

CLINICAL PROBLEM-SOLVING

A Sharp Right Turn

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In this Journal feature, information about a real patient is presented in stages (boldface type) to an expert clinician, who responds to the information, sharing his or her reasoning with the reader (regular type). The authors' commentary follows.

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A 60-year-old man presented to the emergency department for evaluation of rectal bleeding, syncope, and pain in the right leg. Five days earlier, diffuse abdominal pain that worsened with movement had developed in association with nausea, anorexia, and malaise. He had not traveled recently or ingested any unusual foods, and he had no history of fever, weight loss, or change in bowel habits. Approximately six hours before admission, he had a single episode of gross hematochezia and hematuria followed by syncope. Soon after, he began to have intense pain in his right leg, and he sought medical care.

Internist: This patient presented with multisystem findings, for which a unifying diagnosis is not immediately clear. Acute lower gastrointestinal bleeding in this patient's age group is generally explained by diverticulosis, colitis (from ischemia, infection, or inflammatory bowel disease), carcinoma, or vascular malformations. The associated abdominal pain provides support for a diagnosis of ischemic colitis or inflammatory bowel disease. Pain is not expected with diverticulosis; it is common in diverticulitis, but bleeding is not. The absence of fever makes an infection somewhat unlikely. The sudden presentation and absence of weight loss or change in bowel habits argue against a neoplastic disease. The occurrence of syncope may reflect a vasovagal reaction, but it raises the possibility that there has been a substantial reduction in plasma volume.

Typical causes of gross hematuria, such as nephrolithiasis, urinary tract infection, or bladder carcinoma, would not also cause hematochezia. One condition that could explain both findings, as well as the abdominal pain, is enterovesicular fistulization related to inflammatory bowel disease or a diverticular disorder.

The acute severe pain in the leg is also a concern. If the patient had preexisting peripheral vascular disease, hemorrhagic hypovolemia may have exacerbated vascular insufficiency. Alternatively, colon or bladder carcinoma, with an associated hypercoagulable state, may have predisposed the patient to deep venous thrombosis. Of course, it is possible that all the findings at presentation cannot be explained by a single condition. An assessment of vital signs, a physical examination, and laboratory studies are urgently needed.

The patient had a two-year history of chronic diarrhea, without bleeding. One year before his presentation he had undergone a colonoscopy, which showed diverticulosis and two polyps. The polyps were excised and proved to be benign. The results of an upper gastrointestinal series with small-bowel follow-through and endoscopy performed at that time were normal. Empirical treatment with metronidazole for possible giardiasis and hyoscyamine for possible irritable bowel syndrome were min-

imally effective in controlling the symptoms. The patient also had a history of hypertension, hyperlipidemia, and gout. His medications included atenolol (50 mg daily), atorvastatin (20 mg daily), allopurinol (300 mg daily), and aspirin (81 mg daily). His father had died of colon cancer at an advanced age. The patient had a remote history of alcohol abuse, but he reported no alcohol intake for the past 20 years. He had a 100 pack-year smoking history but had recently quit.

Internist: It is unclear whether there is any relationship between the patient's chronic diarrhea and the current illness. Inflammatory bowel disease remains a possible link between the two, but it is less likely given the reportedly negative results of colonoscopy. The history of hypertension, hyperlipidemia, and smoking predisposes the patient to vascular disease, and vascular insufficiency must be considered as a cause of his leg pain. A decreased hemoglobin level associated with bleeding might contribute to the risk of vascular insufficiency. Aspirin therapy increases the risk of upper gastrointestinal bleeding, which if brisk, can be manifested as hematochezia, thus explaining the hemodynamic compromise in this case.

Gastroenterologist: The workup for chronic diarrhea appears to be incomplete and could have been pursued more aggressively. In relation to the patient's current illness, his history of diverticulosis raises the suspicion of diverticulitis. He had a family history of colon cancer; however, the negative results of colonoscopy make this entity somewhat unlikely. His risk factors for cardiovascular disease also raise the question of whether intestinal ischemia caused the abdominal pain and bloody stool.

On physical examination, the patient appeared alert but in moderate distress. He appeared obese; he weighed 108.4 kg, was 175 cm tall, and had a body-mass index (the weight in kilograms divided by the square of the height in meters) of 35.4. He was afebrile; the blood pressure was 74/40 mm Hg, and the heart rate 72 beats per minute. The oxygen saturation level was 98 percent while the patient was breathing ambient air. He was edentulous, wore dentures, and had dry mucosa. Cardiac examination revealed a regular rate and rhythm, without murmur or gallop. There was no jugular venous distention, and no bruits were present. The abdomen was diffusely tender, but there was no

guarding, pulsatile mass, or rebound tenderness. The bowel sounds were normal. The rectal examination revealed normal sphincter tone and gross blood, but no tenderness or mass. The legs were nontender; both legs were considered to be warm, but the right leg had diminished pulses as compared with the left. The neurologic examination revealed no focal deficits.

Internist: Hypotension may be explained by hypovolemia from hemorrhage or by sepsis related to intraabdominal infection. If an infection were present, an associated coagulopathy could have exacerbated gastrointestinal bleeding. The inadequate compensatory heart rate can be explained by the use of beta-blockers. The findings in the right leg suggest the presence of diminished vascular flow, which could be explained by the patient's low cardiac output with associated peripheral vascular disease. Aggressive fluid resuscitation is needed immediately, with monitoring in the intensive care unit. Prompt evaluation of the source of his gastrointestinal bleeding and arterial supply to the right leg is also warranted.

Gastroenterologist: The presence of bowel sounds and absence of rebound tenderness and guarding rule out peritonitis and free perforation. A confined perforation, however, is not ruled out by these findings. Diminished pulses in the right leg in combination with hematochezia raise the possibility of arterioenteric fistulization. Such fistulas are typically manifested by intermittent gastrointestinal bleeding, signs of sepsis, or both. Risk factors for this type of fistulization include a prosthetic vascular graft, aneurysms, penetrating ulcers, tumors, radiation, trauma, diverticulitis, and foreign-body ingestion. The patient was not known to have any of these risk factors, although his history of diverticulosis raises the possibility of diverticulitis.

The white-cell count was 16,100 per cubic millimeter, with 87 percent neutrophils and 7 percent band forms. The hemoglobin level was 12.7 g per deciliter, with a normal mean corpuscular volume. The platelet count was 85,000 per cubic millimeter. The serum creatinine level was 1.4 mg per deciliter (123.8 μ mol per liter), and the level of urea nitrogen was 34 mg per deciliter (12.1 mmol per liter). The electrolyte levels were normal, and the bicarbonate level was 27 mmol per liter. The prothrombin time was prolonged, at 16.2 seconds

(international normalized ratio, 1.8), and the partial-thromboplastin time was normal (31 seconds). The erythrocyte sedimentation rate was 57 mm per hour. Amylase and lipase levels were normal, and the results of liver-function studies were normal, except for an albumin level of 2.6 g per deciliter. No blood smear was obtained. Urinalysis demonstrated the presence of blood (3+), with 2 to 4 red cells, 2 to 4 white cells, and 1+ granular casts per high-power field.

Internist: The mild leftward shift and elevations of the white-cell count and erythrocyte sedimentation rate reflect a stress response or an inflammatory or infectious process. The initial levels of hemoglobin and mean corpuscular volume suggest that this process is not chronic, and in the setting of acute bleeding, it may reflect the fact that there has been insufficient time for equilibration. Thrombocytopenia with an elevated international normalized ratio raises the possibility of early disseminated intravascular coagulation caused by an intraabdominal infection or cancer. A review of a panel of tests to screen for disseminated intravascular coagulation is warranted. Given the patient's hypoalbuminemia, the elevated international normalized ratio could alternatively indicate liver dysfunction.

The patient's urea nitrogen and creatinine levels and the granular casts on urinalysis are consistent with volume loss, although the gastrointestinal blood loss is also likely to have contributed to the elevation in urea nitrogen. Given the small number of red cells seen in the urine sediment, the markedly positive dipstick test for blood suggests the possibility of myoglobinuria, perhaps secondary to ischemic myositis of the leg.

A radiograph of the chest showed no acute disease, and abdominal radiographs demonstrated no obstruction, free air, or stones. The electrocardiogram was normal. Computed tomography (CT) of the abdomen and pelvis revealed an area of sigmoid diverticulosis (Fig. 1), thickening of the wall of the sigmoid colon, and a peripherally calcified right iliac artery with infiltration of the surrounding fat (Fig. 2).

Gastroenterologist: Examination of the plain films is helpful in ruling out free perforation and complete obstruction. The CT findings are nonspecific and are compatible with the presence of

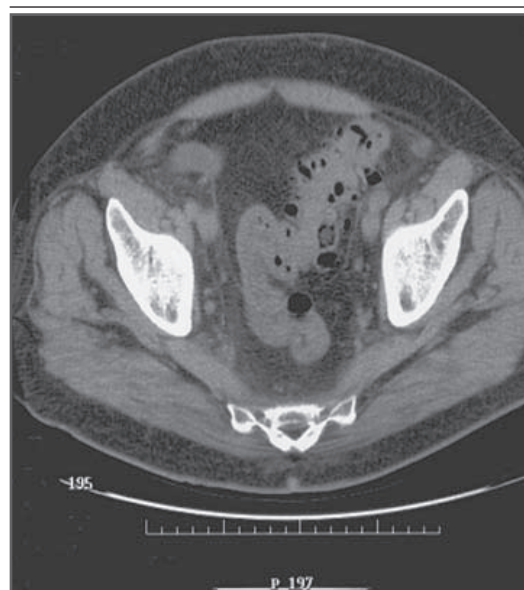


Figure 1. Axial Pelvic CT Obtained without the Administration of Contrast Material, Showing Extensive Sigmoid Diverticulosis.

diverticulitis, ischemic colitis, or inflammatory bowel disease. The presence of lower gastrointestinal bleeding is not consistent with the usual course of diverticulitis. Arterioenteric fistula remains a concern. Colonoscopy might have been helpful but was not performed, presumably because of the brisk bleeding and lack of colonic preparation, as well as the possible presence of diverticulitis.

Blood cultures were obtained, and empirical antibiotic therapy with levofloxacin, metronidazole, and gentamicin was begun, as was vigorous intravenous administration of fluids. Initially, there was transient hemodynamic improvement, but the patient then had another episode of hematochezia followed by syncope, with a fall in blood pressure to 69/41 mm Hg. A second complete blood count obtained within several hours after the initial assessment revealed that the hemoglobin level had fallen to 7.6 g per deciliter and the platelet count had declined to 55,000 per cubic millimeter. The pain in the patient's right leg worsened, and his right foot was cooler than the left. Specialists from both general and vascular surgery were consulted.

Vascular Surgeon: Arterial insufficiency was developing. Arterial duplex scanning may detect thrombus, compression, or aneurysm. Since the



Figure 2. Pelvic CT Scan Showing a Peripherally Calcified Right Common Iliac Artery (A) with Infiltration of the Adjacent Fat (B).

CT findings in this case were unremarkable from a vascular standpoint, angiography might have been helpful, because small fistulas or arterial erosions may be missed by ultrasonography. However, when renal function is compromised, I would consider performing scintigraphic scanning, as an alternative to angiographic examination, to look for bleeding. Open surgery is sometimes necessary to make a definitive diagnosis of erosions or fistulas into an artery. In this circumstance, the patient requires volume resuscitation before surgery. Once the patient's condition is stabilized, testing to localize the bleeding should be performed promptly; there is usually a window of 6 to 10 hours before the onset of irreversible ischemia.

Internist: If vascular intervention is necessary, then antibiotic coverage for gram-positive organisms should be added, given the possibility of staphylococcal contamination from the skin. While additional diagnostic studies are being obtained, and in anticipation of the potential need for emergency surgery, the patient should receive hematologic support, including transfusions of fresh-frozen plasma, platelets, and packed red cells.

Packed red cells, fresh-frozen plasma, and platelets were administered. The blood pressure in-

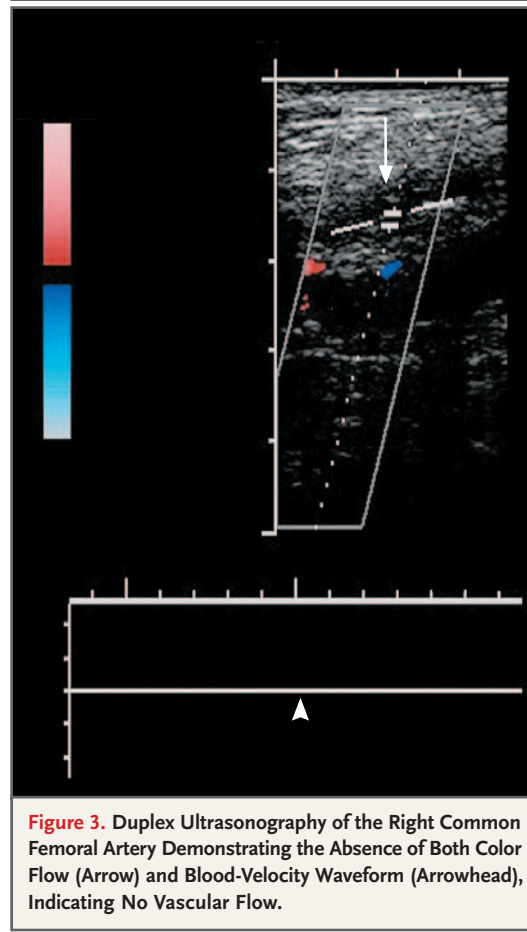


Figure 3. Duplex Ultrasonography of the Right Common Femoral Artery Demonstrating the Absence of Both Color Flow (Arrow) and Blood-Velocity Waveform (Arrowhead), Indicating No Vascular Flow.

creased to 134/80 mm Hg, but the prothrombin time remained elevated. Duplex ultrasonography revealed no flow in the right common femoral artery (Fig. 3) and absent systolic pressures in the right ankle. Technetium-99m scintigraphy (Fig. 4) demonstrated active bleeding in the rectosigmoid colon.

Vascular Surgeon: The scintigraphic scan confirmed the site of bleeding to be the sigmoid colon, with an apparent arterioenteric fistula; this is a life-threatening condition. Diverticulitis perforating the iliac artery and bladder could explain all the patient's symptoms, although such complications of diverticulitis are rare and diverticulitis is more commonly left-sided. The right leg had limb-threatening ischemia, and profuse bleeding persisted; thus, emergency surgery was warranted.

The patient was taken to the operating room. Laparotomy revealed diverticulosis and extensive calcification of the aorta and iliac vessels. Further



Figure 4. Technetium-99m–Labeled Red-Cell Scintigraphy Showing Abnormal Localized Tracer Activity in the Right Side of the Pelvis (Arrowhead), Indicating Bleeding in the Rectosigmoid Region.

exploration revealed a thin, solid foreign body perforating the rectosigmoid junction into the right external iliac artery, producing extensive hemorrhage and thrombus in the colon and vessel. Arteriotomy and thromboembolectomy were performed, but stool contamination of the field prevented graft placement during the arterial repair. The iliac laceration was closed; intraoperative Doppler study showed a slight signal distal to the repair, suggesting only minimal improvement in vascular flow. Sigmoid colectomy with colostomy formation was performed without complications. Blood cultures grew *Clostridium ramosum* and *C. cadaveris*. Pathological examination revealed colonic inflammatory changes, diverticulosis with a perforated diverticulum, and a wooden toothpick, 5.8 by 0.3 cm. The postoperative course was complicated by persistent pain and ischemia in the right leg. Additional revascularization procedures were avoided because of the possibility of infection and irreversible ischemic damage. The development of gangrene resulted in a below-the-knee amputation on the sixth postoperative day, which required revision to an above-the-knee amputation 20 days later because of poor wound healing. The patient returned home one week after this surgery, without further complications.

The patient did not recall ever chewing or ingesting a toothpick.

COMMENTARY

Perforations of the gastrointestinal tract by ingested toothpicks are rare, with an annual rate of 0.2 per 100,000 persons.¹ Of foreign-body ingestions, however, toothpicks have been reported to have the highest rate of impaction and perforation (9 percent).² These small, thin, and indigestible foreign bodies have at least one sharply pointed end, and their length makes it difficult for them to traverse the tortuous intestinal lumen.³ Perforations have occurred throughout the gastrointestinal tract, including the duodenum, jejunum, cecum, sigmoid colon, appendix, and a Meckel's diverticulum,⁴ with complications including abscess formation, sepsis, hemorrhage, and perforations of major vessels resulting in death.⁵⁻⁹ This patient had a major arterial perforation complicated by sepsis and limb gangrene that eventually necessitated amputation. The timely identification and treatment of toothpick perforations are warranted; however, the diagnosis remains challenging, since patients may be unable to recall ingesting a toothpick, the symptoms of the condition may mimic those of other disorders, and a toothpick is difficult to identify radiographically.

This patient had no recollection of chewing or swallowing a toothpick, and such a response is not uncommon. Among a series of patients found to have toothpick ingestion, only 12 percent were aware that it had occurred.¹⁰ Many affected patients have altered oral sensation or awareness owing to dentures, the use of alcohol, or underlying psychiatric illness.¹ Accidental ingestion has also been reported in competent adults, especially in those who habitually chew toothpicks, although this patient denied this practice.⁹ His use of dentures was his only risk factor.

The symptoms and signs associated with toothpick perforation are similar to those of several intraabdominal diseases, including diverticulitis, appendicitis, renal colic, and inflammatory bowel disease.¹⁰⁻¹² Because of this patient's history of diverticular disease and symptoms of anorexia, malaise, and nausea, his physicians initially suspected diverticulitis. The addition of ischemia of the right leg and rectal bleeding to the abdomi-

nal pain was key in diagnosing the arterioenteric fistula, since this provided a single unifying explanation for this patient's unusual presentation. Although the operative note did not clearly identify the cause of hematuria, it may have been related to associated ureteral inflammation.

Because of their radiolucency, toothpicks are difficult to image. In a series of 57 patients who ingested toothpicks, these foreign bodies were visualized by ultrasonography, CT, and radiography in only 14 percent.¹⁰ The definitive diagnosis of toothpick perforation was most commonly made by laparotomy (53 percent) or by endoscopy (19 percent).¹⁰

In the case under discussion, the brisk bleeding and other factors contraindicated colonoscopy. Although the sensitivity and specificity of nuclear scintigraphy are generally suboptimal (85 percent and 70 percent, respectively),¹³ the technique in this case successfully identified the bleeding

site, allowing for prompt and definitive surgical intervention. Laparotomy confirmed the perforation of the sigmoid colon by the toothpick, with penetration of the right external iliac artery.

Diverticulosis has been noted to be a predisposing factor for perforation.¹⁴ Given the evidence of diverticular perforation on pathological examination, it is likely that this patient's toothpick lodged in a sigmoid diverticulum and was forced by peristalsis to make a sharp right turn, resulting in penetration of the mucosa and the right external iliac artery and, ultimately, an arterial fistula. The unfortunate combination of preexisting peripheral vascular disease with trauma, hemorrhage, and subsequent infection resulted in unsalvageable ischemic changes that eventuated in gangrene and amputation.

No potential conflict of interest relevant to this article was reported.

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