

CASE RECORDS of the MASSACHUSETTS GENERAL HOSPITAL

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Case 4-2019: An 18-Year-Old Man with Abdominal Pain and Hematochezia

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PRESENTATION OF CASE

Dr. Fabian J. Scheid: An 18-year-old male professional athlete was admitted to this hospital because of fevers, abdominal pain, and hematochezia.

The patient had been well until 20 days before this admission, when fevers and pain in the right lower quadrant developed during a trip to the southeastern United States for athletic training. One day later, the patient had mild postprandial nausea and loose stools. He presented to a local emergency department for evaluation.

In the emergency department of the first hospital, the pulse was 59 beats per minute, the blood pressure 114/65 mm Hg, and the weight 72.1 kg. The results of the rest of the physical examination were not documented. The blood levels of electrolytes, calcium, alkaline phosphatase, total bilirubin, and lipase were normal; other laboratory test results are shown in Table 1. The results of computed tomography (CT) of the abdomen and pelvis, performed after the administration of oral and intravenous contrast material, were reportedly normal. After 5 hours of observation, the patient was discharged to his hotel without receiving a specific diagnosis.

During the next 2 weeks, the abdominal pain diminished and the fevers and loose stools resolved; mild nausea persisted. The patient traveled with his team to the western United States and participated in reduced-intensity athletic training. Four days before this admission, pain in the right lower quadrant recurred and was associated with low-back pain on the right side. In addition, he produced well-formed stools that contained blood. The following day, the abdominal and back pain persisted. Because the patient had not had a bowel movement, his athletic trainer recommended that he take a rectal suppository. After he took the suppository, he had a bowel movement that consisted of loose stools admixed with blood and mucus. That evening, a temperature of 39.7°C developed, prompting the

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Table 1. Laboratory Data.*

Variable	Reference Range, First Hospital	19 Days before Admission, First Hospital	Reference Range, Second Hospital	3 Days before Admission, Second Hospital	Reference Range, This Hospital†	On Presentation, This Hospital	10 Hr after Presentation, This Hospital	Day 2, This Hospital
Blood								
Hematocrit (%)	40.0–54.0	39.8	40.0–53.0	39.2	41.0–53.0	35.1	27.6	27.7
Hemoglobin (g/dl)	14.0–18.0	12.6	13.5–17.0	12.7	13.5–17.5	11.4	9.2	9.1
White-cell count (per mm ³)	4500–11,500	8900	4000–11,000	9900	4500–13,000	5420	2560	5950
Differential count (%)								
Neutrophils	50.0–75.0	72.4	40–62	88	40–62	78.1		63.5
Immature granulocytes	0.0–1.0	0.1						
Bands			0–10		0–10	9.6		6.9
Metamyelocytes			0		0	0.9		
Lymphocytes	18.0–42.0	19.0	27–40	6	27–40	9.6		29.6
Monocytes	2.0–8.0	6.1	4–11	5	4–11	1.8		0
Eosinophils	1.0–3.0	2.2	0–8	0	0–8	0		0
Basophils	0.0–1.0	0.2	0–3	0	0–3	0		0
Platelet count (per mm ³)	150,000–450,000	184,000	130,000–450,000	257,000	150,000–400,000	99,000	79,000	74,000
Red-cell count (per mm ³)	4,600,000–6,000,000	5,490,000	4,300,000–6,000,000	5,570,000	4,500,000–5,900,000	5,150,000	4,160,000	4,120,000
Mean corpuscular volume (fl)	80.0–94.0	72.5	78–100	70	80.0–100.0	68.2	66.3	63.8
Mean corpuscular hemoglobin (pg)	26.0–32.0	23.0	27.0–34.0	22.8	26.0–34.0	22.1	22.1	21.7
Description of peripheral-blood smear								
Urea nitrogen (mg/dl)	7–21	15	8–25	14	8–25	17		13
Creatinine (mg/dl)	0.7–1.3	1.1	0.60–1.20	1.18	0.60–1.50	1.38		1.18
Glucose (mg/dl)	74–106	89	65–99	114	70–110	130		96
Alanine aminotransferase (U/liter)	12–78	36	10–41	15	10–55	44	36	49
Aspartate aminotransferase (U/liter)	15–37	57	10–50	19	10–40	65	48	69
Protein (g/dl)								
Total	6.4–8.2	7.5	6.0–8.0	8.1	6.0–8.3	7.1	5.7	6.6

Toxic granulation, vacuolated neutrophils, Döhle bodies, Burr cells, elliptocytes, target cells, large platelets, 1+ polychromasia

Albumin	3.4–5.0	3.7	3.4–5.0	3.9	3.3–5.0	3.3	2.9	3.2
Globulin					1.9–4.1	3.8	2.8	3.4
Erythrocyte sedimentation rate (mm/hr)			0–15	41	0–13	40		
C-reactive protein (mg/liter)			2.0–8.0	103.1	<8.0	281.6		
Prothrombin time (sec)			9.4–12.5	15.8	11.5–14.5	16.1	15.1	15.1
Prothrombin-time international normalized ratio			0.9–1.1	1.4	0.9–1.1	1.3	1.2	1.2
Activated partial-thromboplastin time (sec)			24.0–36.5	33.9	22.0–35.0	37.2	35.6	35.9
D-Dimer (ng/ml)					<500		>10,000	
Fibrinogen (ng/ml)					150–400		535	
Iron (µg/dl)					45–160		15	
Iron-binding capacity (µg/dl)					230–404		181	
Ferritin (µg/liter)					20–300		864	
Transferrin saturation (%)					14–50		8	
Reticulocyte count (%)					0.5–2.5		<0.5	
Haptoglobin (mg/dl)					16–199		214	
Lactic acid (mmol/liter)					0.5–2.0			3.7
Venous blood gas measurements								
pH								7.31
Partial pressure of carbon dioxide								50
Partial pressure of oxygen								28
Urine								
Color		Yellow		Yellow	Yellow	Dark yellow	Yellow	Yellow
Clarity		Clear		Clear	Clear	Clear	Clear	Clear
Specific gravity		1.033		1.030	1.001–1.035	1.016	1.032	1.016
pH		7.0		6.0	5.0–9.0	5.0	5.0	5.0
Protein		1+		Negative	Negative	2+	1+	Negative
White cells per high-power field					0–2			0–2
Red cells per high-power field					0–2			0–2

* To convert the values for urea nitrogen to millimoles per liter, multiply by 0.357. To convert the values for creatinine to micromoles per liter, multiply by 88.4. To convert the values for glucose to millimoles per liter, multiply by 0.05551. To convert the values for iron and iron-binding capacity to micromoles per liter, multiply by 0.1791. To convert the values for lactic acid to milligrams per deciliter, divide by 0.1110.

† Reference values are affected by many variables, including the patient population and the laboratory methods used. The ranges used at Massachusetts General Hospital are for adults who are not pregnant and do not have medical conditions that could affect the results. They may therefore not be appropriate for all patients.

patient to present to the emergency department of a second hospital.

In the emergency department of the second hospital, the patient reported pain in the right flank and abdomen and loss of appetite. The temperature was 38.9°C, the pulse 110 beats per minute, the blood pressure 124/76 mm Hg, the respiratory rate 16 breaths per minute, and the oxygen saturation 99% while he was breathing ambient air. The lower quadrants of the abdomen and the right flank were tender; the remainder of the examination was normal. The anion gap and blood levels of electrolytes, calcium, alkaline phosphatase, total bilirubin, and lipase were normal; other laboratory test results are shown in Table 1. Magnetic resonance imaging (MRI) of the abdomen and pelvis, performed after the administration of intravenous contrast material, reportedly revealed mildly distended, fluid-filled loops of small bowel in the left half of the abdomen and the presence of air–fluid levels in the rectum. Acetaminophen and intravenous fluids were administered, and the fever and tachycardia resolved. The team's internist encouraged the patient to return to New England for further medical evaluation.

Two days later and 1 day before this admission, the patient was seen by the team's internist at an outpatient clinic of this hospital. He reported that the abdominal and back pain persisted. He also reported that, earlier that day, he had had a temperature of 38.9°C, which had decreased after the administration of acetaminophen, and produced well-formed stools that contained blood. The patient appeared to be uncomfortable. The temperature was 36.3°C, the pulse 84 beats per minute, and the blood pressure 110/74 mm Hg. The abdomen was soft, with normal bowel sounds; there was tenderness in the right lower quadrant and the suprapubic region, without guarding, rebound tenderness, or masses. The remainder of the examination was normal. Arrangements were made for an expedited colonoscopy to be performed by a gastroenterologist at this hospital the following afternoon.

The next morning, the patient called the team's internist and reported that, after he had taken the bowel-preparation regimen, he had had a bowel movement that contained a large volume of blood. He also reported shaking chills and

fever, with temperatures as high as 39.4°C, as well as worsening pain in the right lower quadrant. He was advised to present to the emergency department of this hospital.

In the emergency department of this hospital, the patient reported light-headedness and malaise. His medications included ibuprofen and acetaminophen as needed, and he had no known allergies. A review of systems was negative for emesis, diarrhea, tenesmus, genitourinary symptoms, arthralgias, rash, and skin and oral ulcerations. The patient was a professional athlete who lived with his family in an urban area of New England and traveled frequently throughout the continental United States. He did not smoke tobacco, drink alcohol, or use illicit drugs. There was no family history of autoimmune diseases or inflammatory bowel disease.

The patient appeared to be tired. The temperature was 37.6°C, the pulse 122 beats per minute, the blood pressure 110/56 mm Hg, the respiratory rate 18 breaths per minute, and the oxygen saturation 97% while he was breathing ambient air. The weight was 72.3 kg, the height 185 cm, and the body-mass index (the weight in kilograms divided by the square of the height in meters) 21.1. The abdomen was soft, with normal bowel sounds; there was tenderness on palpation of the right lower quadrant and the suprapubic region, without guarding, rigidity, distention, or masses. Examination of the rectum revealed a few external hemorrhoids, and there was scant bright-red blood in the rectal vault; there were no skin tags or palpable fissures or masses. There was no testicular tenderness, warmth, or erythema, but there was an enlarged right inguinal lymph node. The remainder of the examination was normal.

Blood samples were obtained for culture. Stool samples, which were liquid and bloody, were obtained for culture, examination for ova and parasites, tests for antigens of *Clostridium difficile* and Shiga toxins 1 and 2, and measurement of the calprotectin level. The anion gap and blood levels of electrolytes, calcium, magnesium, alkaline phosphatase, total bilirubin, direct bilirubin, and lipase were normal; other laboratory test results are shown in Table 1. Tests for infection with human immunodeficiency virus, hepatitis B virus, hepatitis C virus, and *Helicobacter*

pylori were negative. Intravenous fluids were administered, and CT of the abdomen and pelvis was performed. On the initial interpretation of the CT scan, no evidence of an acute process in the abdomen or pelvis was detected and the appendix was not visible.

The patient was admitted to the hospital. That evening, a temperature of 40.2°C developed, with associated rigors, and the patient appeared to be confused. The pulse was 145 beats per minute, the blood pressure 109/52 mm Hg, the respiratory rate 35 breaths per minute, and the oxygen saturation 97% while he was breathing ambient air. There was a new systolic ejection murmur (grade 2/6) that was best heard at the left upper sternal border; the remainder of the examination was unchanged. Another blood sample was obtained for culture. The lactate dehydrogenase level was normal; other laboratory test results are shown in Table 1. Cefepime, metronidazole, acetaminophen, and intravenous fluids were administered, and the vital signs and mental status normalized. Ninety minutes after the initiation of treatment, the microbiology laboratory reported that cultures of the blood that had been obtained in the emergency department 11.5 hours earlier had grown gram-negative rods.

During the next day, additional fevers occurred, with temperatures as high as 40.6°C and with associated rigors. Cultures of the blood that had been obtained in the emergency department grew *Klebsiella pneumoniae* and gram-positive cocci, and repeat blood cultures reportedly grew a second type of gram-negative rod.

A diagnostic test was performed.

INTERPRETATION OF IMAGING STUDIES

Dr. Theodore T. Pierce: In preparation for this discussion, review of the CT scan of the abdomen and pelvis, which had been obtained after the administration of intravenous and oral contrast material, revealed a subtle additional finding that had not been reported to the clinical team at the time of the initial interpretation. There was a possible contained, extraluminal, air-filled collection (20 mm by 10 mm) anterior to the spine, between the sigmoid colon and the right common iliac artery, with adjacent thickening of a short segment of the arterial wall (Fig. 1).

There was no bowel-wall thickening, bowel distention, or colonic diverticulosis; the appendix was not visible.

DIFFERENTIAL DIAGNOSIS

Dr. Helen M. Shields: The patient is a previously healthy 18-year-old male professional athlete who presented with fever, pain in the right lower quadrant, loose stools, and nausea. Starting with these symptoms, I will build my differential diagnosis. In doing so, I will try to explain what happened to this young man and why three hospitals in different parts of the country had trouble establishing a diagnosis, even with the use of sophisticated imaging studies. The difficulty in making an imaging-based diagnosis is an additional clue that will help lead me to my final diagnosis.

Among patients who present to the emergency department, 5 to 7% have acute abdominal pain.^{1,2} Approximately 50% of these patients receive a diagnosis of acute gastroenteritis,³ a condition that is associated with loose stools and nausea, in addition to abdominal pain. Another 25% of the patients receive a diagnosis of a viral or bacterial infection on the basis of results of microbiologic testing.⁴ The remaining patients — including this patient, who presented with pain that was localized to the right lower quadrant — need to undergo further testing and imaging studies for a diagnosis to be established. What are common causes of pain in the right lower quadrant in a previously healthy 18-year-old man?

APPENDICITIS

In considering a diagnosis of appendicitis in this patient, I would ask the following questions. Was the pain in the right lower quadrant preceded by epigastric pain, and was it localized to McBurney's point? Did the patient have a loss of appetite before loose stools and nausea developed? Was there tenderness on gentle palpation of the right lower quadrant, a finding that suggests involvement of the parietal peritoneum? Was the pain exacerbated by coughing or shaking of the bed, which jostles the parietal peritoneum?^{1,2} It is notable that the appendix was not visible on this patient's initial imaging studies; this would be unusual in a patient with appen-



Figure 1 (facing page). CT Scan of the Abdomen and Pelvis.

An axial image obtained at the level of the pelvis (Panel A) and coronal reformatted images obtained at low and high magnification (Panels B and C, respectively) show a contained, extraluminal, air-filled collection (arrowheads) medial to the right common iliac artery (RCIA), with adjacent linear foci of gas (double arrowhead) that extend to the sigmoid colon (S). An axial image obtained at the level of the superior margin of the collection (Panel D, arrowheads) shows additional contiguous soft-tissue density (arrows) surrounding the RCIA, a finding that indicates inflammation of the arterial wall. In comparison, the left common iliac artery (LCIA) is normal, with an imperceptible wall. A sagittal reformatted image (Panel E) shows the collection (arrowheads) immediately anterior to the L5 vertebral body and L5–S1 intervertebral disk space; there is no evidence of diskitis or osteomyelitis. In retrospect, a coronal reformatted image obtained at high magnification (Panel F) shows an equivocal linear low-density structure (double arrowhead) adjacent to the collection (arrowheads) traversing the RCIA.

ditis, in whom the appendix would typically appear thickened and swollen on ultrasonography, as well as on CT and MRI.^{5–8}

DIVERTICULITIS

Could this patient have diverticulitis? It would be helpful to know the ethnic background of the patient, because Asian patients most commonly have diverticulitis on the right side, in the cecum or ascending colon, whereas North American and European patients most commonly have diverticulitis on the left side, in the sigmoid colon, and present with this condition at an older age.^{9,10} Diverticulitis that is located near the sigmoid bend can be associated with pain on the right side. However, this patient's imaging studies do not show evidence of a diverticulum in the colon or fat stranding, and such a finding would be expected in a patient with an inflammatory process adjacent to the colon, such as diverticulitis.

INFLAMMATORY BOWEL DISEASE

Does the patient have a family history of inflammatory bowel disease? This disease is 3 to 20 times as likely to develop in first-degree relatives of patients with Crohn's disease as in the general

population.¹¹ A new diagnosis of Crohn's disease is certainly a possible explanation of this patient's presentation — given the rectal bleeding, pain in the right lower quadrant, nausea, and loose stools — provided that both the colon and the small bowel are involved. However, the imaging studies do not show transmural thickening or inflammation of the bowel, skip lesions, creeping fat, or other hallmarks of Crohn's disease, such as a fistulous tract.¹² The absence of imaging findings is particularly important in ruling out the diagnosis of Crohn's disease in this patient. Clinically significant abnormalities on CT (e.g., intraabdominal abscess, stricture, perforation, fistula, and small-bowel obstruction) are detected in 47% of patients in the emergency department who have Crohn's disease, 81% of whom initially present with abdominal pain.¹³

A diagnosis of ulcerative colitis is possible, given the rectal bleeding and mucous discharge. However, the ulcerations associated with ulcerative colitis are mucosal and are very unlikely to give rise to a bowel perforation, unless toxic megacolon develops.¹⁴

INFECTIOUS COLITIS

Infectious colitis that is due to organisms such as *Salmonella enterica*, *Campylobacter jejuni*, and *Yersinia enterocolitica* should be considered in this case. Stool samples were sent to the laboratory to be tested for salmonella and campylobacter, but there has been no mention of testing for yersinia. The patient had been traveling and presumably eating out for most of his meals, which would put him at risk for an infection. *Y. enterocolitica* is a particularly important consideration in this case, since this organism can cause pain in the right lower quadrant and mesenteric lymphadenopathy. This patient had an enlarged right inguinal lymph node but no other signs of colitis on CT, and his diarrhea subsided spontaneously. In most laboratories, testing for *Y. enterocolitica* must be specifically requested.¹⁵

COLITIS ASSOCIATED WITH NONSTEROIDAL ANTIINFLAMMATORY DRUGS

Colitis that is associated with the use of nonsteroidal antiinflammatory drugs should be in the

differential diagnosis in this case, given the history of ibuprofen use. How much ibuprofen had the patient been taking? Could the use of ibuprofen have led to the colitis and abdominal pain?¹⁶ It could have led to increased bleeding from ulcerations in the colon.

MECKEL'S DIVERTICULUM

Meckel's diverticulum with perforation is a compelling diagnosis in this case, given this patient's young age. However, Meckel's diverticulum with perforation usually occurs in early childhood.¹⁷ In addition, the imaging studies do not show evidence of this specific small-bowel condition, except for the dilated loops of small bowel on MRI of the abdomen at the second hospital, a finding that suggests partial small-bowel obstruction or ileus.

ISCHEMIC COLITIS

Ischemic bowel disease is a rare and serious condition that causes lower gastrointestinal bleeding and has been described in marathon runners.¹⁸ In athletes, reversible ischemic bowel disease involving the cecum and ascending colon, with associated pain on the right side, may be due to physiological shunting caused by splanchnic vasoconstriction or to intravascular volume depletion, or it may result from other factors.¹⁸

SIGMOID OR CECAL VOLVULUS

Volvulus, which is a twist in the large bowel, accounts for 10 to 15% of cases of large-bowel obstruction.¹⁹ Sigmoid volvulus is more common than cecal volvulus. This patient's imaging studies do not show evidence of a twist in the bowel.

COLON CANCER

Colon cancer in the ascending colon or cecum with perforation should be in the differential diagnosis in this case, even though the patient is only 18 years old. Given the rising incidence of colon cancer among young people in the United States,²⁰ this diagnosis must be ruled out. Although this patient's imaging studies do not show a mass lesion or evidence of a perforating cancer, the use of CT colonography or colonoscopy would provide a more accurate assessment for a mass lesion in the colon.

RIGHT INGUINAL HERNIA

The risk of an inguinal hernia with intermittent incarceration, which can lead to ischemic bowel, may be increased in athletes. However, this patient's imaging studies do not show evidence of a hernia, and a targeted physical examination and ultrasonography of the groin have not been mentioned.

FOREIGN BODY

I think that perforation of the large bowel by a foreign body is the most likely diagnosis in this case, given the slow tempo of the disease course, imaging findings, and baffling clinical picture.²¹⁻³³ Since the history does not provide any clues about what may have pierced the bowel to cause a perforation, I would ask the patient to describe what he had eaten before the onset of abdominal pain.²³⁻³⁰ I would specifically ask whether he had eaten any fish with bones; chicken wings or other bone-in chicken parts; shellfish such as crabs, lobsters, or mussels; or sandwiches held together with toothpicks, such as a turkey club.^{19,20,24-29} The diagnosis of perforation by a foreign body makes the most sense in this case because it is the only cause of bowel perforation that is associated with both the absence of imaging findings and the absence of an inflamed-appearing bowel at the site where the perforation has occurred.^{19,20}

Two weeks after the initial episode of pain occurred in this young athlete, he had a repeat episode that was accompanied by back pain. In retrospect, this new pain was most likely associated with the development of an abscess, which could explain the findings on the CT scan obtained in the emergency department of this hospital. It is likely that the contained, extraluminal, air-filled collection adjacent to the sigmoid colon is located at the site of perforation and is the cause of polymicrobial sepsis. However, the patient probably also had an arterioenteric fistula³⁴⁻³⁷ between the sigmoid colon and the right common iliac artery that was caused by penetration of the vessel by a foreign body.³⁴ On the CT scan, the right common iliac artery has a distinctly abnormal-appearing vessel wall. These complications of perforation by a foreign body — an abscess and a fistulous connection to the right common iliac artery with resulting hemor-

rhage into the bowel and polymicrobial sepsis — would explain all the symptoms and signs in this young man.³⁴

Patients with perforation by a foreign body are usually unable to remember ingesting the foreign body.²⁴⁻²⁸ Most ingested foreign bodies pass without consequence, but 10 to 20% need to be removed endoscopically and 1% surgically. In this case, I would recommend drainage of the abscess adjacent to the sigmoid colon, evaluation for an arterioenteric fistula involving the right common iliac artery, and surgical correction of the perforated area of the sigmoid colon.

DR. HELEN M. SHIELDS'S DIAGNOSIS

Perforation of the sigmoid colon by a foreign body, with an adjacent abscess and a possible arterioenteric fistula involving the right common iliac artery with resulting intestinal bleeding.

DIAGNOSIS AND MANAGEMENT

Dr. Scheid: On the basis of the initial interpretation of the CT scan, a colonoscopy was performed. The colonoscopy revealed a large amount of fresh blood in the sigmoid colon (Fig. 2A), which was lavaged. A 5-cm wooden toothpick was found lodged in the proximal sigmoid colon, 25 cm from the anal verge, and there was evidence that it had eroded the colon wall on one end (Fig. 2B and 2C).

Dr. Karin L. Andersson: Endoscopic removal of the toothpick led to immediate pulsatile bleeding (Fig. 2D and 2E), which was first addressed with placement of nine hemostatic clips and administration of a total of 10 ml of epinephrine (Fig. 2F and 2G). Despite these measures, ongoing bleeding was noted at the end of the procedure and emergency surgical consultation was obtained.

Toothpick ingestion is associated with a particularly high risk of complications; 79% of cases lead to perforation and 10% to death.³⁸ The severity of the complications in this case is not atypical. Surgical exploration is recommended in cases that have led to perforation or abscess. Endoscopic extraction of sharp foreign bodies should be attempted in patients who are in a stable condition and do not yet have overt

complications from the ingestion. Endoscopic evaluation was performed in this case because neither the toothpick nor the resulting perforation was initially evident on the CT scan.

Dr. David M. Dudzinski (Medicine): Drs. Conrad and Rosenthal, would you tell us what happened next?

Dr. Martin G. Rosenthal: Because of life-threatening bleeding, the patient was urgently taken to a hybrid operating room, which is equipped with a variety of advanced medical devices. The interventional radiology service performed angiography, which revealed extravasation of contrast material from the right common iliac artery into the sigmoid colon (Fig. 3A). A decision was made to perform an exploratory laparotomy with repair of the injury of the right common iliac artery, since there was a relative contraindication to endovascular placement of a synthetic graft in the presumably contaminated field and the colon injury needed to be addressed. An occlusion balloon was placed in the right common iliac artery for temporary control of the bleeding (Fig. 3B).

On exploration of the abdomen, we encountered an arterioenteric connection between the sigmoid colon and the right common iliac artery (Fig. 4). Primary repair of the colon was performed, and the vascular surgery service was consulted for management of the arterial injury.

Dr. Mark F. Conrad: The arterial segment was not viable, and thus a 3-cm segment of artery was excised. The superficial femoral vein was harvested from the ipsilateral leg to serve as an interposition graft. Given that there was an ischemic time of 3.5 hours, that ligation of the ipsilateral superficial femoral vein causes venous hypertension, and that the patient was to remain intubated, with an associated risk of the development of the compartment syndrome, we performed prophylactic four-compartment fasciotomy of the right lower leg. As we performed ligation of the deep venous system, we mapped out the greater saphenous vein to protect it during the fasciotomy, since this vein was to serve as his major venous outflow tract until collateral veins developed.

Dr. Rosenthal: At the end of the procedure, we were unable to close the abdomen, and thus we performed a temporary abdominal closure with

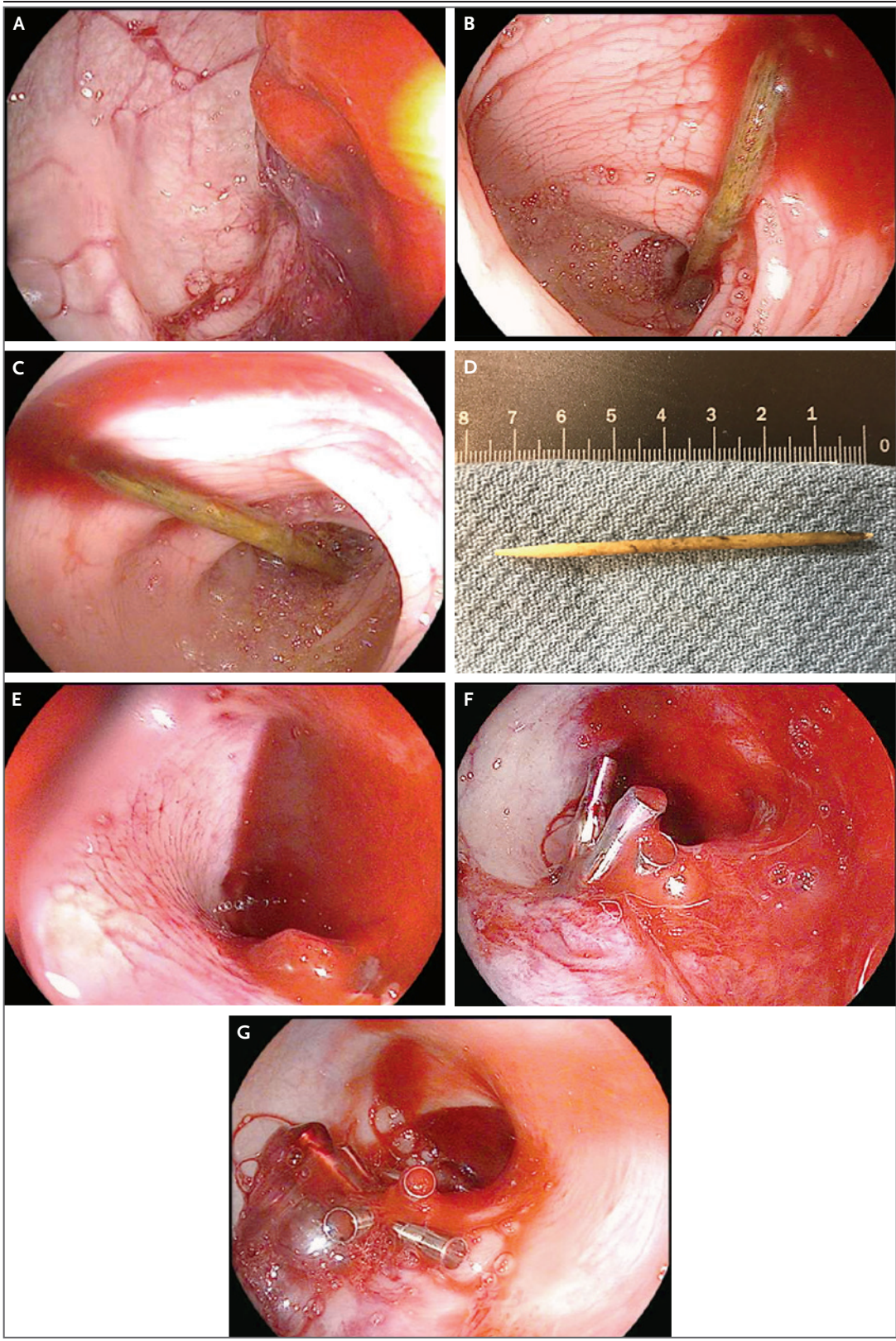


Figure 2 (facing page). Images Obtained during Endoscopy.

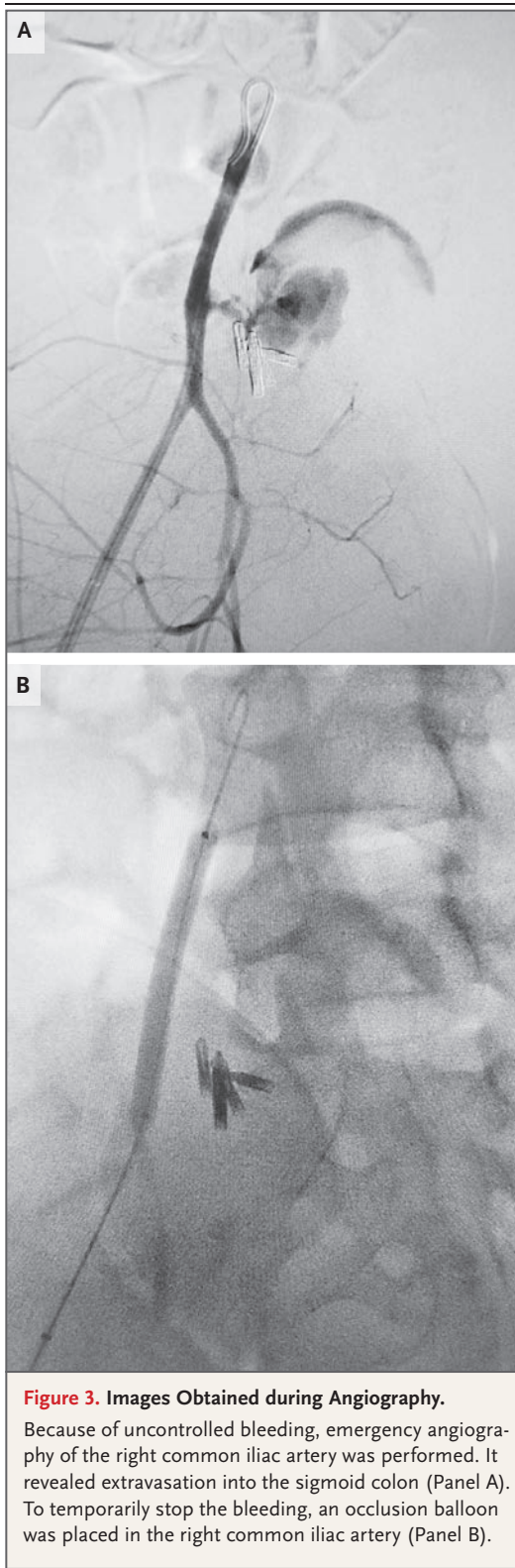
During colonoscopy, blood was found throughout the sigmoid colon (Panel A). A wooden toothpick was visible 25 cm from the anal verge, with evidence that it had eroded the colon wall (Panels B and C). After the toothpick was removed (Panel D), pulsatile bleeding occurred (Panel E). The bleeding was addressed with placement of nine hemostatic clips and administration of a total of 10 ml of epinephrine (Panels F and G). Ongoing bleeding was noted at the end of the procedure, and emergency surgical consultation was obtained.

negative-pressure wound therapy (vacuum-assisted dressing). The patient underwent diuresis during the ensuing 24 hours and was taken back to the operating room the following day for abdominal closure and skin closure over the fasciotomy sites.

FOLLOW-UP

Dr. Scheid: The patient did well after surgery and was discharged on the 10th hospital day, 6 days after the second surgery. At the time of discharge, he was able to walk without assistance. He completed a 14-day course of intravenous ceftriaxone and vancomycin along with oral metronidazole and fluconazole and then received a 4-week course of cefpodoxime and metronidazole. At the direction of the team's internist, additional follow-up was arranged with the physical therapy, vascular surgery, general surgery, and infectious disease services.

Dr. Scott D. Martin: Once the patient's condition had stabilized, we were able to safely tailor the rehabilitation program with the goal of restoring his elite athlete status. The first stage of his recovery involved a low-impact program with walking on level ground. After 6 weeks, he progressed to aqua therapy and exercise on a stationary bike as his vascular and intestinal anastomoses healed. The second stage involved a gradual increase in resistance. The third stage involved a higher-impact program with jogging, weight training, and intermittent sprinting. As the patient's endurance and strength improved, he was advanced to sport-specific activities. The final stages involved light, controlled training with select teammates. After a final evaluation



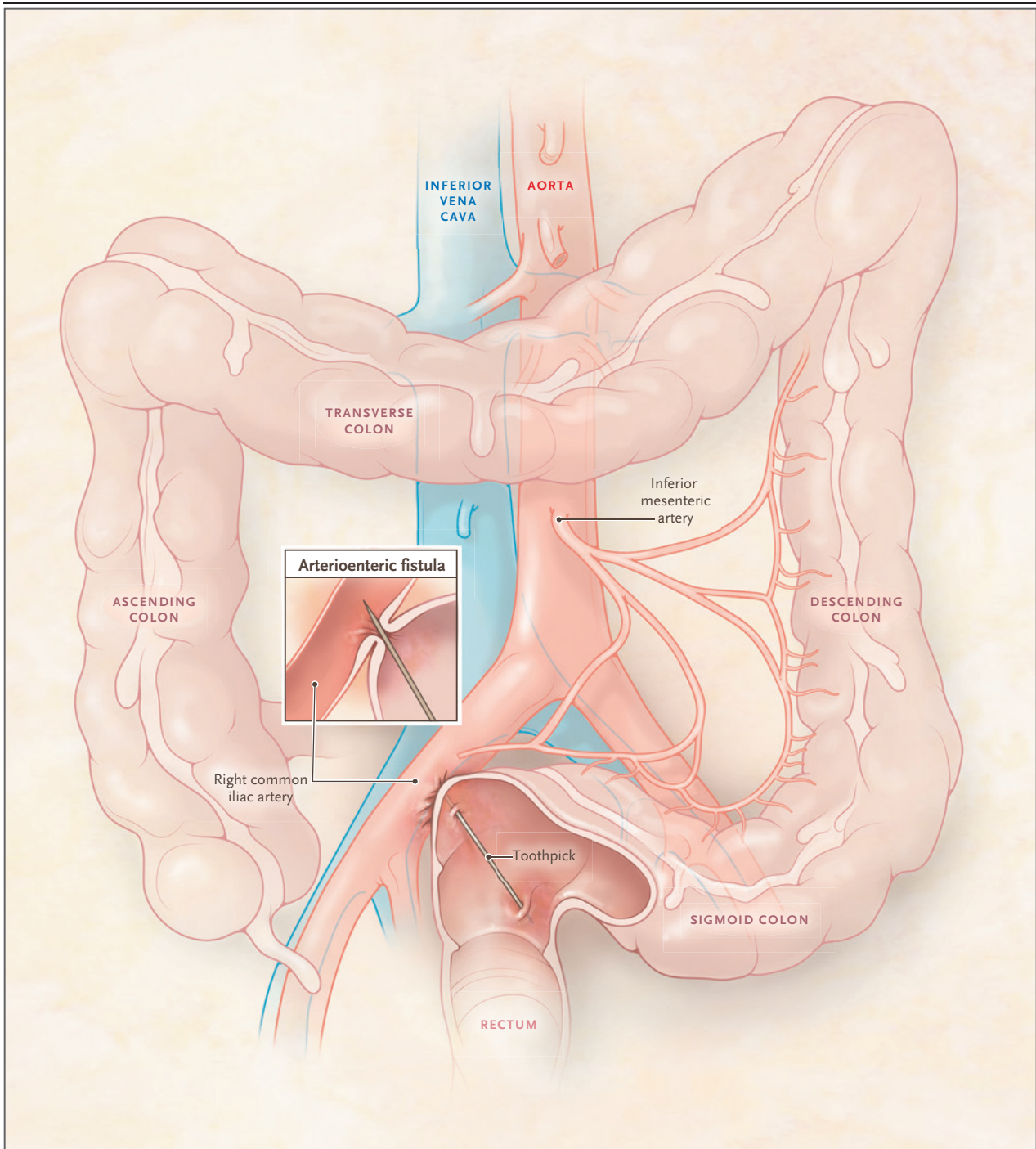


Figure 4. Anatomy of the Toothpick Injury.

The illustration shows the patient's injury, including perforation of the sigmoid colon by a toothpick and an associated arterioenteric fistula (inset).

in which he received clearance from the team's internist and subspecialists, he was allowed to participate in training and competitive play. Seven months after his injury, he played in his first professional game, and he continues to have a substantial role in his sport.

FINAL DIAGNOSIS

Perforation of the sigmoid colon by a foreign body (toothpick) that caused a fistula to the right common iliac artery.

This case was presented at Medicine Grand Rounds.

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

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

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