. Median total effective dose for CD was 26.6 mSv (range, 0-279) vs 10.5 mSv (range, 0-251) for UC (P<0.001). CT accounted for 51% and 40% of total effective dose, respectively. Patients with CD had 2.46 times higher total effective dose than UC patients (P=0.001), adjusting for duration of disease. Radiation exposure in the IBD population was equivalent to the average annual background radiation dose from naturally occurring sources in the U.S. (3.0 mSv). However, a subset of patients had substantially higher doses. The development of imaging management guidelines to minimize radiation dose, dose-reduction techniques in CT, and faster, more robust MR techniques are warranted.	4
123. Castiglione F, Bucci L, Pesce G, et al. Oral contrast-enhanced sonography for the diagnosis and grading of postsurgical recurrence of Crohn's disease. <i>Inflamm Bowel Dis.</i> 2008;14(9):1240-1245.	Observational-Dx	40 patients	To evaluate the diagnostic accuracy of bowel sonography and oral contrast-enhanced sonography for postsurgical recurrence compared to the endoscopical Rutgeerts's grading system.	In all, 22 out of the 40 CD showed an endoscopic evidence of postsurgical recurrence (55%). A severe postsurgical recurrence was present in 14 patients (64%). Sensitivity, specificity, and PPV and NPV were 77%, 94%, 93%, and 80% for bowel sonography, and 82%, 94%, 93%, and 84% for oral contrast-enhanced sonography. On the ROC curve a bowel wall thickness >5 mm showed sensitivity, specificity, and PPV and NPV of 93%, 96%, 88%, and 97% for the diagnosis of severe postsurgical recurrence at bowel sonography, while a bowel wall thickness >4 mm was the best cutoff differentiating the mild from the severe CD recurrence for oral contrast-enhanced sonography, with a sensitivity, specificity, and PPV and NPV of 86%, 96%, 97%, and 79%, respectively.	2

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
124. Stoker J, van Randen A, Lameris W, Boermeester MA. Imaging patients with acute abdominal pain. <i>Radiology</i> . 2009;253(1):31-46.	Review/Other-Dx	N/A	To discuss the role of imaging in adults who present with acute abdominal pain to the emergency department.	CT findings have been demonstrated to have a marked effect on the management of acute abdominal pain and CT is proved to be cost-effective. CT can therefore be considered the primary technique for the diagnosis of acute abdominal pain, except in patients clinically suspected of having acute cholecystitis. In these patients, US is the primary imaging technique of choice. The use of conventional radiography has been surpassed; this examination has only a possible role in the setting of bowel obstruction. However, CT is more accurate and more informative in this setting as well. In cases of bowel perforation, CT is the most sensitive technique for depicting free intraperitoneal air and is valuable for determining the cause of the perforation. Imaging is less useful in cases of bowel ischemia, although some CT signs are highly specific. MRI is a promising alternative to CT in the evaluation of acute abdominal pain and does not involve the use of ionizing radiation exposure. However, data on the use of MRI for this indication are still sparse.	4

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EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
125. Charron M, Di Lorenzo C, Kocoshis S. CT and 99mTc-WBC vs colonoscopy in the evaluation of inflammation and complications of inflammatory bowel diseases. <i>J Gastroenterol.</i> 2002;37(1):23-28.	Observational-Dx	313 consecutive patients	To evaluate the accuracy of CT and Tc-99m WBC scintigraphy vs colonoscopy in assessing IBD in a large population of children.	In the 21 children with a positive Tc-99m WBC scan, 62% (13/21) of the CT scans underestimated the bowel wall inflammation in at least 1 segment. In the children with a negative Tc-99m WBC study, there were 17 negative CT examinations and 4 examinations showing an abnormal terminal ileum. When CT was compared with colonoscopy in assessing inflammation, there were 5 true-negative CT, 2 true-positive CT, no false-positive, and 7 false-negative CT examinations. When Tc-99m WBC scintigraphy was compared with colonoscopy in assessing inflammation, there were 7 true-positive, 2 false-negative, 5 true-negative, and no false-positive Tc-99m WBC studies. The Tc-99m WBC scan was positive in 5 patients with a false-negative CT examination. Of the total 103 CT scans obtained, 53 (51%) were normal. 4 abscesses (3.8%) were demonstrated by CT. Tc-99m WBC scintigraphy is more sensitive than CT for detecting inflammation of the bowel wall. The incidence of complications from IBD in this retrospective study was much lower than had been previously reported.	3
126. Froslic KF, Jahnsen J, Moum BA, Vatn MH. Mucosal healing in inflammatory bowel disease: results from a Norwegian population-based cohort. <i>Gastroenterology.</i> 2007;133(2):412-422.	Observational-Dx	495 patients	To examine both the possible predictors of mucosal healing and the impact of healing on subsequent course of disease.	In UC patients, education longer than 12 years and extensive disease at diagnosis were significant predictors of mucosal healing after 1 year (adjusted P=.004 and P=.02, respectively). Mucosal healing was significantly associated with a low risk of future colectomy (P=.02). In patients with CD, fever at diagnosis and medical treatment without steroids were significant predictors for mucosal healing (adjusted P=.03 and P=.01, respectively). Mucosal healing was significantly associated with less inflammation after 5 years (P=.02), decreased future steroid treatment (P=.02).	3

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
127. Schnitzler F, Fidler H, Ferrante M, et al. Mucosal healing predicts long-term outcome of maintenance therapy with infliximab in Crohn's disease. <i>Inflamm Bowel Dis</i> . 2009;15(9):1295-1301.	Observational-Tx	214 patients	To investigate the impact of mucosal healing on long-term outcome in the subgroup of patients who underwent a lower gastrointestinal endoscopy before the start of infliximab therapy and who underwent a follow-up endoscopy during therapy with infliximab.	Mucosal healing was observed in 67.8% of the 183 initial responders (n = 124), with 83 patients having complete healing (45.4%) and 41 having partial healing (22.4%). Scheduled infliximab treatment from the start resulted in mucosal healing more frequently (76.9% mucosal healing rate) than episodic treatment (61.0% mucosal healing rate; P=0.0222, OR 2.14, 95% CI 1.11–4.12). Concomitant treatment with corticosteroids had a negative impact on mucosal healing (37.9% in patients with corticosteroids vs 63.2% in patients without corticosteroids; P=0.021, OR 0.36, 95% CI 0.16–0.80). Mucosal healing was associated with a significantly lower need for major abdominal surgery during long-term follow-up (14.1% of patients with mucosal healing needed major abdominal surgery vs 38.4% of patients without mucosal healing; P<0.0001).	2
128. De Cruz P, Kamm MA, Prideaux L, Allen PB, Moore G. Mucosal healing in Crohn's disease: a systematic review. <i>Inflamm Bowel Dis</i> . 2013;19(2):429-444.	Review/Other-Dx	N/A	A systematic review to assess mucosal healing in CD.	No results stated in abstract.	4
129. Maccioni F, Staltari I, Pino AR, Tiberti A. Value of T2-weighted magnetic resonance imaging in the assessment of wall inflammation and fibrosis in Crohn's disease. <i>Abdom Imaging</i> . 2012;37(6):944-957.	Review/Other-Dx	N/A	To focus specifically on the diagnostic value of T2-weighted imaging in the assessment of CD inflammation.	T2-weighted imaging offers a comprehensive evaluation of CD main features similarly to T1-weighted imaging, further providing crucial information on disease characterization and activity. Owing to its potential predictive character in the therapy decision process and its capability in monitoring the disease activity, unenhanced T2-weighted imaging is going to play an increasing role in diagnostic management of the disease. For this purpose, however, optimization of the MRI technique with proper intestinal contrast agents and sequences is mandatory.	4

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
130. Adler J, Punglia DR, Dillman JR, et al. Computed tomography enterography findings correlate with tissue inflammation, not fibrosis in resected small bowel Crohn's disease. <i>Inflamm Bowel Dis.</i> 2012;18(5):849-856.	Observational-Dx	22 patients	To compare CT enterography findings with histology from surgically resected specimens.	In all, 22 patients met inclusion criteria. Inflammatory CT enterography findings correlated with histologic inflammation ($\rho = 0.52$). Strictures believed to be "active" on CT enterography were more inflamed at histology ($P=0.0002$). Strictures lacking inflammatory findings on CT enterography or considered "inactive" were not associated with greater histologic fibrosis or significant histologic inflammation. Upstream dilation was associated with greater tissue fibrosis in univariate ($P=0.014$) but not in multivariate analysis ($P=0.53$). Overall, histologic fibrosis correlated best with histologic inflammation ($\rho = 0.52$). Strictures on CT enterography with the most active disease activity also had the most fibrosis on histology.	2
131. Ziech ML, Bipat S, Roelofs JJ, et al. Retrospective comparison of magnetic resonance imaging features and histopathology in Crohn's disease patients. <i>Eur J Radiol.</i> 2011;80(3):e299-305.	Observational-Dx	25 patients	To retrospectively compare histopathological findings of surgically resected bowel segments with MRI findings on CD activity.	39 segments in 25 patients (mean age 38 years) were included. Of the MRI features, disease activity per segment and bowel wall thickness had a positive association with the acute inflammatory score ($P<0.05$). T1-enhancement had a positive correlation with disease chronicity. All other MRI features did not have an association with the acute inflammatory score. Interobserver agreement between the 3 observers was weak to moderate.	3

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
132. Karmiris K, Bielen D, Vanbeckevoort D, et al. Long-term monitoring of infliximab therapy for perianal fistulizing Crohn's disease by using magnetic resonance imaging. <i>Clin Gastroenterol Hepatol</i> . 2011;9(2):130-136.	Observational-Dx	59 patients	To assess the outcome of infliximab therapy in patients with perianal fistulizing CD.	Compared with the baseline MRI, the short-term follow-up MRI (n = 29) revealed a reduced number of fistula tracks in 13.8% and in the inflammatory activity in 55.2% of patients, respectively; mid-term MRI (n = 25) in 56% and in 52%, respectively; and long-term MRI (n = 13) in 15.4% and in 31%, respectively. Improvement of perianal fistulizing CD based on MRI results coincided with clinical improvement in 54.7% of the patients. Short-term and mid-term (but not long-term) MRI showed a significant decrease in the activity score. Therapy outcome was worse among patients with persisting fistulas (P=.01), collections (P=.009), and rectal wall involvement (P=.01) in the final MRI. Patients with single-branched fistulas (P<.0001) and collections (P=.006) in their baseline MRI were more likely to undergo surgery.	2
133. Savoye-Collet C, Savoye G, Koning E, Dacher JN, Lerebours E. Fistulizing perianal Crohn's disease: contrast-enhanced magnetic resonance imaging assessment at 1 year on maintenance anti-TNF-alpha therapy. <i>Inflamm Bowel Dis</i> . 2011;17(8):1751-1758.	Observational-Dx	20 patients	To assess perianal fistulas by MRI in patients with severe fistulizing CD using maintenance antitumor necrosis factor alpha therapy and to correlate MRI changes with clinical outcome.	Response and remission were observed in respectively 40% and 35% of cases. The Van Assche score varied from 13.8 (7-20) to 6.13 (0-12) in patients with a response or remission (P<0.05). The T2 hyperintensity follow-up value decreased in patients in response or remission (P<0.01). T2 hyperintensity disappeared or decreased in 14/15 patients in clinical response or remission as compared to 1 among the 5 nonresponding patients (P<0.01). The decrease in Van Assche score and hyperintensity value was not significantly different in patients in remission compared to those with response. Only 1 patient in clinical remission had a persisting contrast enhancement on MRI, whereas contrast enhancement persisted in all other patients not in remission (P=0.002).	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
134. Hara AK, Alam S, Heigh RI, Gurudu SR, Hentz JG, Leighton JA. Using CT enterography to monitor Crohn's disease activity: a preliminary study. <i>AJR Am J Roentgenol.</i> 2008;190(6):1512-1516	Observational-Dx	40 CT enterography exams in 20 patients	Retrospective study to determine whether imaging changes of CD at sequential CT enterography examinations correlate with disease progression or regression.	Disease progression or regression by CT enterography correlated with symptoms in 16 of 20 (80%) patients. Study indicates that imaging changes between CT enterography examinations have excellent potential for reliably monitoring CD progression or regression.	3
135. Rispo A, Imbriaco M, Celentano L, et al. Noninvasive diagnosis of small bowel Crohn's disease: combined use of bowel sonography and Tc-99m-HMPAO leukocyte scintigraphy. <i>Inflamm Bowel Dis.</i> 2005;11(4):376-382.	Observational-Dx	84 patients	To evaluate the diagnostic accuracy of small bowel enteroclysis, bowel sonography, and Tc-99m-HMPAO leukocyte scintigraphy in the diagnosis of small bowel CD.	Small bowel CD was present in 50 patients, whereas the other 34 patients received a different diagnosis. Sensitivity, specificity, PPV and NPV, and diagnostic accuracy were, respectively, 98%, 97%, 98%, 97%, and 0.97 for small bowel enteroclysis; 92%, 97%, 98%, 88%, and 0.94 for bowel sonography; and 90%, 93%, 96%, 85%, and 0.92 for Tc-99m-HMPAO leukocyte scintigraphy. In addition, the combined use of bowel sonography and Tc-99m-HMPAO leukocyte scintigraphy led to overall sensitivity, specificity, PPV and NPV, and diagnostic accuracy of 100%, 93%, 96%, 100%, and 0.97, respectively. Bowel sonography showed a fair concordance with small bowel enteroclysis in terms of location ($k = 0.71$) and a correlation with the extension of the disease ($r = 0.67$, $P < 0.001$). Tc-99m-HMPAO leukocyte scintigraphy showed a concordance with small bowel enteroclysis with regard to location in about one-half the population ($k = 0.54$), whereas it was less effective than small bowel enteroclysis in defining disease extension.	2
136. Biancone L, Schillaci O, Capoccecci F, et al. Technetium-99m-HMPAO labeled leukocyte single photon emission computerized tomography (SPECT) for assessing Crohn's disease extent and intestinal infiltration. <i>Am J Gastroenterol.</i> 2005;100(2):344-354.	Observational-Dx	21 patients	SPECT leucoscintigraphy compared to planar imaging to assess value of SPECT leucoscintigraphy in assessing CD extent and intestinal infiltration.	SPECT superior to planar imaging in visualizing CD lesions, including perianal disease, and allows better discrimination between intestinal and bone marrow uptake.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
137. Groshar D, Bernstine H, Stern D, et al. PET/CT enterography in Crohn disease: correlation of disease activity on CT enterography with 18F-FDG uptake. <i>J Nucl Med.</i> 2010;51(7):1009-1014.	Experimental-Dx	28 patients	FDG-PET and CT enterography were combined in a single examination to compare the level of FDG-PET uptake measured by SUVmax with the CT enterography patterns of disease activity found in patients with CD.	Of the 28 patients with suspected active CD, 22 had 85 abnormal segments and 6 had no abnormal segments. SUVmax was significantly higher in the abnormal segments than in the normal segments (5.0 +/- 2.5 [95% CI, 4.5–5.5] and 2.1 +/- 0.69 [95% CI, 1.9–2.2], respectively; P<0.0001). A good correlation was found between SUVmax with CT enterography measurements of mural thickness and enhancement (P<0.00001). There was a significant difference in SUVmax between the 3 levels of disease activity found by intramural attenuation, perienteric fat infiltration, and the comb sign on CT enterography. SUVmax was significantly higher when there were intense CT enterography findings of active disease (P<0.001). SUVmax assessment may allow an objective, reliable indication of the grade and severity of inflammation activity in abnormal segments of the bowel detected by CT enterography.	1

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
138. Jacene HA, Ginsburg P, Kwon J, et al. Prediction of the need for surgical intervention in obstructive Crohn's disease by 18F-FDG PET/CT. <i>J Nucl Med.</i> 2009;50(11):1751-1759.	Observational-Dx	17 patients, 2 reviewers	Prospective study. To preoperatively determine the accuracy of 1 FDG-PET/CT for differentiating fixed muscle hypertrophy and fibrotic stenoses from acute transmural inflammatory stenoses in patients with CD who were already scheduled to undergo surgery for obstructive symptoms.	13/17 patients underwent surgery (median, 28 d after PET/CT; range, 2–148 d), and 12 of these 13 had histopathologic correlation. Despite the predominant histopathologic subtype (inflammation, 5; fibrosis, 4; and muscle hypertrophy, 3), acute and chronic inflammation, fibrosis (median, 50%; range, 40%–90%), and muscle hypertrophy (median, 20-fold thickening; range, 9– to 40-fold thickening) were found in all patients. SUL(max) was significantly higher in severe than in mild-to-moderate chronic inflammation (8.2 +/- 2.8 vs 4.7 +/- 2.5, P=0.04). No patient with predominantly fibrosis or muscle hypertrophy (n = 7) had an SUL(max) greater than 8. Visually, 10/12 patients on PET/CT were considered to have active inflammation of the bowel. Patients with CD who undergo surgery for obstructive symptoms have histopathologically mixed findings of inflammation, fibrosis, and muscle hypertrophy. Qualitative PET interpretations were quite sensitive, but additional semiquantitative analyses using SUL(max) helped identify patients with active inflammation.	2
139. Louis E, Ancion G, Colard A, Spote V, Belaiche J, Hustinx R. Noninvasive assessment of Crohn's disease intestinal lesions with (18)F-FDG PET/CT. <i>J Nucl Med.</i> 2007;48(7):1053-1059.	Observational-Dx	22 consecutive patients: 95 intestinal and colonic segments PET/CT images, 2 blinded reviewers	To prospectively assess the use of FDG-PET/CT in evaluating the activity and location of CD along the gastrointestinal tract.	FDG-PET/CT detected 35/48 endoscopically affected segments (sensitivity for the detection of endoscopic lesions, 72.9%). The sensitivity of FDG-PET/CT for the detection of severe endoscopic lesions (deep ulcers and strictures) was 100% (14/14). The global PET/CT score significantly correlated with CDEIS (r = 0.51; 95% CI, 0.09–0.77; P=0.017), CDAI (r = 0.58; 95% CI, 0.17–0.80; P=0.005), and CRP (r = 0.56; 95% CI, 0.19–0.81; P=0.007). FDG-PET/CT was globally well correlated to the clinical, endoscopic, and biologic activity of CD. Above all, this technique had a good sensitivity for the detection of intestinal and colonic segments with moderate to severe mucosal lesions.	2

**Crohn Disease
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
140. Meisner RS, Spier BJ, Einarsson S, et al. Pilot study using PET/CT as a novel, noninvasive assessment of disease activity in inflammatory bowel disease. <i>Inflamm Bowel Dis.</i> 2007;13(8):993-1000.	Observational-Dx	12 patients (7 with CD and 5 with UC) 20 controls	Prospective pilot study evaluating the potential use of PET/CT as an improved technique of noninvasively identifying disease activity. The aim was to see if PET/CT would identify regions of active inflammation in both UC and CD.	In UC patients, PET activity was seen in 13/24 (52%) regions. There was high (23/24; 95.8%) correlation between PET activity and disease activity as determined by colonoscopy, disease activity indices, and radiology. In patients with CD, PET activity was seen in 19/32 (59.4%) regions. Again, there was a high (26/32; 81.3%) correlation between PET activity and clinical disease activity. Of the 20 controls, significant PET activity (Grades 2 and 3) was seen in only 2/100 regions (2%). PET activity correlated well with active inflammation in both UC and CD, suggesting that this may be a noninvasive method of identifying disease activity in patients with IBD.	2

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

CD = Crohn disease
CDAI = Crohn's disease activity index
CE-US = Contrast-enhanced ultrasonography
CI = Confidence interval
CRP=C-reactive protein
CSF = Cerebrospinal fluid
CT = Computed tomography
CT-E = Computed tomography enteroclysis
DCE-MRI = Dynamic contrast-enhanced magnetic resonance imaging
FDG-PET = Fluorine-18-2-fluoro-2-deoxy-D-glucose-positron emission tomography
HMPAO = Hexamethyl-propylamine-oxime
HR = Hazard ratio
HU = Hounsfield units
IBD = Inflammatory bowel disease
MDCT = Multidetector computed tomography
MRI = Magnetic resonance imaging
mSv = Millisieverts
NPV = Negative predictive value
OR = Odds ratio
PPV = Positive predictive value
ROC = Receiver-operator characteristic
ROI = Region of interest
SBFT = Small bowel follow-through
SPECT = Single-photon emission tomography
SUV = Standardized uptake value
UC = Ulcerative colitis
UGI = Upper gastrointestinal
US = Ultrasound
WBC = White blood cell