CASE REPORT

Enterolith ileus: liberated large jejunal diverticulum enterolith causing small bowel obstruction in the setting of jejunal diverticulitis

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ABSTRACT. We present an 80-year-old man with multiple medical problems, and acute abdominal pain with feculent emesis. An unenhanced CT examination of the abdomen and pelvis demonstrated jejunal diverticulitis and findings of high-grade small bowel obstruction caused by a large enterolith. Enterolith ileus has rarely been reported in the radiology literature. This phenomenon has occasionally been reported in the surgical and gastroenterology literature. We highlight the CT findings associated with enterolith ileus in the setting of jejunal diverticulitis, to alert radiologists to this unusual diagnosis.

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Case report

We present an 80-year-old man with a medical history of hypertension, diabetes, left below-the-knee amputation for arterial disease, coronary arterial stent placement, myocardial infarction, Parkinson's dementia and splenectomy. The patient presented with a 1 day history of sharp, non-radiating left lower quadrant abdominal pain and feculent emesis. The patient was afebrile on presentation. Laboratory values were notable for a leukocytosis of 27 000 and acute renal failure.

An unenhanced CT examination of the abdomen and pelvis was performed to evaluate the patient's abdominal pain. The study demonstrated a large-mouth jejunal diverticulum measuring 4.1 cm by 3.9 cm (Figure 1a,b,d,e). There was inflammation and oedema of the mesentery. The findings were diagnostic of jejunal diverticulitis. A second, although not inflamed, jejunal diverticulum was noted proximally (Figure 1c). Additionally, there was a 2.9 cm by 2.1 cm lamellated and partially-calcified enterolith (Figure 2a–d). The enterolith was not located within the above-mentioned inflamed jejunal diverticulum; however, it was noted more distally within the mid-small bowel lumen causing a high-grade small bowel obstruction with a transition point at the enterolith. Collapsed small bowel loops were noted distally. CT examination from 7 years earlier showed the jejunal diverticula in retrospect although they were smaller and did not contain any enteroliths (not shown). The CT findings were then prospectively reviewed with the attending surgeon.

A nasogastric tube was then placed, and approximately 1.5 l of feculent material was removed. The patient underwent laparoscopic abdominal surgery which

was subsequently converted to an exploratory laparotomy after finding adherent loops of small bowel, scarring and adhesions secondary to the patient's remote splenectomy. After running the small bowel proximal to the transition point of obstruction, an enterolith was palpated and was milked intraluminally to a proximal loop of jejunum, which was also noted to have a gross perforation at the inflamed jejunal diverticular site. A 38 cm segment of small bowel was resected. Pathological evaluation of the resected small bowel demonstrated chronic diverticular disease, an ulcerated/perforated diverticulum, mesenteric microabscesses and a 3 cm enterolith. The patient was post-operatively managed in the surgical intensive care unit secondary to intra-operative hypotension and inability to wean-off mechanical ventilation. Upon clinical stabilisation, the patient was subsequently transferred to a surgical inpatient nursing unit on post-operative day 2. The patient was subsequently discharged in stable condition.

Discussion

Diverticulosis is a common disorder of the colon. Uncommonly, diverticulosis may develop in the small bowel with an incidence at autopsy of 0.3–4.5% [1]. Small bowel diverticula are false diverticula and do not contain all layers of small bowel tissue (epithelium, lamina propria muscularis mucosa, submucosa, muscularis propria and serosa). Small bowel diverticula are thought to arise in the setting of bowel dyskenia, abnormalities in peristalsis or high intraluminal pressures. Diverticula occur on the mesenteric border of small bowel at sites of insertion of penetrating mesenteric vessels. Penetrating visceral vessels create gaps in the muscularis propria, and allow for mucosa to herniate through these defects [2]. The duodenum is the most frequent site of small

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Figure 1. (a,b,c,d,e) Axial and coronal images from an unenhanced CT examination of the abdomen and pelvis in an 80-year-old man with acute abdominal pain and feculent emesis demonstrate a wide-mouth diverticulum (arrowheads) extending laterally from a loop of jejunum (asterisk), measuring 4.1 by 3.9 cm. There is irregular gas in the lumen of the diverticulum. The surrounding mesentery is oedematous, and there is inflammation of the adjacent fat consistent with jejunal diverticulitis. (c) An axial image of the abdomen slightly superior to the above noted inflamed diverticulum demonstrates a smaller jejunal diverticulum without adjacent inflammation (double arrowhead).

bowel diverticulosis, followed by the jejunum and ileum, with an incidence of 60–70%, 20–25% and 5–10%, respectively [3].

Patients with small bowel diverticulosis are generally asymptomatic. However, small bowel diverticulosis has been associated with complications. These include haemorrhage, intestinal obstruction, volvulus, intussusception, stenosis, and repeated episodes of diverticulitis [4]. Enteroliths, indigestible cores of food lamellated with faecal material, may develop within small bowel diverticula, or subsequently develop and enlarge in the native small bowel lumen. It has been postulated that enterolith formation may also be secondary to small bowel dyskinesia. This then leads to bacterial overgrowth, causing deconjugation of bile acids, which subsequently precipitate into aggregates when combined with choleretic acid in the small bowel lumen [5]. Enteroliths have been previously described in duodenal, jejunal, and Meckel's

diverticula [6–8]. Very uncommonly, enteroliths may enlarge, causing subsequent small bowel obstruction.

The imaging finding of enterolith ileus and imaging findings have rarely been reported in the radiology literature. We, including an experienced abdominal radiologist, were not aware that this entity even existed until we conducted a literature search. To the best of our knowledge the earliest reported case in the diagnostic imaging literature was by Berry et al [9] in 1987, when they described a 70-year-old woman who presented with a small bowel obstruction on CT secondary to a large bilirubin enterolith in the setting of jejunal diverticulosis but without findings of concurrent jejunal diverticulitis. CT findings demonstrated a 7.5 cm solid mass in the left pelvis and a small bowel obstruction. Exploratory laparotomy was performed and confirmed an intraluminal jejunal enterolith and jejunal diverticulosis. Herbertko and Brunton [10] described four patients presenting with

Figure 2. (a) Axial image from the same unenhanced CT examination as in Figure 1 shows an enterolith with layers of calcification measuring 2.9 by 2.1 cm (arrow). Loops of small bowel distal to the transition point/enterolith are collapsed (arrowheads). (b) A slightly more superior axial image of the abdomen demonstrates the superior extent of the enterolith (arrow) and dilated loops of bowel proximal to the transition point/enterolith (curved arrow, with the arrowhead at the proximal extent of the bowel). (c,d) Coronal reconstructed images again demonstrating the enterolith (arrow) and collapsed distal bowel loops (arrowhead).

small bowel obstruction secondary to jejunal enteroliths. Three of the four patients had surgically confirmed jejunal enteroliths and jejunal diverticular disease and only two patients had jejunal enteroliths and concurrent jejunal diverticulitis. These patients had representative conventional radiographs and/or small bowel series; however, CT imaging was not performed [10]. Sonographic imaging characteristics including a thickened jejunal wall and a hyperechoic jejunal enterolith, in a patient with small bowel obstruction complicated by jejunal diverticulitis, was described by Liu et al, and correlation with CT imaging was reported [11].

The above mentioned reported cases describe patients with small bowel obstruction in the setting of a large enterolith and jejunal diverticulosis; to the best of our knowledge only three previous reports of enterolith ileus in the setting of acute jejunal diverticulitis have been documented in the imaging literature. This phenomenon has been reported, however, in the surgical and gastroenterology literature without emphasis on CT imaging findings [3, 12–24]. As few as two reported cases of enterolith ileus with concurrent jejunal diverticulitis has been described in the surgical and gastroenterology literature [25–26]. It is our intent to highlight the CT findings associated with enterolith ileus in the setting of jejunal diverticulitis. We hope that our case may heighten radiologists' awareness of this rare entity in

those patients presenting with small bowel obstruction and small bowel diverticular disease on CT.

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