Gasless Abdomen in the Adult: What Does It Mean?

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OBJECTIVE. The objective of this article is to illustrate the causes of a gasless abdomen in an adult.

CONCLUSION. The gasless abdomen in the adult is often interpreted as nonspecific, which does not provide useful information for the patient's physician. There are at least six causes of the gasless abdomen in the adult. A specific cause of the gasless abdomen can usually be made when the patient's history is known. The most serious cause of the gasless abdomen is small-bowel obstruction with or without ischemia.

gasless abdomen seen on an abdominal radiograph is a common entity in the neonate that may be caused by many serious gastro-

intestinal tract abnormalities [1]. The gasless abdomen on abdominal radiographs in the adult has received little attention in the literature [2, 3]. When a gasless abdomen is encountered, the radiologist will describe the finding and conclude "nonspecific abdomen." This does not provide useful information to the patient's physician.

In my experience, a number of entities can produce a gasless abdomen in the adult. These range from benign to life-threatening. In some patients the radiologist can determine the precise cause from the radiographs, but in many other cases the patient's history is necessary to determine the specific cause of the gasless abdomen. This is particularly true in patients who have a small-bowel obstruction producing a gasless abdomen. After reading this article, radiologists should be able to appropriately interpret abdominal radiographs in the adult that show a paucity of intestinal gas.

Normal Abdomen

Most normal adults have scattered gas throughout their small and large bowel [4, 5]. In the large bowel there is usually mottled gas due to the presence of feces mixed with gas. This increases with age. There are usually numerous loops of gas-containing small bowel centrally located in the abdomen. The healthy patient with little or no smallbowel gas probably swallows very little air, especially during meals. The clue to identifying these patients is that they lack clinical signs of small-bowel obstruction or ischemia (Figs. 1 and 2).

Small-Bowel Obstruction and Ischemia

The cause of the gasless abdomen in small-bowel obstruction is the presence of fluid rather than air filling the lumen of the dilated small bowel proximal to the site of obstruction (Figs. 3 and 4). Ischemia can produce similar findings even though thickening of the bowel wall may be present [2, 3] (Fig. 5). A proximal small-bowel obstruction may produce a gasless abdomen (Fig. 6).

Small-bowel obstruction with or without ischemia is the most serious cause of the gasless abdomen in the adult because it may be life-threatening. The gasless abdomen in the presence of a clinical finding of bowel obstruction implies a more long-standing obstruction, often in the presence of a closedloop obstruction, strangulation, or ischemic small bowel. Therefore, it is imperative that the radiologist know the patient's history and laboratory data. If symptoms and signs of obstruction or ischemia are present with a gasless abdomen on abdominal radiographs, the referring physician should be contacted immediately. The patient should undergo either emergent confirmatory CT (Figs. 3 and 4) or a surgical consultation. Some patients will have upright or decubitus radiographs in addition to their nondependent radiographs. These may help confirm the diagnosis of small-bowel obstruction by showing significant air–fluid levels or the string-ofpearls sign (Fig. 7).

CT is the most valuable imaging technique in the evaluation of the gasless abdomen. It can be of great value by confirming not only the presence of a small-bowel obstruction but also the site and cause of the obstruction, as well as showing complications such as closed-loop obstruction and signs of ischemic small bowel (Fig. 5). This information is critical for the surgeon to manage the patient promptly.

At my institution, we avoid the term "nonspecific abdomen" when a gasless abdomen is encountered. We make every effort to correlate the abdominal radiographic findings with the patient's history so the examination can be interpreted as normal or abnormal.

Ascites

Ascites may be the most common cause of the gasless abdomen in the adult. One can usually determine that ascites is present by noting the classic findings: obliteration of the fat outlining the internal edge of the liver, increased distance between the flank stripe and both the ascending and descending colon, medial displacement of the lateral liver edge, central location of small-bowel loops that may be displaced, bulging flanks, increased density over the entire abdomen, and fluid accumulation in the pelvis, the "dogears sign" [5-7] (Figs. 8 and 9). A history of metastatic disease, especially ovarian carcinoma, or portal hypertension is helpful in confirming the presence of ascites.

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Surgery, Especially Total Colectomy

For reasons that are unclear, many patients, after a total colectomy, have a paucity of gas in the small bowel (Fig. 10). Without surgical clips, it can be difficult to recognize the patient has had surgery such as a total colectomy (Fig. 10). One clue is these are usually younger patients who have had a colectomy for adenomatous polyposis or diffuse colitis. Other postsurgical patient groups we have encountered with a gasless abdomen include those who have undergone esophagogastrectomy, gastrectomy, and low anterior resection for colorectal adenocarcinoma (Fig. 11).

Gastroenteritis

Patients with gastroenteritis have a paucity of intestinal gas during their acute illness due to vomiting or diarrhea (Fig. 12). Patients with acute pancreatitis, graft-versus-host disease, inflammatory bowel disease, and irritable bowel syndrome can also have significant diarrhea that may produce a gasless abdomen [8, 9] (Fig. 13). By knowing the patient's history and symptoms, one can explain the gasless abdomen seen on abdominal radiographs.

Large Abdominal Mass

Patients with a large abdominal mass rarely present a problem to the radiologist interpreting abdominal radiographs. Huge masses are usually readily apparent on the radiographs (Fig. 14). Hepatomegaly, splenomegaly, retroperitoneal malignancies, mesenteric cysts, and benign and malignant gynecologic tumors are the most common large masses that produce a gasless abdomen in adults.

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Fig. 1—38-year-old man with 2 days of mild abdominal pain and no symptoms of bowel obstruction. A and B, Note paucity of small-bowel gas on supine (A) and upright (B) abdominal radiographs. Also note small amount of gas in right colon (*arrows*).

Gasless Abdomen in the Adult



Fig. 2—28-year-old woman with mild abdominal pain. Supine abdominal radiograph shows paucity of gas in small bowel and small amount of gas in right colon and rectum (arrow).





Fig. 3—17-year-old boy with testicular sarcoma after orchiectomy and retroperitoneal lymph node resection who developed signs and symptoms of small-bowel obstruction.

A, Digital radiograph shows nasoenteric feeding tube in place and small amount of barium present in right colon (arrow) and rectum from prior study. Note lack of gas in small bowel.

B, Axial CT image through lower abdomen shows dilated small bowel completely filled with fluid (arrow). Highgrade small-bowel obstruction due to dense adhesions was found at surgery.





Fig. 4—73-year-old woman with history of lymphoma who presented with nausea, vomiting, and sharp pain in left lower abdomen.

A, Supine abdominal radiograph shows paucity of small-bowel gas (*large arrow*) and small amount of gas and feces in right colon (small arrows). B, Coronal CT scan shows multiple fluid-filled loops of small bowel extending to pelvis, where transition point was identified (not shown) just distal to feces (arrow) in small bowel ("small-bowel feces sign"). Adhesion found at surgery was responsible for obstruction.







Fig. 5—72-year-old woman with severe abdominal pain and vomiting. A, Supine abdominal radiograph shows paucity of gas in right side of abdomen with air-containing jejunum that has fold thickening (*arrow*).

B, Axial CT scan through mid abdomen shows minimal thickening of air- and fluidcontaining dilated small bowel on left side of abdomen (*arrows*). Note fluid density in central mesentery and tiny amount of ascites in left lower lateral abdomen (*arrowhead*).

C, Axial CT scan at level of iliac crests shows dilated fluid-filled small bowel, increased density in central mesentery, and engorged vessels (*arrow*). At surgery, small-bowel obstruction and ischemic small bowel caused by adhesions were found.



С

Fig. 6—40-year-old woman with gradual onset of upper abdominal pain.

A, Supine abdominal radiograph shows normal gas in colon and paucity of small-bowel gas.

B, Upright abdominal radiograph shows normal colonic gas and distended loop of proximal small bowel (*arrow*) just inferior to stomach and transverse colon. C, Radiograph from enteroclysis (tube had been removed) shows abrupt change in caliber of proximal small bowel (*arrow*) and marked dilation of obstructed proximal small bowel. Distal small bowel is normal. Tiny (1 cm) ulceration at site of obstruction was noted on other radiographs. At surgery, less-than-totally-obstructing 1-cm primary jejunal adenocarcinoma was resected.

В

Gasless Abdomen in the Adult

Fig. 7—50-year-old man with abdominal pain, nausea, and vomiting.

A, Supine abdominal radiograph shows paucity of gas in lower abdomen and several faintly gas-filled bowel loops in left upper quadrant, some of which are left colon; others could represent dilated fluid-filled small bowel (*arrow*).

B, Upright abdominal radiograph shows scattered colonic air-fluid levels in periphery of abdomen. Note multiple tiny air-fluid levels in central abdomen that are in small bowel (*arrows*) and represent dilated fluid-filled loops of small bowel with tiny amounts of gas, the string-of-pearls sign. At surgery, distal small-bowel obstruction caused by adhesion was found.





Α



Fig. 8—73-year-old man with hepatic and renal failure due to amyloid and increasing abdominal distention.

A, Supine abdominal radiograph shows gas-filled stomach and many classic findings of ascites, increased density over abdomen, central location of a few loops of contrast-filled small bowel (*arrow*), and loss of normal fat outlining posterior liver edge as well as loss of all other normal fat planes.
B, Coronal CT image through mid abdomen shows central displacement of small bowel and medial displacement of liver due to ascites.







Fig. 9—71-year-old woman with known ascites due to liver failure. Supine radiograph of lower abdomen shows perivesical fat (*arrows*) outlining dome of bladder below and ascites above that extend into perivesical recesses. This finding due to visualization of fluid above perivesical fat has been called "dogears sign."

RIGHT





Fig. 10—48-year-old woman 6 months after total colectomy for ulcerative colitis who presented for ileostomy removal.

A, Preliminary abdominal radiograph shows paucity of gas throughout abdomen. Note surgical staples in pelvis from J-pouch (*arrow*).

B, Radiograph after instillation of contrast material into J-pouch shows normal distal ileum and contrast material filling ileostomy bag. No extravasation of contrast medium or stricture at ileoanal anastomosis was seen.

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Fig. 11—55-year-old man 2 days after esophagogastrectomy for high-grade Barrett's esophagus. A, Supine abdominal radiograph before barium swallow shows paucity of bowel gas, jejunostomy feeding tube, and cardiac monitoring wires.

B, Radiograph from barium swallow shows normal postoperative esophagogastrectomy. Note paucity of distal bowel gas.

Fig. 12—28-year-old woman with 2 weeks of mild abdominal pain, nausea, and vomiting. Digital supine abdominal radiograph shows paucity of gas throughout abdomen due to acute enterocolitis.



Fig. 13—28-year-old man with known acute myelogenous leukemia who presented with nausea, diarrhea, and fever.

A, Supine abdominal radiograph shows paucity of gas throughout entire abdomen. Tiny amount of gas is present in sigmoid colon (arrow).

B-**E**, Axial CT images through abdomen show both small- and large-bowel wall thickening (*arrowheads*). Small amount of ascites is present in sigmoid mesentery and pelvis (*arrowheads*, **B** and **C**). Note moderate dilation of duodenum and proximal jejunum (*arrowhead*) due to inflammation in proximal small-bowel mesentery (not shown). After treatment, all findings were shown to have resolved on 2-week follow-up CT. Findings were thought to be caused by neutropenic enterocolitis.

Gasless Abdomen in the Adult

Fig. 14—54-year-old woman with marked abdominal distention.

A, Supine abdominal radiograph shows marked abdominal fullness, displacement of small bowel cephalad (arrow), and elevation of hemidiaphragm. B, Axial CT scan through mid abdomen shows large multiseptate fluid-filled mass that proved to be metastatic sigmoid colon adenocarcinoma to left ovary.





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