RADIOLOGY ROUNDS

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A woman with severe abdominal pain after a barium enema

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One day after having sigmoidoscopy for anal stricture, this 61-year-old obese woman was admitted to the emergency department in shock. Earlier that morning, she had a barium enema, and acute abdominal pain developed several hours later. Radiographs on admission revealed extravasation of barium into the peritoneal cavity.

On the second hospital day, she had a transverse colostomy and rapidly developed severe postoperative oliguria and board-like rigidity and shock (her systolic blood pressure had dropped from about 130-140 mm Hg to 100 mm Hg). She was diagnosed with myocardial infarction and congestive heart failure. Management included a tracheostomy to facilitate respiration, digoxin, and oxygen by respirator. Culture of the peritoneal contents was positive for *Escherichia coli, Proteus mirabilis,* and *Staphylococcus aureus*, which was treated with gentamicin. Because of gram-negative septicemia, she was in a continuous state of shock during the hospital course. Obtundation developed and increased, and atelectasis became marked by the 12th day of hospitalization. The patient developed severe metabolic acidosis 1 day before her death from cardiorespiratory failure.

Radiographic findings

An anteroposterior (AP) supine abdominal view was done when the patient was admitted (Figure 1); it displayed free air and

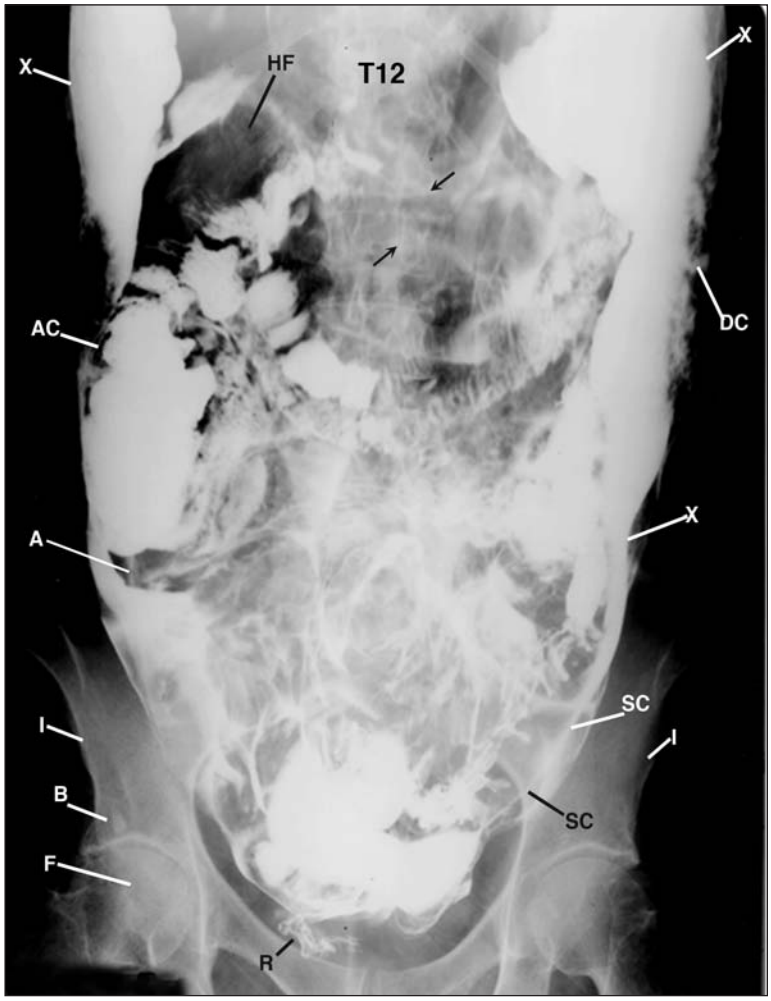

Figure 1 This supine anteroposterior abdominal radiograph displays free barium (X) within the peritoneal cavity of the abdomen and pelvis. Observe the lucency of free air (A) within the margins of the ascending colon (AC) and the hepatic flexure (HF). Barium coats the serosal surface of the small bowel (arrows) and the lumen of the descending (DC) and sigmoid colon (SC). Note the narrowing of the right hip joint and sclerotic density above the left acetabulum consistent with a bone island (B). F = femoral head; I = iliac bone; R = rectum; T12 = twelfth thoracic vertebra.

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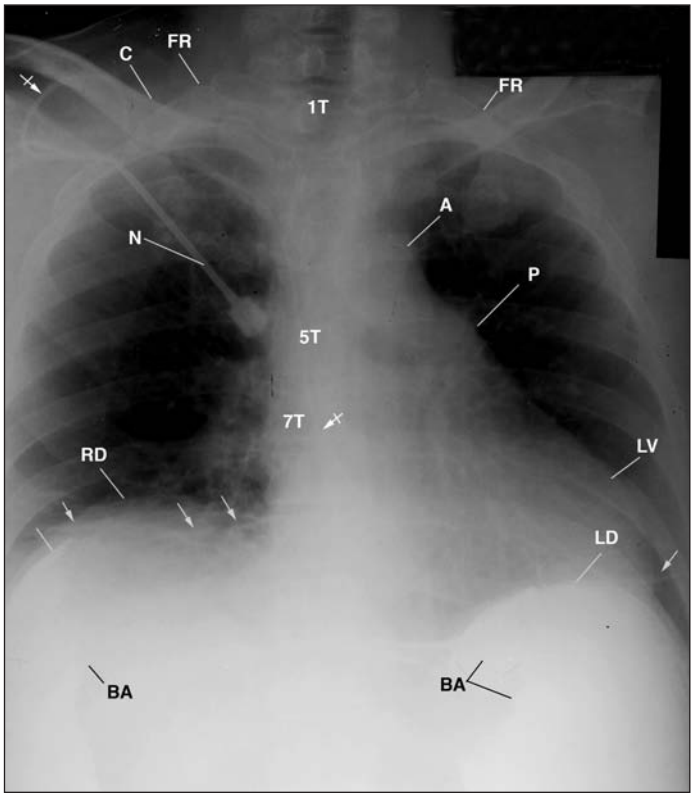

Figure 2 This anteroposterior chest radiograph displays free barium (BA) below the left (LD) and right diaphragm (RD), the heart displaced to the left of midline, an intravenous catheter (bar arrow) and needle (N) over the upper right shoulder, and the tip of the catheter next to the seventh thoracic vertebra (7T). Observe the linear atelectatic areas (arrows) at both lung bases. A = aorta; C = clavicle; FR = first rib; LV = left ventricle; P = pulmonary artery; 1T, 5T, 7T = thoracic vertebrae.

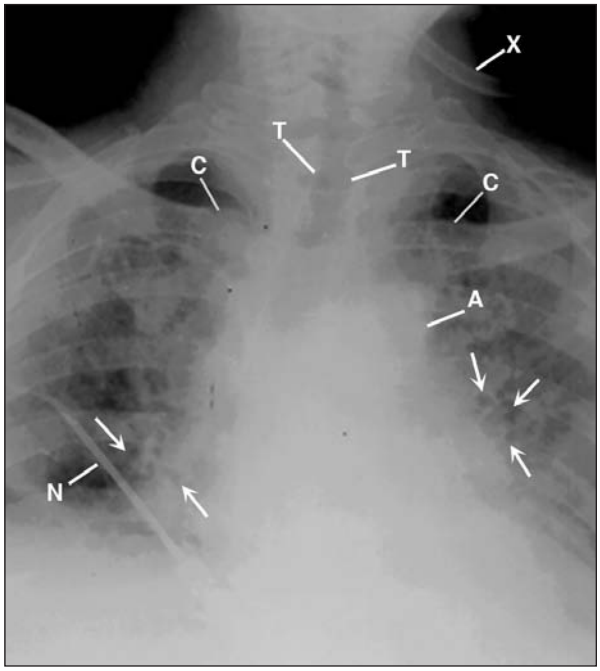

Figure 3 This anteroposterior chest radiograph displays air bronchograms (arrows) and the hazy amorphorus densities obscuring the aorta (A), diaphragm, and definition of both lungs, the left greater than the right. C = clavicle; N = needle; T = trachea; X = oxygen tubing.

barium in the peritoneal cavity and retained barium lining portions of the large and small bowel. In an AP chest radiograph, the trachea and cardiomediastinal structures were shifted to the left of midline, and the diaphragm was elevated with linear atelectatic areas at both lung bases (Figure 2).

On day 6, an AP chest radiograph displayed increased pulmonary vasculature that was accompanied by bilateral patchy amorphous dense areas. Infiltrate partially obscured the margins of the heart, and there were bilateral air bronchograms (Figure 3).

Autopsy results

Autopsy confirmed bowel perforation, demonstrating blood dispersed on mucosal surfaces of the large bowel and barium coating the serosal surfaces (Figure 4, page 18). No pulmonary emboli or effusions were detected. The left lung had extensive fibrous adhesions, and pulmonary edema was massive. Hyaline membranes were prevalent as well as alveolar hemorrhage. The adrenal glands were atrophic. The liver demonstrated barium peritonitis, and the kidneys had many areas of hyalinized and swollen glomeruli and focal areas of necrotic tubules with eosinophilic granular material. The stomach had one area of erosion and many monilial organisms at its base. The small intestine had areas of intramural hemorrhage and some submucosal edema, and the large intestine had chronic cell inflammatory infiltrates.

The final diagnosis

This patient had a perforated sigmoid colon that caused extravasation of air and barium into the peritoneal cavity. Other findings were bilateral pulmonary congestion secondary to congestive heart failure, ure-

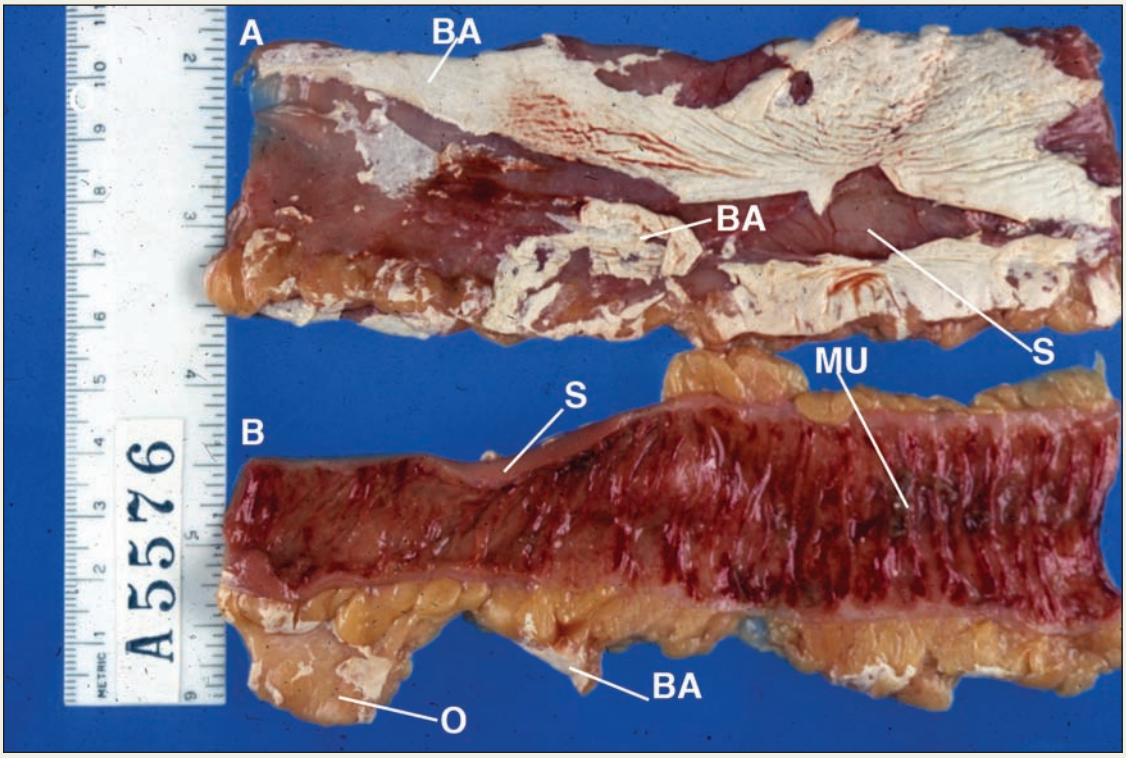

Figure 4 In these two fresh autopsy specimens of the large bowel, strips of the white barium (BA) adhere to the serosal surface (S) in the upper section (A). The lower section (B) displays hemorrhagic mucosal folds (MU) and adhesive strips of barium (BA) on sections of the marginating omentum (O).

mic pneumonitis, and bronchopneumonia. Barium peritonitis led to bilateral basal atelectatic changes.

Discussion

Although barium enema is usually a safe diagnostic procedure, it can occasionally result in bowel perforation and become a surgical—and life-threatening—emergency.[1,2] Recognizing the problem is vital, as barium in the peritoneal cavity causes macrophage proliferation and barium adhesive peritonitis. Rectal bleeding and mild abdominal complaints are common symptoms and may be followed by progressive sepsis and peritonitis. Recent advances in treatment have cut the mortality rate from about 50% to 35%.[2]

Endoscopy has reduced the demand for barium studies, but they are inexpensive and continue to be done in many small hospitals. Advances such as computed tomography and magnetic resonance imaging of the colon may further diminish complications. Nevertheless, fluoroscopic study coupled with spot-filming and overhead radiographs provide landmark anatomic definition unlike those special studies.

Take-home message

It is essential to have an accurate history and good bowel preparation in such cases. It is also important to help the patient understand how a barium enema is performed. Baseline scout radiographs with the catheter tip in the rectum should be reviewed before introducing the barium, and postevacuation radiographs help avoid complications. ■

REFERENCES

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2. de Feiter PW, Soeters PB, Dejong CH. Rectal perforations after barium enema: A review. Dis Colon Rectum 2006;49: 261-271.