

## I. ABDOMINAL PAIN

- I. **Problem.** A 34-year-old woman admitted for control of her diabetes develops acute abdominal pain that increases in severity over several hours.

### II. Immediate Questions

- A. **What are the patient's vital signs?** Acute abdominal pain may signify a condition as benign as gastroenteritis or as catastrophic as an infarcted bowel or perforated viscus. The significant morbidity and mortality of the acute surgical abdomen can be obviated by early diagnosis. **Tachycardia** and **hypotension** would suggest circulatory or septic shock from perforation, hemorrhage, or fluid loss into the intestinal lumen or peritoneal cavity. Orthostatic blood pressure and pulse changes would also be helpful in ascertaining the presence of volume loss. **Fever** occurs in inflammatory conditions such as cholecystitis and appendicitis. When the temperature exceeds 102° F, gangrene or perforation of a viscus should be suspected. Fever may not be present in elderly patients, patients on corticosteroids or patients who are immunocompromised
- B. **Where is the pain located?** Abdominal pain is produced by three mechanisms; (1) **tension** within the walls of the alimentary tract (biliary or intestinal obstruction); (2) **ischemia** (strangulated bowel, mesenteric vascular occlusion); and (3) **peritoneal irritation**. The first two causes result in visceral pain, a dull pain perceived in the midline and **poorly localized**. Generally, **pain arising from the GI tract** is perceived in the midline because of the symmetric and bilateral innervation of these organs. **Unilateral pain** is likely caused by organs with unilateral innervation such as the kidney, ureter, or ovary. Generally, **midepigastric pain** is caused by disorders of the stomach, duodenum, pancreas, liver, and biliary tract. Disease of the small intestine, appendix, upper ureters, testes, and ovaries results in **periumbilical pain**. **Lower abdominal pain** is caused by processes in the colon, bladder, lower ureters, and uterus. Inflammation of the parietal peritoneum results in more severe pain that is **well localized** to the area of inflammation. It is also important to realize that the **referred pain** (pain originating from a site more central than where it is perceived) occurs because the cutaneous dermatomes and visceral organs share the same spinal cord level.
- C. **Does the pain radiate?** Pain that becomes rapidly generalized implies perforation and leakage of fluid into the peritoneal cavity. Biliary pain can radiate from the right upper quadrant to the right inferior scapula. Pancreatic and abdominal aneurysmal pain may radiate to the back. Ureteral colic classically is referred to the groin and thigh.
- D. **When did the pain begin?** Sudden onset suggests perforated ulcer, mesenteric occlusion ruptured aneurysm, or ruptured ectopic pregnancy. A more gradual onset (> 1 hour) implies an inflammatory condition such as appendicitis, cholecystitis, diverticulitis, or an obstructed viscus such as bowel obstruction.
- E. **What's the quality of the pain?** Intestinal colic occurs as cramping abdominal pain interspersed with pain-free intervals. Biliary colic is not a true colicky pain in that it usually presents as sustained persistent pain. Unfortunately, the terms **sharp, dull, burning, and tearing**, although used by patients to describe pain, seldom assist in determining the etiology.
- F. **What relieves the pain or makes it worse?** Pain with deep inspiration is associated with diaphragmatic irritation, such as with pleurisy or upper abdominal inflammation. Patients with intestinal or ureteral colic tend to be restless and active, whereas patients with peritonitis attempt to avoid all motion. Coughing frequently exacerbates abdominal pain from peritonitis.
- G. **Are there any associated symptoms?** **Vomiting** may result from intestinal obstruction or may result from a visceral reflex caused by pain in conditions causing an acute surgical abdomen, the vomiting usually follows rather than precedes the onset of pain. **Hematemesis** suggests gastritis or peptic ulcer disease. **Diarrhea** may result from gastroenteritis but may also result from ischemic colitis or inflammatory bowel disease. **Obstipation** (absence of passage of stool or flatus) suggests mechanical bowel obstruction. **Hematuria** points to genitourinary disease such as nephrolithiasis. **Cough** and **sputum production** might occur if lower lobe pneumonia is present.

- H. **For women, what is the patient's menstrual history?** A missed period in a sexually active woman would suggest ectopic pregnancy. A foul vaginal discharge might indicate pelvic inflammatory disease.
- I. **What is the patient's past medical history?** Is there a history of peptic ulcer disease, gallstones, diverticulosis, alcohol abuse, abdominal operations suggesting adhesions, or an abdominal aortic aneurysm? Is there any known history of cardiac arrhythmias (eg. AFIB) or other cardiac disease (e.g. dilated cardiomyopathy) that could result in embolization to a mesenteric artery? A history of hernias would be a risk factor for bowel obstruction.

III. **Differential Diagnosis.** There are several potential causes of acute abdominal pain, some of which are listed in Table 1—1. Many of these diseases can be managed medically; others require urgent surgery. Abdominal pain can result from extra-abdominal processes as well as intra-abdominal disease.

A. **Intra-abdominal disease**

- 1. **Hollow viscera.** Perforation of a hollow viscus represents a surgical emergency.

TABLE I-1. COMMON CAUSES OF ACUTE ABDOMEN: CONDITIONS IN BOLD TYPE OFTEN REQUIRE SURGERY.

<p><b>Gastrointestinal tract disorders</b>            Nonspecific abdominal pain  <b>Appendicitis</b>  <b>Small and Large Bowel Obstruction</b>  <b>Incarcerated hernia</b>  <b>Perforated peptic ulcer</b>  <b>Bowel Perforation</b>  <b>Boerhaave's Syndrome</b>  <b>Meckel's Diverticulum</b>            Diverticulitis            Inflammatory Bowel Disorders            Mallory-Weiss Syndrome            Gastroenteritis            Acute Gastritis            Mesenteric adenitis  <b>Acute ischemic colitis</b></p> <p><b>Liver, spleen, and biliary tract disorders</b>  <b>Acute cholecystitis</b>  <b>Acute cholangitis</b>  <b>Hepatic Abscess</b>  <b>Ruptured hepatic tumor</b>  <b>Spontaneous/Traumatic Rupture of Spleen</b>            Splenic Infarct            Biliary colic            Acute Hepatitis</p> <p><b>Pancreatic Disorders</b>            Acute pancreatitis</p>	<p><b>Urinary Tract Disorders</b>            Ureteral or renal colic            Acute pyelonephritis            Acute cystitis            Renal infarct</p> <p><b>Gynecological disorders</b>  <b>Ruptured ectopic pregnancy</b>  <b>Twisted ovarian tumor</b>  <b>Ruptured ovarian follicular cyst</b>            Acute salpingitis            Dysmenorrhea            Endometriosis</p> <p><b>Vascular Disorders</b>  <b>Ruptured aortic/visceral aneurysms</b>  <b>Mesenteric thrombosis/ischemia</b></p> <p><b>Peritoneal Disorders</b>  <b>Intraabdominal abscesses</b>            Primary peritonitis            Tuberculous peritonitis</p> <p><b>Retroperitoneal disorders</b>            Retroperitoneal disorders</p>
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- a. **Upper abdomen:** Esophagitis, gastritis, peptic ulcer disease, cholecystitis, cholelithiasis, and biliary colic.
- b. **Midgut:** Small bowel obstruction or infarction.
- c. **Lower abdomen:** Inflammatory bowel disease, appendicitis, large bowel obstruction, diverticulitis.
- 2. **Solid organ**
  - a. **Hepatitis**
  - b. **Pancreatitis**
  - c. **Splenic infarction or abscess**
  - d. **Pyelonephritis/Urolithiasis**

3. **Pelvis**
  - a. **Pelvic inflammatory disease**
  - b. **Ruptured ectopic pregnancy**
4. **Vascular system**
  - a. **Ruptured aneurysm**
  - b. **Dissecting aneurysm**
  - c. **Mesenteric thrombosis or embolism**

**B. Extra-abdominal disease.** To prevent unnecessary surgery, these causes of acute abdominal pain should be considered.

1. **Diabetic ketoacidosis**
2. **Acute adrenal insufficiency**
3. **Acute porphyria**
4. **Pneumonia involving tower lobes**
5. **Pulmonary embolism involving lower lobes**
6. **Pneumothorax**
7. **Sickle cell crisis**

**C. Special populations.** In these patients, pain is secondary to unusual causes or unusual presentation of common problems.

1. **Elderly patients.** Pain is often present without signs and symptoms commonly seen in younger patients.
2. **Patients with HIV.** See Section I, Chapter 23, Fever in the HIV Positive Patient, p 135.
3. **Patients with hemophilia. Hematoma of bowel wall.**

**D. Rare causes**

1. **Celiac axis compression syndrome**
2. **Painful rib syndrome**
3. **Wandering spleen syndrome**
4. **Abdominal migraine**
5. **Fitz-Hugh--Curtis syndrome.** Perihepatitis secondary to gonococcal or Chlamydial salpingitis.

#### **IV. Database**

**A. Physical examination key points.** See Table 1—2.

1. **Vital signs and general appearance.** See Section II.A. Does the patient appear uncomfortable? Is the patient jaundiced? and Is there a position that provides some relief of the pain? Patients with peritonitis resist movement, whereas patients with colic writhe in pain.
2. **Lungs.** Percuss for dullness at the bases, suggests a pleural effusion or consolidation. In addition to dullness, the presence of crackles or bronchial breath sounds suggests a pneumonia, infarction, or atelectasis associated with decreased inspiratory effort because of pain.
3. **Heart.** Look for jugular venous distension, **S3** gallop, or a displaced apical impulse indicative of congestive heart failure that might predispose to passive congestion of the liver or mesenteric ischemia. An irregular pulse could indicate atrial fibrillation, which might result in mesenteric artery embolism.
4. **Abdomen**
  - a. **Inspection.** Examine for the presence of distension (obstruction, ileus, ascites), ecchymoses (hemorrhagic pancreatitis), caput medusae (portal hypertension), and surgical scars (adhesions).

TABLE 1—2. PHYSICAL FINDINGS WITH VARIOUS CAUSES OF ACUTE ABDOMEN.<sup>1</sup>

Condition	Signs
Perforated viscus	Scaphoid, tense abdomen; diminished bowel sounds (rate); loss of liver dullness; guarding or rigidity
Peritonitis	Motionless, absent bowel sounds (late); cough and rebound tenderness; guarding or rigidity
Inflamed mass	Tender mass (abdominal, rectal, or pelvic (punch tenderness; special or abscess signs (Murphy's, psoas, or obturator)
Intestinal obstruction	Distension; visible peristalsis (late); hyperperistalsis (early) or quiet abdomen (late); diffuse pain without rebound tenderness; hernia or rectal mass (some)
Paralytic ileus	Distension; minimal bowel sounds; no localized tenderness
Ischemic bowel	Not distended (until late); bowel sounds variable; severe pain but little strangulated bowel tenderness; rectal bleeding (some)
Bleeding	Pallor, shock; distension; pulsatile (aneurysm) or tender (eg, ectopic pregnancy) mass; rectal bleeding (some)

<sup>1</sup> With permission from Bony JH: *Acute abdomen*. In Way LW, ed. *Current Surgical Diagnosis and Treatment*. 10th ed. Appleton & Lange; 1994.

**b. Auscultation.** Listen for bowel sounds (absent or an occasional tinkle with ileus, hyperperistaltic with gastroenteritis, high-pitched rushes with small bowel obstruction).

**c. Percussion.** Tympany is associated with distended loops of bowel. Shifting dullness and a fluid wave suggest ascites with peritonitis.

**d. Other signs.** Pain with active hip flexion or with extension of the patient's right thigh while lying on the left side (*psoas sign*) could result from an inflamed appendix. *Obturator sign* (pain on internal rotation of the flexed thigh) can occur with appendicitis.

5. **Rectum.** Evaluation of acute abdominal pain is not complete until a rectal exam has been performed. A mass suggests the presence of rectal carcinoma. Lateral rectal tenderness occurs with appendicitis, a condition in which examination of the abdomen may not reveal localized findings. If stool is present, evaluate for occult blood.

6. **Female genitalia.** Examine for pain with cervical motion and cervical discharge that may suggest pelvic inflammatory disease. Also palpate for adnexal masses that would indicate an ectopic pregnancy, ovarian abscess, cyst, or neoplasm.

**B. Laboratory data.** The decision to operate is seldom made solely on the basis of laboratory data. This information serves mainly as an adjunct in (1) cases in which the etiology of the pain is unclear, or (2) to assist preoperative assessment in individuals for whom the diagnosis is certain and the decision to operate has already been made.

1. **Hematology.** An increased hematocrit suggests hemoconcentration from volume loss (pancreatitis). A low hematocrit may suggest a process that has resulted in chronic blood loss, or possibly acute intraabdominal hemorrhage or an acute gastrointestinal (GI) hemorrhage. With acute blood loss, however, the hematocrit may not decrease for several hours. An elevated white blood cell count (WBC) suggests an inflammatory process such as appendicitis or cholecystitis.

2. **Electrolytes, blood urea nitrogen (BUN), creatinine.** Bowel obstruction with vomiting can result in hypokalemia, azotemia, and volume contraction alkalosis. A strangulated bowel or sepsis may result in a metabolic gap acidosis. An elevated BUN/creatinine ratio is seen with volume depletion and O1 bleeding.

3. **Liver function tests** including bilirubin, transaminases, and alkaline phosphatase. Results are elevated in acute hepatitis, cholecystitis, and other biliary tract disease.

4. **Amylase & lipase.** Markedly elevated levels are associated with pancreatitis. However, in up to 30%

of patients with acute pancreatitis, amylase may be initially normal, especially in patients with lipemic serum. Conversely, amylase can also be elevated in conditions other than pancreatitis, such as acute cholecystitis, perforated ulcer, small bowel obstruction with strangulation, and ruptured ectopic pregnancy. Serum lipase will help differentiate pancreatitis from the other causes of hyperamylasemia.

5. **Arterial blood gases (ABG).** Hypoxemia is often an early sign of sepsis and may occur with pancreatitis. As mentioned, metabolic acidosis may result from ischemic bowel or sepsis.
8. **Pregnancy test.** All premenopausal women with acute right or left lower abdominal pain should be tested for human chorionic gonadotropin (HCG) levels to rule out ectopic pregnancy, regardless of whether or not they missed their last period.
7. **Urinalysis.** Hematuria may indicate nephrolithiasis; pyuria and hematuria can be present in urinary tract infections. In addition, pyuria is occasionally present with appendicitis.
8. **Cervical culture.** Obtain a cervical culture for chlamydia and gonorrhea when pelvic inflammatory disease (PID) is suspected.

### C. Radiology and other studies

1. **Flat & upright abdominal films.** These films can be readily obtained and may provide important information. Watch for the following indicators: gas pattern; evidence of bowel dilation; air-fluid levels; presence or absence of air in the rectum; pancreatic calcifications; biliary and renal calcifications; aortic calcifications; loss of psoas margin (suggesting retroperitoneal bleeding); and presence or absence of air in the biliary tract.
2. **Chest film.** A CXR may reveal lower lobe pneumonia, pleural effusion, or elevation of a hemidiaphragm indicating a subdiaphragmatic inflammatory process. Free air under the diaphragm suggests a perforated viscus and is most often seen on the upright chest film. As many as 15–20% of cases of perforation do not manifest this sign.
3. **Ultrasound (US).** This readily obtainable and noninvasive test is the preferred modality for right upper quadrant pain or gynecologic disease. US may reveal the presence or absence of gallstones, biliary tract dilation, or ectopic pregnancy.
4. **CT.** The most sensitive test when considering many possible diagnoses. CT has a sensitivity of 96% and a specificity of 83–89% for appendicitis.
5. **Electrocardiogram (ECG).** An ECG is needed to rule out an acute myocardial infarction (MI) or pericarditis, which may present with acute upper abdominal pain.
6. **Paracentesis.** See Section III, Chapter 11, Paracentesis, p 418. With known ascites and acute abdominal pain, this test is required to rule out the possibility of spontaneous bacterial peritonitis. If ascites is suspected but has not been documented, an ultrasound should be performed before an attempted paracentesis.
7. **Other studies** may be obtained in a more leisurely fashion to determine the nature of the pain, provided the patient does not appear to have a case of acute abdominal pain requiring surgery. These tests can include the following:
  - a. **Intravenous pyelogram (IVP)**
  - b. **Abdominal CT scan**
  - c. **Hepato-iminodiacetic acid (HIDA) scan**, to rule out acute cholecystitis
  - d. **Contrast bowel studies**, such as an upper GI and small bowel series, to look for evidence of occult perforation or mechanical obstruction. A barium enema may be helpful in evaluation for sigmoid or cecal volvulus.
  - e. **Endoscopic studies**, such as esophagogastroduodenoscopy (EGD), colonoscopy, or endoscopic retrograde cholangiopancreatography (ERCP).
  - f. **Arteriography.** This may be necessary in patients in whom mesenteric artery ischemia is suspected.

**V. Plan.** As mentioned previously, the initial goal in evaluating acute abdominal pain is to determine whether or not surgical treatment is indicated to prevent further morbidity. When pain has been present 6 or more hours and has not improved, there is an increased likelihood that the patient will require surgical exploration to determine the cause. Often the specific etiology of the patient's abdominal pain is not determined until laparotomy. The use of analgesics remains controversial, but many surgeons now favor the use of moderate doses of pain medication to make the patient more comfortable and facilitate further examination (See Section 1, Chapter 54, Pain Management, V, p 289).