Crohn's disease: Less common radiographic manifestations

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Crohn's disease may involve the gastrointestinal tract from the esophagus to the anus. Unless the unusual manifestations of the disease are kept in mind, many cases are likely to be misdiagnosed radiographically.

Introduction

The usual radiographic appearance of Crohn's disease involving the distal small bowel and colon is well known. Less well known, however, are the atypical radiographic manifestations of this disease. This pictorial essay will demonstrate many of the unusual radiographic findings seen in Crohn's disease.

Atypical Locations

Although Crohn's disease may affect the gastrointestinal tract from the oropharynx to the anus, radiographic evidence of esophageal involvement is unusual. Aphthous ulcers are the classic finding in Crohn's disease of the esophagus, but their presence is not pathognomonic, and the finding must be considered in the overall clinical and radiographic context before the diagnosis can be established (Figure 1). Aphthous ulcers in the esophagus may be seen in up to 3% of patients with Crohn's disease, if double contrast techniques are used (15). As the involvement progresses, the size and number of the ulcers increase to produce a more severe esophagitis. The ulcers may become confluent and, rarely, they may progress to produce a cobblestone mucosa. Fistulas are seen in very advanced cases (15).
In the stomach, the presence of aphthous ulcers may suggest the diagnosis of Crohn's disease, but these are virtually indistinguishable from gastric erosions. Both single contrast (Figure 2) and double contrast radiography (Figure 3) may show this feature. According to Stevenson and Laufer (19), double contrast studies reveal aphthous gastric ulcers in 20–30% of patients with granulomatous ileocolitis. As the gastric involvement becomes more severe, it causes narrowing and decreasing pliability of the distal stomach, especially the antrum (Figure 4). This accounts for the unique configuration called the ram's horn or "Shofar" sign (3). The scarring may cross the pylorus to involve the adjacent duodenal bulb creating a tubular appearance similar to that seen following Billroth I surgery (18).

Figure 1
A double contrast examination of the esophagus reveals scattered aphthous ulcers (open arrows) on a background of otherwise normal mucosa.

Figure 2
A compression spot radiograph from a single contrast upper gastrointestinal examination shows at least two aphthous ulcers (arrows) and thickened, nodular gastric folds in the antrum. Slightly limited distensibility is also seen.
A double contrast spot radiograph of the antrum (different patient from Figure 2) shows multiple aphthous ulcers with very prominent halos of edema. Thickened prepyloric folds with normal pliability are also seen.

A single contrast upper gastrointestinal study reveals severe narrowing of the body and antrum of the stomach with irregular, ulcerated mucosal contours. The duodenal bulb is similarly involved and cannot be distinguished from the distal antrum. This continuum of gastroduodenal involvement produces the "Shofar" sign.
Despite the finding of the National Cooperative Crohn’s Disease Study (5) that the duodenum was abnormal in 20% of all cases and showed the classical features of Crohn’s disease in approximately 10% of all cases, anecdotal evidence suggests a less frequent rate of radiographic demonstration. Duodenal involvement is usually found in patients with antral disease, although isolated duodenal Crohn’s disease may rarely be seen. Aphthous ulcers, seen early in the disease process in the duodenum, may progress to larger ulcers in the bulb or post bulbar duodenum. Differentiation from peptic disease is often extremely difficult. Eventually, a deformed duodenum with thick nodular folds may be seen (Figure 5). When fibrosis and scarring lead to a stricture, it usually is not the typical cloverleaf seen as a sequela of duodenal peptic ulcer disease (15).

Granulomatous bowel disease may also involve the proximal jejunum. Jejunal involvement is reported in approximately 8% of cases (10). Multifocal segmental involvement of the duodenum and jejunum was seen in one of our patients who previously had had small and large bowel resections (Figure 6).

Figure 5
Two spot radiographs of the descending duodenum reveal a very irregular, nodular, narrowed but changeable lumen. An inconstant outpouching along the lateral wall is probably a pseudodiverticulum.

Figure 7
A double contrast barium enema shows a markedly distorted proximal transverse colon with pseudopolyps and ulcerations. Extending superiorly, is a fistula to the air filled distal descending duodenum. The duodenum shows minimally thickened folds, but was otherwise unremarkable, even on an upper gastrointestinal series (not shown).
Unusual Fistulas

Enteroenteric, enterocolic and enterocutaneous fistulas are well known and relatively common features of Crohn's disease. Less often seen are duodenocolic, enterovesical or colorectal fistulas.

Duodenocolic fistulas may form as a result of the intimate anatomic relationship of the retroperitoneal descending duodenum and the proximal transverse colon. The root of the transverse mesocolon arises at the level of the infra-ampullary portion of the duodenum and is relatively short at this level; providing a direct pathway for the spread of disease. These fistulas are almost always the result of transverse colon disease that secondarily involves the duodenum (15). Although readily apparent on a barium enema, the fistula seen in Figure 7 was not demonstrated on an antegrade study in the same time period. The duodenum, which may show nonspecific changes in the presence of such a fistula, often returns to a normal appearance following resection of the fistula (11).
Many tests have been advocated for demonstrating suspected enterovesical or colovesical fistulas. These include examining the urine for previously ingested colored materials, cystoscopy, computed tomography and conventional barium studies. The Bourne test is probably the simplest, briefest and least expensive test to perform (1). In this test, following the rectal administration of barium, a freshly voided or catheterized urine sample is obtained and centrifuged. The centrifuge tube is then radiographed with a horizontal x-ray beam. The barium sediment, if present, is revealed as a separate layer from the supernatant liquid. In this manner, extremely dilute concentrations of barium may be detected. Although evaluated before the widespread use of computed tomography, the Bourne test was positive in 9 of 10 cases with proven fistulas. In seven of these cases, it was the only positive evidence of a fistula (1). This compares favorably with results obtained using computed tomography as the primary diagnostic tool (6). In our example, a barium enema revealed evidence of Crohn’s ileocolitis, but no fistulous tract or opacification of the bladder (Figure 8A). A freshly voided urine specimen, however, revealed traces of barium in the sediment confirming the clinical suspicion of an enterovesical fistula (Figure 8B).

Figure 8A
This double contrast barium enema, with reflux into the terminal ileum, reveals a coarse granular mucosa in the terminal ileum and proximal transverse colon. The appendix shows irregular narrowing. All these findings are consistent with Crohn’s disease.
Another unusual fistula is the intramural, paracolic or paraenteric sinus tract (Figure 9). When seen in the colon, this lesion may be difficult to distinguish from the sinus tract characteristic of diverticulitis.

**Figure 9**
A single contrast barium enema reveals a long, paracolic, intramural sinus tract parallel to the medial (mesenteric) border of the sigmoid colon. The sinus tract communicates with multiple diverticula. This may be difficult to differentiate from the sinus tracts seen in diverticulitis.

**Abscesses**

The abscesses most often associated with Crohn’s disease are interloop or mesenteric in location. Although separation of small bowel loops on conventional contrast examinations is most commonly the result of fibrofatty proliferation of the mesentery, it may be evidence of an abscess, and computed tomography can differentiate fibrofatty proliferation from abscess formation (7). Fluid collections with or without associated extraluminal air can be detected readily by CT. Two of the more unusual locations, in our experience, were the anterior abdominal wall and the psoas muscles. In the first case, CT scans revealed an abnormally thickened loop of bowel leading to an anterior abdominal wall abscess (Figure 10). Although this patient had known Crohn’s disease, no external sign of this abscess was recognized clinically.

**Figure 10**
This CT section through the pelvis reveals an abnormal small bowel loop with a thickened wall adjacent to the posterior aspect of the anterior abdominal wall. Within the abdominal wall at this site, is an air and fluid collection representing an abscess. The attenuation of the mesenteric fat in the area is increased, representing inflammatory change.
In the second patient, back pain was the most significant clinical feature. The CT examination revealed bilateral psoas abscesses (Figure 11A). A subsequent barium enema demonstrated the changes of Crohn’s disease in both the ileocecal region and the sigmoid colon, accounting for the bilateral involvement (Figure 11B).

**Figure 11A**
A pelvic CT section demonstrates multiple circumscribed lucencies representing fluid collections in the right psoas muscle and a large fluid collection in the left psoas muscle. These findings are evidence of bilateral psoas abscesses.

**Figure 11B**
A double contrast barium enema on the same patient reveals distorted mucosal folds and compression of the medial wall of the cecum by an extrinsic mass. The sigmoid colon shows multiple areas of narrowing with mucosal irregularity and some ulcerations. Spot radiographs of these sites (not shown) demonstrated many small sinus tracts.
Secondary Changes in Adjacent Bowel

Inflammatory changes in one segment of the gastrointestinal tract secondary to the presence of inflammatory disease in an adjacent bowel loop may be seen. These changes may be produced either by an adjacent extrinsic inflammatory mass (phlegmon or abscess) or by fistulization from adjacent, diseased bowel. In either case, the secondary changes are nonspecific but readily differentiated from Crohn’s disease. Following resection of the diseased bowel, these nonspecific changes resolve, and the affected areas return to a normal appearance (11).

In one patient, the greater curvature of the stomach was abnormal (Figure 12A). Computed tomography revealed involvement of the transverse colon by Crohn’s colitis that had spread via the gastrocolic ligament to involve the stomach (Figure 12B). In a second patient, an air contrast barium enema revealed abnormalities involving the ileocecal valve and the medial wall of the ascending colon (Figure 13A). A small bowel series showed multiple fistulas to this region (Figure 13B).

Figure 12A
This double contrast spot film of the antrum shows a flattened greater curvature. Prominent folds without evidence of a mass or ulceration are noted. The overlying mucosal pattern is normal.

Figure 12B
This CT section demonstrates irregular thickening of the wall of the transverse colon with narrowing of the lumen. Inflammatory changes are noted in the pericolonic fat. More superior sections revealed these inflammatory changes, which arose in the colon, to extend to the greater curvature of the stomach.
A spot radiograph from a double contrast barium enema reveals abnormal thickening of the superior lip of the ileocecal valve. This thickening extends superiorly along the medial wall of the proximal ascending colon. The overlying mucosa is intact.

This spot radiograph from a small bowel follow through examination shows an abnormal terminal ileum with nodularity, deep ulcerations and multiple ileocolic fistulas involving the abnormal segment of the ascending colon seen in Figure 13A.

**Tumors and Pseudotumors**

The incidence of malignant neoplasms of the bowel in patients with Crohn's disease is greater than in the general population. A prevalence of 0.5% has been reported (14). Small bowel tumors are usually found distally, paralleling the distribution of Crohn's disease and differing from the usual more proximal involvement seen in the general population (4). Most commonly affected are those loops of diseased bowel that have been bypassed in diversionary surgery (9) and those involved in fistulas (4). Colonic neoplasms may also be encountered. This risk is not as great as in the case of ulcerative pancolitis, however (4). In one of our patients with a previous ileotransverse colostomy (without small bowel or colon resection), a carcinoma of the bypassed loop was found (Figures 14A and 14B).
Figure 14A
This upright radiograph from a double contrast barium enema reveals an ileotransverse colostomy. There was no history of a prior colonic resection. There was obstruction to the flow of barium in the short segment of visualized small bowel.

Figure 14B
A spot radiograph of the obstructed, bypassed ileum shows irregular abrupt tapering of the bowel with an overhanging edge consistent with a carcinoma.
Postinflammatory polyps (previously called pseudopolyps) secondary to prolonged and intense mucosal regeneration may be seen in varying sizes and configurations (16). They have been reported to occur in up to 15% of cases of granulomatous colitis (2). Rare reports of the giant overgrowth of these polyps, sometimes leading to obstruction, can be found (13). In one of our patients, a large, bulky mass of polyps simulated an apple core lesion of the ascending colon (Figure 15A). Close inspection revealed the true polypoid nature of this lesion (Figure 15B).

Figure 15A
This double contrast barium enema reveals an annular, constricting, "apple core" type of lesion of the ascending colon.

Figure 15B
A spot radiograph of the ascending colon reveals that the "apple core" is composed of innumerable small, inflammatory and post inflammatory polyps rather than of an annular ulcerated mass.
In another patient, a large, intraluminal, ulcerated mass was seen in the rectum associated with abnormal rectal mucosa (Figure 16). Clinically, this was thought to be a rectal carcinoma. Subsequent surgery revealed it to be a penetrating ulcer and inflammatory mass secondary to Crohn's disease affecting the entire rectum.

Figure 16
A frontal view from a barium enema shows a large intraluminal mass arising from the right lateral wall of the rectum. A large central ulceration is noted within it. The entire rectal vault is narrowed and the mucosal contour is very irregular. Surgical exploration revealed a deep ulcer with a large inflammatory mass.
Obstruction and Dilatation

The transmural nature of the inflammation and associated fibrosis may lead to obstruction in Crohn’s disease. Rarely intussusception is seen (Figure 17). Intussusception in Crohn’s disease is usually seen in the postoperative period (12). Intussusceptions usually are jejunjejunal in type and are secondary to chronic dilatation related to long standing obstruction. In our case, a more distal ileocolonic intussusception was seen. There was no history of previous surgery and no leading mass was identified.

Enterolith formation depends on stasis, usually proximal to an obstruction or in a diverticulum or pseudodiverticulum. Because both true and false diverticula may be found in Crohn’s disease, these patients are at risk for enteric stone formation. In one patient, stone formation resulted from the presence of multiple sites of focal narrowing (Figures 18A and B).

Asymmetric dilatation may occur on the antimesenteric border of the small bowel secondary to fibrosis on the mesenteric border with resulting loss of pliability (17) (Figure 19). This asymmetric involvement can be seen in approximately 25% of the cases of small bowel disease. In one third of these (8% of the total), asymmetric dilatation leads to sacculation of the antimesenteric border (10).

Figure 17
A coned down view from a single contrast barium enema shows a rounded mass in the ascending colon with just a hint of a “coiled spring” appearance. This represented the lead point of an ileocolic intussusception. A small bowel examination (not shown) revealed evidence of Crohn’s disease with thickening of the bowel wall but no mass.
This upright abdominal radiograph shows an ovoid soft tissue density within a dilated loop of small bowel in the right lower quadrant.

A small bowel series reveals the smooth ovoid defect to be within a dilated ileal loop. It is completely outlined by barium and has no apparent point of attachment. This represents a totally intraluminal mass consistent with an enterolith. Adjacent areas of ileitis can be seen.

This small bowel examination shows a giant sacculation with a relatively short base, representing a pseudodiverticulum of the ileum. Strictures and a "cobblestone" mucosa secondary to Crohn's disease are seen immediately proximal and distal to the pseudodiverticulum. The sacculation is along the antimesenteric border opposite the less distensible and more fibrotic mesenteric margin. (Courtesy of D. Faegenburg, M.D., Mineola, NY)
Toxic megacolon is estimated to occur approximately four times more commonly in ulcerative colitis than in Crohn’s colitis (8). Toxic megacolon occurred as the first manifestation of Crohn’s disease in 11 of 12 patients in one series, however (21) (Figure 20).

Figure 20
A supine abdominal radiograph shows a dilated large bowel with prominent haustrations in the ascending and transverse portions of the colon. These findings, in the appropriate clinical setting, are consistent with toxic megacolon.

Summary
Unusual manifestations of common diseases are still relatively common events. Crohn’s disease may involve the entire gastrointestinal tract from the pharynx to the anus. Although the classic findings of ileocolic disease are well known, the changes described above are less commonly encountered. They may be subject to misdiagnosis unless the protean manifestations of Crohn’s disease are kept in mind.
References


