Helical CT Evaluation of Acute Right Lower Quadrant Pain: Part I, Common Mimics of Appendicitis

OBJECTIVE. The purpose of our pictorial essay is to present common mimics of appendicitis as noted on helical CT in patients with right lower quadrant pain and to highlight the features that provide clues to the diagnosis.

CONCLUSION. Recognition of the findings of common diseases that simulate acute appendicitis on helical CT, along with features that help to differentiate these entities from appendicitis, is important in establishing a correct diagnosis and in guiding appropriate therapy.

Helical CT plays an important role in the evaluation of patients with right lower quadrant (RLQ) pain and suspected acute appendicitis. Many conditions can produce RLQ pain or inflammatory changes similar to those of acute appendicitis resulting in a diagnostic challenge on CT [1, 2]. Common diseases that mimic appendicitis include Crohn’s disease, pelvic inflammatory disease, acute pyelonephritis, renal and urinary tract obstruction, hemorrhagic ovarian cyst, right-sided diverticulitis, mesenteric adenitis, epiploic appendagitis, bowel ischemia, right colonic neoplasia, and infectious ileocolitis. Helical CT findings of these common mimics along with features that help to differentiate them from appendicitis are emphasized in these proven cases.

Acute Appendicitis

Acute appendicitis (Fig. 1) manifests on CT as enlargement of the appendix with a diameter greater than 6 mm, thickened wall with enhancement, periappendiceal fatty stranding, and sometimes with an appendicolith, or focal thickening of terminal ileum or cecum [1–3]. In early or mild appendicitis, the appendix may remain normal in size. The thickened wall with enhancement may be the only major finding on CT (Fig. 2). A focal defect in the wall of the inflamed appendix (Fig. 3), appendicolith outside the appendix, periappendiceal fluid collection, or extraluminal air near the appendix indicates perforation of the appendix.

Crohn’s Disease

Crohn’s disease may present as acute RLQ pain with fever and elevated WBC, mimicking appendicitis. Helical CT findings in Crohn’s disease include bowel wall thickening, narrowing of the lumen, mesenteric fatty stranding, creeping fat, and skip lesions [4] (Fig. 4). Abdominal abscesses may develop adjacent to segments of bowel severely affected by Crohn’s disease (Fig. 5). The long segmental wall thickening of the terminal ileum, the center of inflammation away from the appendix, and circumferential symmetric thickening of the cecum are the major features that differentiate Crohn’s disease from appendicitis.

Pelvic Inflammatory Disease

Pelvic inflammatory disease represents a spectrum of infection within the female reproductive system. Hydrosalpinx, especially...
Fig. 1.—22-year-old man with acute appendicitis. C = cecum. 
A, Axial CT image shows enlarged appendix (arrow) and fat stranding in right lower quadrant (arrowheads) posterior and medial to cecum. 
B, Axial CT scan obtained inferior to A shows dilated appendix arising from cecum with wall enhancement and thickening (arrows).

Fig. 2.—27-year-old man with right lower quadrant pain for 1 day and low-grade fever. Axial CT image shows mildly enhanced appendix (arrows) with diameter of 6 mm and minimal periappendiceal fatty stranding consistent with early acute appendicitis.

Fig. 3.—27-year-old man with perforated acute appendicitis. 
A, Axial CT scan shows extensive fat stranding and fluid collection (arrows) surrounding enhanced and dilated appendix (A). Adjacent small bowel (sb) shows wall thickening. 
B, Axial CT scan obtained inferior to A shows defect (arrowheads) in inflamed appendiceal wall (A), indicating perforation. Extensive fat stranding and fluid collection (arrows) are present.
when involvement is limited to the right fallopian tube, may be confused with a dilated appendix on CT (Fig. 6). The extrinsic inflammation from a tuboovarian abscess, if it lies adjacent to the appendix, may cause serosal edema and mural thickening of the appendix, which create a diagnostic challenge. Recognizing that the inflammation is centered in the adnexa rather than in the appendix assists in making the correct diagnosis.

**Acute Pyelonephritis**

Acute pyelonephritis may present with appendicitis-like symptoms. However, on contrast-enhanced helical CT, numerous low-attenuation wedges and streaks in the renal parenchyma with associated focal or diffuse enlargement and perinephric fat stranding readily allow the differentiation of this entity from appendicitis (Fig. 7).

**Renal and Urinary Tract Obstruction**

Urinary tract disorders commonly present with acute right lower abdominopelvic pain [5]. Occasionally, urine extravasation may occur from the renal collecting system or ureter if the obstruction is acute and severe and may extend into RLQ, resulting in fat stranding mimicking acute appendicitis (Fig. 8). Identifying the normal appendix and tracing the fat stranding back to the urinary tract may help in differentiating this entity from acute appendicitis.

**Hemorrhagic Ovarian Cyst**

Hemorrhagic ovarian cyst is the most frequent gynecologic condition presenting with lower abdominopelvic pain that may simulate appendicitis, especially when it occurs on the right side. On helical CT, a hemorrhagic ovarian cyst appears as a well-circumscribed structure with attenuation greater than that of simple fluid (Fig. 9). Rupture of the ovarian cyst resulting in free pelvic fluid and/or fat stranding may mimic acute appendicitis. Identification of a normal appendix in conjunction with an ovarian cyst and associated inflammatory changes centered in the adnexa is helpful in establishing the correct diagnosis.

**Right-Sided Diverticulitis**

Right colonic diverticulitis may be mistaken clinically for acute appendicitis. The helical CT findings usually consist of asymmetric thickening...
ing of the cecal wall, pericolonic inflammation, and the presence of diverticula [6] (Fig. 10). Identifying pericolonic inflammation centered above the ileocecal valve or adjacent to a diverticulum is helpful in differentiating diverticulitis from appendicitis.

Mesenteric Adenitis
Mesenteric adenitis represents a benign infection or inflammation of the lymph nodes within the mesentery that results in abdominal pain, often mimicking appendicitis clinically [7]. If the sole finding in patients with RLQ pain is enlarged mesenteric lymph nodes clustered in the RLQ seen in association with a normal appendix, the diagnosis of mesenteric adenitis is highly likely (Fig. 11).

Epiploic Appendagitis
Epiploic appendagitis is thought to occur as a result of spontaneous torsion, ischemia, or inflammation of an epiploic appendage of the colon. The condition presents with acute abdominal pain that can mimic appendicitis [8]. On helical CT, the lesion shows a characteristic appearance as an ovoid fat-attenuation focus with a hyperattenuating rim associated with the serosal surface of the adjacent colon (Fig. 12). Mild inflammatory changes of the surrounding fat may be seen.

Bowel Ischemia
Bowel ischemia is a common cause of abdominal pain in the elderly. Helical CT findings

Fig. 6.—34-year-old woman with acute right lower quadrant pain.
A, Axial CT scan shows dilated tubular fluid-density structure in right adnexa (arrows) medial to cecum (C) consistent with right hydrosalpinx.
B, Axial CT scan obtained inferior to A shows fat stranding (open arrows) surrounding right ovary (O). Physical examination showed vaginal discharge and cervical motion tenderness consistent with pelvic inflammatory disease. Uterus (U) is noted.

Fig. 7.—33-year-old woman with fever and right abdominal pain.
A, Axial CT scan shows linear low densities with striated appearance (arrows) in right kidney consistent with pyelonephritis.
B, Axial CT scan obtained inferior to A shows complex fluid collection (arrow) consistent with evolving abscess.
Fig. 8.—41-year-old man with right lower quadrant (RLQ) pain.
A, Axial CT image shows fatty stranding in RLQ (solid arrows) surrounding contrast-filled appendix (open arrow).
B, Axial CT scan obtained superior to A shows dilatation of right renal collecting system (arrows) consistent with obstruction. Final diagnosis was right ureteropelvic obstruction.

Fig. 9.—28-year-old woman with acute right lower quadrant pain. Axial CT scan shows cystic structure in right adnexa (arrows) with well-defined wall most likely representing hemorrhagic cyst. Follow-up pelvic sonography performed 6 weeks later (not shown) showed interval resolution of cyst.

Fig. 10.—42-year-old man with right-sided diverticulitis.
A, Axial CT scan shows multiple diverticula (arrowheads) of right colon (C) with pericolonic fat stranding (arrows).
B, Axial CT scan obtained superior to A shows inflamed diverticulum (arrowhead) in medial aspect of right colon (C) with extensive pericolonic fat stranding (arrows).
Fig. 11.—23-year-old man with right lower abdominal pain. Axial CT scan shows several slightly enlarged lymph nodes (arrows) in mesentery, medial to right colon (C).

Fig. 12.—42-year-old woman with right abdominal pain. Axial CT scan shows fat-containing lesion (asterisk) with hypodense rim and fat stranding (arrows) in right lower quadrant right lateral to cecum (C). Loops of small bowel are dilated, consistent with ileus. Surgery confirmed infarction of cecum.

Fig. 13.—58-year-old man with acute right lower quadrant pain. Axial CT scan shows wall thickening of cecum (C) with pneumatosis (open arrows) and pericecal fat stranding (solid arrows). Loops of small bowel (S) are dilated, consistent with ileus. Surgery confirmed infarction of cecum.

Fig. 14.—59-year-old woman with fever and acute right abdominal pain. A, Axial CT image shows mass in right abdomen, containing gas and fluid with adjacent fatty stranding (solid arrows) consistent with abscess. Right renal hemorrhagic cyst (open arrow) was noted and confirmed on follow-up sonography (not shown). B, Axial CT image obtained 1 cm inferior to A shows marked wall thickening of short segment of right colon (arrows). Right colonic carcinoma with perforation was confirmed surgically.
include symmetric bowel wall thickening, mucosal thumbprinting, and pneumatosis coli if infarction occurs (Fig. 13). When these findings are localized to the distal ileum, differentiation from acute appendicitis resulting in reactive changes of the ileum may be difficult, especially if a normal appendix is not visualized.

Right Colonic Carcinoma
Right colonic carcinoma may present with acute lower abdominal pain, usually due to obstruction or perforation. On helical CT, marked asymmetric colonic wall thickening, short segment involvement, and abrupt change from a normal to an abnormal segment of colon are the key features that help to distinguish this from other entities. However, the diagnosis becomes more challenging and may mimic appendicitis when perforation occurs and results in fat stranding, fluid collections, and abscess formation in the RLQ (Fig. 14).

Infectious Ileocolitis
Infectious ileocolitis is usually caused by Yersinia, Campylobacter, or Salmonella organisms. The characteristic CT features of infectious ileocolitis include wall thickening of the terminal ileum, cecum, and a portion of the ascending colon (Fig. 15) and enlargement of the mesenteric lymph nodes. Identification of the normal appendix and lack of periappendiceal fat stranding help to exclude appendicitis.

References