Chapter 27
Abdominal Pain
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PERSPECTIVE

Abdominal pain is a common emergency department (ED) complaint but for many reasons is often diagnostically challenging. The nature and quality of abdominal pain may be difficult for the patient to convey. Physical examination findings are variable and can be misleading. The location and severity of the pain may change over time. Initially benign symptoms and presentations may evolve into life-threatening conditions. Conversely, patients with severe symptoms may carry a relatively benign diagnosis. All of these factors make evaluation of patients with acute abdominal pain challenging in the ED setting.

Epidemiology

Abdominal pain accounts for up to 10% of all ED visits. Some of the most common causes of acute abdominal pain are listed in Table 27-1. Many patients have pain and other symptoms that are not typical of any specific disease process. Even after ED workup, a diagnosis may not be found in some patients. In addition, several adult groups deserve special consideration: elders (those older than 65 years of age), the immunocompromised, and women of reproductive age.

Elders with acute abdominal pain are more likely to have a life-threatening process as the cause of their pain. Conditions such as diverticulitis, ruptured abdominal aneurysm, or mesenteric ischemia may manifest atypically and be rapidly progressive. Decreased diagnostic accuracy, coupled with increased probability of severe disease, results in increased mortality in elderly patients with abdominal pain.

Increasingly, emergency physicians are seeing patients in immunocompromised states secondary to human immunodeficiency virus and acquired immunodeficiency syndrome (HIV/AIDS), uncontrolled diabetes, chronic liver disease, chemotherapy, and immunosuppressive drugs. For many reasons, these patients also prove challenging. Their clinical presentation can be misleading owing to atypical physical and laboratory findings, such as lack of fever. The white blood cell (WBC) count, which is unreliable in all cases of abdominal pain, may be frankly misleading in such patients, such as in those with persistent elevations. With regard to infection, the scope of the differential diagnosis also should be broader than usual. Presentations in the immunocompromised patient may be highly variable and subtle and are discussed in Chapter 183.

The evaluation of abdominal pain in women involves a differential diagnosis of considerable extent and often requires a more in-depth physical examination and further diagnostic testing. Pelvic organs may be the source of significant pathology in both the pregnant and the nonpregnant patient. The possibility of ectopic pregnancy in women of reproductive age greatly increases the risk of serious disease with a high potential for misdiagnosis. During pregnancy the uterus becomes an abdominal rather than a pelvic organ and may displace the normal intraperitoneal contents, adding complexity to the evaluation of these patients. Non-pregnant patients require evaluation for various ovarian and uterine pathologic states.

Pathophysiology

Pathology in the gastrointestinal and genitourinary tracts remains the most common source of pain perceived in the abdomen. Also, pain can arise from a multitude of other intra-abdominal and extra-abdominal locations (Box 27-1). Abdominal pain is derived from one or more of three distinct pain pathways: visceral, somatic, and referred.

Visceral pain results from stimulation of autonomic nerves invested in the visceral peritoneum surrounding internal organs. It is often the earliest manifestation of a particular disease process. Distention of hollow organs by fluid or gas and capsular stretching of solid organs from edema, blood, cysts, or abscesses are the most common stimuli. This discomfort is poorly characterized and difficult to localize. If the involved organ is affected by peristalsis, the pain often is described as intermittent, crampy, or colicky. In general, visceral pain is perceived from the abdominal region that correlates with the embryonic somatic segment, as follows:

- Foregut structures (stomach, duodenum, liver, and pancreas) are associated with upper abdominal pain.
- Midgut derivatives (small bowel, proximal colon, and appendix) are associated with periumbilical pain.
- Hindgut structures (distal colon and genitourinary tract) are associated with lower abdominal pain.

Visceral pain can be perceived in a location remote from the actual disease process. Localization occurs with the extension of the disease process beyond the viscera. A classic example is that of the early periumbilical pain of appendicitis (midgut). When the parietal peritoneum becomes involved, the pain localizes to the right lower quadrant of the abdomen, the usual location of the appendix.

Somatic pain occurs with irritation of the parietal peritoneum. This is usually caused by infection, chemical irritation, or another inflammatory process. Sensations are conducted by the peripheral nerves and are better localized than the visceral pain component. Figure 27-1 illustrates some more typical pain locations corresponding to specific disease entities. Somatic pain is often described as intense and constant. As disease processes evolve to peritoneal irritation with inflammation, better localization of the pain to the area of pathology generally occurs.
### Table 27-1: Common Causes of Abdominal Pain

<table>
<thead>
<tr>
<th>CAUSATIVE DISORDER OR CONDITION</th>
<th>EPIDEMIOLOGY</th>
<th>ETIOLOGY</th>
<th>PRESENTATION</th>
<th>PHYSICAL EXAMINATION</th>
<th>USEFUL TEST(S)</th>
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<tr>
<td>Gastric, esophageal, or duodenal inflammation</td>
<td>Occurs in all age groups.</td>
<td>Caused by gastric hypersecretion, breakdown of mucoprotective barriers, infection, or exogenous sources.</td>
<td>Epigastric radiating or localized, associated with certain foods. Pain may be burning. In some cases, exacerbation in supine position.</td>
<td>Epigastric tenderness without rebound or guarding. Perforation or bleeding leads to more severe clinical findings.</td>
<td>Uncomplicated cases are treated with antacids or histamine H₂ blockers before invasive studies are contemplated. Gastroendoscopy is valuable in diagnosis and biopsy. Testing for Helicobacter pylori with blood or biopsy specimens. If perforation is suspected, an upright chest radiograph is obtained early to rule out free air. CT may be beneficial.</td>
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<td>Acute appendicitis</td>
<td>Peak age in adolescence and young adulthood; less common in children and elders. Higher perforation rate in women, children, and elders and in pregnancy. Mortality rate is 0.1% but increases to 2-6% with perforation.</td>
<td>Appendiceal lumen obstruction leads to swelling, ischemia, infection, and perforation.</td>
<td>Epigastric or periumbilical pain migrates to RLQ over 8-12 hr (50-60%). Later presentations associated with higher perforation rates. Pain, low-grade fever (15%), and anorexia (80%) common; vomiting less common (50-70%).</td>
<td>Mean temperature 38° C (100.5° F). Higher temperature associated with perforation. RLQ tenderness (90-95%) with rebound (40-70%) in majority of cases. Rectal tenderness in 30%.</td>
<td>Leukocyte count usually elevated or may show left shift. Urinalysis may show sterile pyuria. CT is sensitive and specific. US may have use in women, pregnancy, and children with RLQ pain.</td>
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<td>Biliary tract disease</td>
<td>Peak age 35-60 yr; rare in patients younger than 20. Female-to-male ratio of 3:1. Risk factors include multiparity, obesity, alcohol intake, and use of birth control pills.</td>
<td>Passage of gallstones causes biliary colic. Impaction of a stone in cystic duct or common duct causes cholecystitis or cholangitis.</td>
<td>Crampy RUQ pain radiates to right subscapular area. Prior history of pain is common. May have nausea or postprandial pain. Longer duration of pain favors diagnosis of cholecystitis or cholangitis.</td>
<td>Temperature normal in biliary colic, elevated in cholecystitis and cholangitis. RUQ tenderness, rebound, and jaundice (less common) may be present.</td>
<td>WBC count elevated in cholecystitis and cholangitis. Lipase and liver function tests may help differentiate this from gastritis or ulcer disease. US shows wall thickening, pericholecystic fluid, stones, or duct dilatation. Hepatobiliary scintigraphy diagnoses gallbladder function.</td>
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<td>Diverticulitis</td>
<td>Incidence increases with advancing age, affects males more often than females. Recurrences are common. Often called “left-sided” appendicitis.</td>
<td>Colonic diverticula may become infected or perforated or cause local colitis. Obstruction, peritonitis, abscesses, fistulae result from infection or swelling.</td>
<td>Change in stool frequency or consistency commonly reported. LLQ pain is common. Associated with fever, nausea and vomiting; rectal bleeding may be seen.</td>
<td>Fever usually of low grade. LLQ pain without rebound is common. Stool may be heme positive.</td>
<td>Results on most tests usually normal. Plain radiographs may show obstruction or mass effect. CT is often diagnostic.</td>
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<td>Acute gastroenteritis</td>
<td>Common diagnosis. Seasonal. Most common misdiagnosis of appendicitis. May be seen in multiple family members. History of travel or immunocompromise.</td>
<td>Usually viral. Consider invasive bacterial or parasitic cause in prolonged cases, in travelers, or immunocompromised patients.</td>
<td>Pain usually poorly localized, intermittent, crampy, and diffuse. Diarrhea is key element in diagnosis; usually large volume, watery. Nausea and vomiting usually begin before pain.</td>
<td>Abdominal examination usually nonspecific without peritoneal signs. Watery diarrhea or no stool noted on rectal examination. Fever is usually present.</td>
<td>Usually symptomatic care with antiemetics and volume repletion. Hematochezia stools may be a clue to invasive pathogens. Key is not using this as a “default” diagnosis and missing more serious disease.</td>
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Table 27-1  Common Causes of Abdominal Pain—cont’d

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<tr>
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<tr>
<td>Constipation and obstipation</td>
<td>More common in females, elders, the very young, and patients on narcotics.</td>
<td>Idiopathic or hypokinesis secondary to disease states (low motility) or exogenous sources (diet, medications).</td>
<td>Abdominal pain; change in bowel habits.</td>
<td>Variable, nonspecific without peritoneal signs. Rectal examination may reveal hard stool or impaction.</td>
<td>Radiographs may show large amounts of stool. This is a diagnosis of exclusion.</td>
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<td>Nonspecific abdominal pain</td>
<td>More common in persons of young and middle age, women of childbearing age, or persons of low socioeconomic status and patients with psychiatric disorders. Up to 10% of patients older than 50 years of age will have intra-abdominal cancer.</td>
<td>Unknown. Early or undiagnosed presentation of pathologic conditions.</td>
<td>Variable but tends to be chronic or recurrent.</td>
<td>Variable but no peritoneal signs. Rectal examination should be done to evaluate for subtle signs of pathology, including heme-positive stool, fistulae, and fissures.</td>
<td>Variable and often can be done on an outpatient basis.</td>
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CT, computed tomography; CVA, costovertebral angle; LLQ, left lower quadrant; RLQ, right lower quadrant; RUQ, right upper quadrant; US, ultrasonography; WBC, white blood cell.

Box 27-1  Important Extra-abdominopelvic Causes of Abdominal Pain

**Thoracic**
- Myocardial infarction or unstable angina
- Pneumonia
- Pulmonary embolism
- Herniated thoracic disk (neuralgia)
- Pericarditis or myocarditis

**Genitourinary**
- Testicular torsion

**Abdominal Wall**
- Muscle spasm
- Muscle hematoma
- Herpes zoster

**Infectious**
- Streptococcal pharyngitis (more often in children)
- Rocky Mountain spotted fever
- Mononucleosis

**Systemic**
- Diabetic ketoacidosis
- Alcoholic ketoacidosis
- Uremia
- Sickle cell disease
- Porphyria
- Systemic lupus erythematosus
- Vasculitis
- Glaucoma
- Hyperthyroidism

**Toxic**
- Methanol poisoning
- Heavy metal toxicity
- Scorpion bite
- Snake bite
- Black widow spider bite

Referred pain is defined as pain felt at a distance from its source because peripheral afferent nerve fibers from many internal organs enter the spinal cord through nerve roots that also carry nociceptive fibers from other locations, as illustrated in Figure 27-2. This makes interpretation of the location of noxious stimuli difficult for the brain. Both visceral pain and somatic pain can manifest as referred pain. Two examples of referred pain are the epigastric pain associated with an inferior myocardial infarction and the shoulder pain associated with blood in the peritoneal cavity irritating the diaphragm. It is common for a patient to interpret pain originating from the hips as pelvic pain, especially in the very young or elderly. Lower lobe pneumonias can cause referred abdominal pain secondary to diaphragmatic irritation. Finally, some metabolic disorders and toxidromes may manifest with abdominal pain.

Gynecologic and obstetric presentations are discussed in other chapters. Notably, abdominal pain in a female may represent referred pain from pelvic structures or an extension of a pelvic process, as in the case of perihepatic inflammation with pelvic inflammatory disease.

**DIAGNOSTIC APPROACH**

The clinical approach should focus on early stabilization, history, physical examination, and any ancillary tests collectively facilitating appropriate management and disposition plans.

**Differential Considerations**

Classically, potential diagnoses are divided into intra-abdominopelvic (intraperitoneal, retroperitoneal, and pelvic) causes (e.g., appendicitis, cholecystitis, pancreatitis) and extra-abdominopelvic processes (e.g., pneumonia, myocardial infarction, ketoacidosis, toxicologic).

Although significant morbidity and mortality can result from many disorders causing abdominal pain, a few processes warrant careful consideration in the ED. Table 27-2 lists important potentially life-threatening nontraumatic causes of abdominal pain. This group represents the major causative disorders likely to be...
associated with hemodynamic compromise and for which early therapeutic intervention is critical.

**Rapid Assessment and Stabilization**

As with any complaint, triage is the first critical step in management. Most patients with abdominal pain do not have hemodynamic instability, although a small proportion of these stable-appearing patients may have a life-threatening process. This percentage is higher in elders and immunocompromised patients. Physiologically compromised patients should be brought to a treatment area immediately, and resuscitation initiated. Sepsis or protracted severe volume loss (emesis, diarrhea) can lead to shock; prompt resuscitation is required.

Extreme conditions, such as ruptured abdominal aortic aneurysm, massive gastrointestinal hemorrhage, ruptured ectopic pregnancy, ruptured spleen, and hemorrhagic pancreatitis, may necessitate blood or blood product replacement. Bedside ultrasonography can be used to quickly evaluate patients for free intraperitoneal fluid, volume status, and presence of aortic pathology. Ultrasound assessment should be part of the initial physical examination and can be invaluable in guiding treatment and disposition. Because any of the immediately life-threatening entities may necessitate surgical intervention or management, early surgical consultation is indicated.

**Pivotal Findings**

**Symptoms**

A careful and focused history is central to unlocking the puzzle of abdominal pain. Box 27-2 lists some historical questions with high yields for serious pathology. Language and cultural differences may influence accurate communication and mutual understanding; therefore use of an accurate interpreter can be invaluable.

Abrupt onset often is indicative of a more serious cause; however, delayed presentations also may represent a surgical condition. Surgical causes of abdominal pain are more likely to manifest with pain first, followed by nausea and vomiting, rather than with nausea and vomiting followed by pain, although in elder patients the progression may be reversed or pain may be absent entirely. Localization and pain migration also are helpful components of the pain history. Diffuse pain generally is nonsurgical, but it may represent the early visceral component of a surgical condition.
process. Colicky pain is indicative of hollow viscus distention, and duration and time of colic may give clues to the identity of the culprit organ, as displayed in Figure 27-3.

The severity and descriptive nature of the pain are the most subjective aspects of the pain history, but a few classic descriptions are recognized, such as the following:

- The diffuse, severe, colicky pain of bowel obstruction
- The “pain out of proportion to examination” observed in patients with mesenteric ischemia
- The radiation of pain from the epigastrium straight through to the midback associated with pancreatitis, either related to primary organ inflammation or secondary to a penetrating ulcer
- The radiation of pain to the left shoulder or independent pain in the left shoulder associated with splenic pathology, diaphragmatic irritation, or free intraperitoneal fluid
- The onset of pain associated with syncope seen in perforation of gastric or duodenal ulcer, ruptured aortic aneurysm, or ruptured ectopic pregnancy

A thorough review of the patient’s past medical history and medications is also mandatory, as this frequently provides key information about the current presentation. A history of immunosuppressed state or immunosuppressive medications may point to infection. A patient undergoing anticoagulation therapy or taking nonsteroidal anti-inflammatory medications may have

| Table 27-2 Potentially Life-threatening Causes of Abdominal Pain |
|---------------------------------|----------------|-----------------|-----------------|-----------------|
| **CAUSE**                        | **EPIDEMIOLOGY**                           | **ETOLOGY**                                     | **PRESENTATION**                              | **PHYSICAL EXAMINATION**                               | **USEFUL TOOL(S)**                                      |
| Ruptured ectopic pregnancy       | Occurs in females of childbearing age. No method of contraception prevents ectopic pregnancy. Approximately 1 in every 100 pregnancies. | Risk factors include nonwhite race, older age, history of STD or PID, infertility treatment, intrauterine contraceptive device placed within the past year, tubal sterilization, and previous ectopic pregnancy. | Severe, sharp constant pain localized to the affected side. More diffuse abdominal pain with intraperitoneal hemorrhage. Signs of shock may be present. Midline pain tends not to be ectopic pregnancy. | Shock or evidence of peritonitis may be present. Lateralized abdominal tenderness. Localized adnexal tenderness or cervical motion tenderness increases the likelihood of ectopic pregnancy. Vaginal bleeding does not have to be present. | β-hCG testing necessary in all females of childbearing age (10-35 yr); combined with ultrasonography, preferably transvaginal in early pregnancy, usually is diagnostic. FAST examination is useful in evaluating for free fluid in patients with shock or peritonitis. |
| Ruptured or leaking abdominal aneurysm | Incidence increases with advancing age. More frequent in men. Risk factors include HTN, DM, smoking, COPD, and CAD. | Exact cause is undetermined. Contributing factors include atherosclerosis, genetic predisposition, HTN, connective tissue disease, trauma, and infection. | Patient often asymptomatic until rupture. Acute epigastric and back pain often associated with or followed by syncope or signs of shock. Pain may radiate to back, groin, or testes. | Vital signs may be normal (70%) to severely hypotensive. Palpation of a pulsatile mass is usually possible in aneurysms 5 cm or greater. The physical examination may be nonspecific. Bruits or inequality of femoral pulses may be evident. | Abdominal plain films abnormal in 80% of cases. Ultrasonography can define diameter and length but can be limited by obesity and bowel gas. FAST examination can be helpful in evaluating for free fluid. Spiral CT test of choice in stable patients. |
| Mesenteric ischemia               | Occurs most commonly in elders with CV disease, CHF, cardiac dysrhythmias, DM, sepsis, and dehydration. Responsible for 1 of 1000 hospital admissions. Mortality 70%. Mesenteric venous thrombosis associated with hypercoagulable states, hematologic inflammation, and trauma. | 20-30% of lesions are nonocclusive. The causes of ischemia are multifactorial, including transient hypotension in the presence of preexisting atherosclerotic lesion. The arterial occlusive causes (65%) are secondary to emboli (75%) or acute arterial thrombosis (25%). | Severe pain, colicky, that starts in periumbilical region and then becomes diffuse. Often associated with vomiting and diarrhea. Sometimes postprandial. “Mesenteric or abdominal angina.” | Early examination results can be remarkably benign in the presence of severe ischemia. Bowel sounds often still present. Rectal examination important because mild bleeding with positive guaiac stools can be present. | Often a pronounced leukocytosis is present. Elevations of amylase and creatine kinase levels are seen. Metabolic acidosis caused by lactic acidemia is often seen with infarction. Plain radiographs of limited benefit. CT, MRI, and angiography are accurate to varying degrees. |
Table 27-2  Potentially Life-threatening Causes of Abdominal Pain—cont’d

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<tr>
<td>Intestinal obstruction</td>
<td>Peaks in infancy and elders. More common with history of previous abdominal surgery.</td>
<td>Adhesions, carcinoma, hernias, abscesses, volvulus, and infarction. Obstruction leads to vomiting, “third spacing” of fluid, or strangulation and necrosis of bowel.</td>
<td>Crampy diffuse abdominal pain associated with vomiting.</td>
<td>Vital signs usually normal unless dehydration or bowel strangulation has occurred. Abdominal distention, hyperactive bowel sounds, and diffuse tenderness. Local peritoneal signs indicate strangulation.</td>
<td>Elevated WBC count suggests strangulation. Electrolytes may be abnormal if associated with vomiting or prolonged symptoms. Abdominal radiographs and CT are useful in diagnosis.</td>
</tr>
<tr>
<td>Perforated viscus</td>
<td>Incidence increases with advancing age. History of peptic ulcer disease or diverticular disease common.</td>
<td>More often a duodenal ulcer that erodes through the serosa. Colonic diverticula, large bowel, and gallbladder perforations are rare. Spillage of bowel contents causes peritonitis.</td>
<td>Acute onset of epigastric pain is common. Vomiting in 50%. Fever may develop later. Pain may localize with omental walling off of peritonitis. Shock may be present with bleeding or sepsis.</td>
<td>Fever, usually of low grade, is common; worsens over time. Tachycardia is common. Abdominal examination reveals diffuse guarding and rebound. “Boardlike” abdomen in later stages. Bowel sounds are decreased.</td>
<td>WBC count usually elevated owing to peritonitis. Amylase may be elevated; LFT results are variable. Upright radiographic view reveals free air in 70-80% of cases with perforated ulcers.</td>
</tr>
<tr>
<td>Acute pancreatitis</td>
<td>Peak age in adulthood; rare in children and elders. Male preponderance. Alcohol abuse and biliary tract disease are risk factors.</td>
<td>Alcohol, gallstones, hyperlipidemia, hypercalcemia, or endoscopic retrograde pancreatography causing pancreatic damage, saponification, and necrosis. ARDS, sepsis, hemorrhage, and renal failure are secondary.</td>
<td>Acute onset of epigastric pain radiating to the back. Nausea and vomiting are common. Pain disproportionate to physical findings. Adequate volume repletion is important in the initial therapy.</td>
<td>Low-grade fever common. Patient may be hypotensive or tachypneic. Some epigastric tenderness usually present. Because pancreas is retroperitoneal organ, guarding or rebound not present unless condition is severe. Flank ecchymosis or periumbilical ecchymosis may be seen if process is hemorrhagic.</td>
<td>Lipase determination is test of choice. Ultrasound examination may show edema, pseudocyst, or biliary tract disease. CT scan may show abscesses, necrosis, hemorrhage, or pseudocyst. CT is ordered if severe acute pancreatitis is suspected. Rule out gallstones with ultrasound examination.</td>
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ARDS, acute respiratory distress syndrome; β-hCG, β-human chorionic gonadotropin; CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CT, computed tomography; CV, cardiovascular; DM, diabetes mellitus; FAST, focused assessment with sonography in trauma; HTN, hypertension; LFT, liver function test; MRI, magnetic resonance imaging; PID, pelvic inflammatory disease; STD, sexually transmitted disease; WBC, white blood cell.

Box 27-2  High-Yield Historical Questions

1. How old are you? Advanced age means increased risk.
2. Which came first—pain or vomiting? Pain first is worse (i.e., more likely to be caused by surgical disease).
3. How long have you had the pain? Pain for less than 48 hours is worse.
5. Is the pain constant or intermittent? Constant pain is worse.
6. Have you ever had this before? A report of no prior episodes is worse.
7. Do you have a history of cancer, diverticulosis, pancreatitis, kidney failure, gallstones, or inflammatory bowel disease? All are suggestive of more serious disease.
8. Do you have human immunodeficiency virus (HIV)? Consider occult infection or drug-related pancreatitis.
9. How much alcohol do you drink per day? Consider pancreatitis, hepatitis, or cirrhosis in patients with history or signs of significant intake.
10. Are you pregnant? Test for pregnancy—consider ectopic pregnancy.
11. Are you taking antibiotics or steroids? Effects of these drugs may mask infection.
12. Did the pain start centrally and migrate to the right lower quadrant? High specificity for appendicitis.
13. Do you have a history of vascular or heart disease, hypertension, or atrial fibrillation? Consider mesenteric ischemia and abdominal aneurysm.

gastrointestinal bleeding. Diabetics may be experiencing abdominal pain as a feature of ketoacidosis. A patient undergoing chronic narcotic therapy may have constipation or even a bowel obstruction.

Signs

The objective tachycardia and hypotension are indicators that hypovolemia or sepsis may be present. Tachypnea may be an indicator of metabolic acidosis from gangrenous viscera or sepsis, hypoxemia from pneumonia, or simply a catecholamine-induced reaction to pain. Elevated temperature often is associated with intra-abdominal infections. Although important, vital signs may be misleading and should be interpreted in the context of the entire presentation. Tachycardia may develop late for various reasons in hypovolemia. Temperature often is normal in elderly patients with laparotomy-proven intraperitoneal infections. Elders with sepsis also may demonstrate hypothermia.

A thorough abdominal examination is an essential part of evaluation of the patient with abdominal pain. This requires properly positioning the patient supine and exposing the abdomen. The examination should begin with inspection for any signs of trauma, bruising, or skin lesions. The patient should be asked to localize the area of maximal tenderness by pointing with one finger. The abdomen can be divided into four quadrants: right upper, right lower, left upper, and left lower; each area is then examined individually. Tenderness in one quadrant often corresponds with the location of the diseased organ, which will direct the workup (see Fig. 27-1). Some disease processes may manifest with pain that is not exclusively within one specific quadrant, such as the suprapubic pain of a urinary tract infection or the midepigastic pain of a gastric ulcer. Although most patients with suspected appendicitis have right lower quadrant abdominal tenderness, a small percentage of patients with proven appendicitis do not.

Rectal examination may have limited use in the evaluation of abdominal pain, except that associated with intraluminal gastrointestinal hemorrhage, prostatitis, or perirectal disease. The main utility of the rectal examination is in the detection of hemepositive stool, anal fissures or fistulae, or stool impaction. Rectal examination has not been shown to increase diagnostic accuracy for appendicitis when added to external physical examination of the abdomen.

The abdominal evaluation should include a pelvic examination in female patients with lower abdominal pain and genital examination in male patients. The pelvic examination should be done early in the evaluation of the female patient with abdominal pain to help differentiate an abdominal from a pelvic source. This information is helpful in choosing an imaging modality. Pelvic ultrasound examination is helpful in evaluating uterine and ovarian pathology, whereas computed tomography (CT) is more beneficial in evaluation of suspected intra-abdominal pathology. Although the pelvic examination may guide the initial choice of imaging modality, overlap in examination findings is common. For example, a patient with right lower quadrant tenderness may have both right adnexal tenderness and tenderness over McBurney’s point, necessitating exclusion of both appendicitis and ovarian torsion. The diagnosis highest on the differential list should be ruled out first through use of the corresponding imaging modality.

In the male patient with abdominal pain, the urogenital examination is a routine and required part of the evaluation. Diseases such as prostatitis, orchitis, and epididymitis commonly cause abdominal pain in males. Furthermore, inguinal hernias are more common in males, with the possibility of strangulation or incarceration in the inguinal canal, necessitating a thorough genitourinary examination.

In view of the evolving nature of abdominal pain, repetitive examinations may be useful. This is common practice with respect to suspected appendicitis and has improved the diagnostic accuracy in patients whose presentations were atypical.

Ancillary Testing

Urinalysis and testing for pregnancy are perhaps the most time-and cost-effective adjunctive laboratory tests available. Results often can be obtained quickly, so the former can lead to an early diagnosis and the latter may significantly affect further evaluation and management approaches. It is necessary to interpret urinalysis results within the context of the patient’s clinical picture. Pyuria, with or without bacteriuria, often is present in a variety of conditions besides a simple urinary tract infection. For example, appendicitis may feature sterile pyuria. Similarly, hematuria usually is present with the relatively benign condition of nephrolithiasis but also may indicate a more severe pathology.

Complete blood counts frequently are ordered for patients with abdominal pain, but findings seldom are contributory to a diagnosis. Despite the association of elevated WBC counts with many infectious and inflammatory processes, the WBC count is neither sufficiently sensitive nor sufficiently specific to be considered a discriminatory test to help establish or rule out a serious cause for the pain. Even serial WBC counts have failed to differentiate surgical from nonsurgical conditions. The WBC count is therefore not helpful for diagnosis, except when a low WBC indicates immunosuppression. Serum electrolytes, even in the presence of protracted emesis or diarrhea, are abnormal in less than 1% of patients. Blood urea nitrogen concentrations can be elevated in gastrointestinal hemorrhage and dehydration, but such conditions are better detected and quantified by history and physical examination. Increased serum creatinine usually is indicative of renal dysfunction. Blood glucose, anion gap, and serum ketone determinations are useful in diabetic ketoacidosis, one cause of acute abdominal pain and tachypnea.

Liver enzymes and coagulation studies are helpful only in a small subset of patients with suspected liver disease. If pancreatitis is suspected, the most useful diagnostic result is serum lipase elevated to at least double the normal value, because it is more specific and more sensitive than serum amylase for this process.
Measurement of serum amylase is of no value if a serum lipase level is available. Serum lactate levels are elevated late in bowel ischemia, and such determination may be useful if this entity is suspected, but serum lactate levels cannot be considered either sufficiently sensitive or specific enough to establish or exclude the diagnosis on their own.

Plain radiography of the abdomen has limited usefulness in the evaluation of acute abdominal pain and should be performed only when bowel obstruction or radiopaque foreign body is suspected and there is no intent to obtain a CT scan. For suspected perforated hollow viscus, an upright chest radiograph is a better study than an abdominal film but is not indicated if the plan is to proceed to CT scan regardless of the findings on the plain film. CT of the abdomen has become the imaging modality of choice with nonobstetric, nonbiliary abdominal pain. It allows visualization of both intraperitoneal and extraperitoneal structures and has a high degree of accuracy. Incidental findings are common on CT scans and may lead to a diagnosis. CT scan results often lead to a change in diagnosis. The proper execution and interpretation of CT studies will reduce morbidity, mortality, and medical expenses. CT is not indicated for biliary disease, however, for which ultrasound is a much better modality.

CT has increased diagnostic utility in elderly patients for several reasons. Older people with abdominal pain are significantly more likely to require surgery and have a greatly increased mortality compared with younger adults. Furthermore, evaluation of abdominal pain in elders often is more challenging owing to unreliable findings on physical examination, including vital signs, difficulties in history taking, physiologic age-related changes, and comorbid conditions. In the elderly population, CT results change management or disposition decisions in a significant proportion of patients. Table 27-3 lists the most common findings on CT scans in elders with abdominal pain.

Some controversy surrounds the use of oral contrast in abdominal CT in the critically ill ED patient. Technologic advances have improved image acquisition and resolution, and several studies have shown that intravenous contrast alone may now be adequate in the evaluation of certain suspected pathologic processes, such as solid organ or bowel wall disease. CT with intravenous contrast alone also has been shown to be sensitive and specific for the confirmation or exclusion of acute appendicitis. The exclusion of oral contrast in these patients significantly decreases ED time to disposition and improves patient satisfaction.

Controversy also surrounds the use of CT with regard to radiation exposure that patients receive. Several studies have attempted to quantify the radiation exposure associated with CT, but in reality there is a wide variation in dosage among different types of CT studies. One study estimated an abdominal CT with intravenous contrast to produce a dose of 10 to 50 millisieverts (mSv), enough to increase the lifetime risk of cancer to 1 in 470 in a 20-year-old woman. Another study demonstrated that although patients were more confident when CT imaging was part of their ED workup, they had a very poor understanding of the radiation dose involved. CT is an important adjunct in ED care, but the decision to scan is carefully weighed against the patient’s history, physical examination findings, age, and gender. In particular, a patient with a history of chronic undifferentiated abdominal pain, multiple previous CT scans, and alternative diagnoses may benefit from observation as opposed to another CT scan.

Bedside transabdominal and transvaginal ultrasonography have emerged as extremely useful adjuncts, decreasing time to diagnosis of life-threatening abdominopelvic conditions. Useful indications include the following:

- Identification of an intrauterine pregnancy
- Measurement of the cross-sectional diameter of the abdominal aorta to determine the presence of an abdominal aortic aneurysm
- Detection of free intraperitoneal fluid indicating hemorrhage, pus, or extrusion of gut contents
- Use as a diagnostic aid for detection of the following nonlife-threatening conditions:
  - Gallstones or a dilated common bile duct, which may be a clue to the presence of cholelithiasis
  - Pericholecystic fluid or gallbladder wall thickening, which may be indicative of cholecystitis
  - Free intraperitoneal fluid indicating ascites
  - Hydronephrosis indicating possible obstructive uropathy
  - Inferior vena cava distention or collapse as an indicator of volume status

The results of sonographic examinations are operator dependent, and misdiagnosis can occur because of failure to detect or identify pathology, incorrect identification of normal anatomy as pathologic, or overinterpretation of correctly identified findings (e.g., the mere presence of gallstones does not indicate that cholelithiasis is the cause of the pain). Emergency physicians should receive proper training in image acquisition and interpretation, and ultrasound evaluation in the radiology department or other confirmatory imaging such as CT should be sought if there is ambiguity or uncertainty in findings.

### Differential Diagnosis

The differential considerations with abdominal pain include a significant number of potentially life- or organ-threatening entities, particularly in the setting of a hemodynamically unstable or toxic-appearing patient. Severely ill patients require timely resuscitation and expeditious evaluation for potentially life-threatening conditions. A focused history and examination should be conducted, and the patient should be placed in a monitored acute care area well equipped for airway control, quick intravenous access, and fluid administration. Only when there should appropriate diagnostics be initiated (bedside focused assessment with sonography in trauma [FAST], aorta ultrasound assessment, and radiographic, electrocardiographic, and laboratory studies). This approach is particularly important in dealing with elderly or potentially pregnant patients (see Tables 27-1 and 27-2).

Women of reproductive age with abdominal pain should undergo pregnancy testing early, and a known pregnancy or a positive result on urine or serum pregnancy testing associated with abdominal pain in the ED should be considered to represent an ectopic pregnancy until proved otherwise. If evidence of blood loss is present, early obstetric consultation and diagnostic ultrasonography should be promptly sought. Bedside transabdominal...
sonography may identify free intraperitoneal fluid during the evaluation of shock, which may be sufficient evidence to justify operative intervention in the context of a positive pregnancy test and appropriate history and physical examination findings.

Despite the limitations already described, the approach to the differential diagnosis of abdominal pain generally is based on the location of maximum tenderness. Figure 27-1 shows locations of subjective pain and maximal tenderness on palpation related to various underlying causes. In women of childbearing age, a positive result on pregnancy testing may indicate ectopic pregnancy, but the entire spectrum of intra-abdominal conditions remains in the differential diagnosis, as for the nonpregnant patient. When the very broad differential list is compartmentalized by both history and physical examination, ancillary testing should proceed to either confirm or support the clinical suspicion.

Despite the significant variety of tests available, close to one half of the patients in the ED with acute abdominal pain will have no conclusive diagnosis. It is incumbent on the clinician to reconsider the extra-abdominal causes of abdominal pain (see Box 27-1), with special consideration in elders and immunocompromised patients, before arriving at the diagnosis of “nonspecific abdominal pain.”

EMPIRICAL MANAGEMENT

The main therapeutic goals in managing acute abdominal pain are physiologic stabilization, mitigation of symptoms (e.g., emesis control, pain relief), and expeditious diagnosis, with consultation if required.

There is no evidence to support withholding analgesics from patients with acute abdominal pain to preserve the accuracy of subsequent abdominal examinations; in fact, the preponderance of evidence supports the opposite. Pain relief may facilitate the diagnosis in patients ultimately requiring surgery. In the acute setting, analgesia usually is accomplished with intravenously titrated opioids. Meperidine (Demerol) has an unfavorable side effect profile and should be avoided. Intravenous ketorolac, the only parenteral nonsteroidal anti-inflammatory drug available in North America, is useful for both ureteral and biliary colic, as well as some gynecologic conditions, but is not indicated for general treatment of undifferentiated abdominal pain. Ketorolac has been shown to cause increased bleeding times in healthy volunteers; it should be avoided in patients with gastrointestinal bleeding and potential surgical candidates.

Aside from analgesics, a variety of other medications may be helpful to patients with abdominal pain. The burning pain caused by gastric acid may be relieved by antacids. Intestinal cramping may be diminished with oral anticholinergics, such as the combination agent atropine-scopolamine-hyoscyamine-phenobarbital (Donnatal), although evidence for this is scant and highly variable.

Antiemetics such as promethazine, prochlorperazine, ondansetron, or droperidol can be useful for nausea and vomiting. Gastric emptying by nasogastric tube with suction is appropriate for suspected small bowel obstruction with intractable pain and vomiting.

If intra-abdominal infection is suspected, broad-spectrum antibiotic therapy should be initiated promptly. Abdominal infections are often polymicrobial, and coverage for enteric gram-negative, gram-positive, and anaerobic bacteria is included. In the choice of antibiotic or combination, the following should be considered:

- Unless local antibiotic resistance dictates otherwise, second-generation cephalosporins (e.g., cefamandole, cefotetan, cefoxitin) or quinolone (ciprofloxacin, levofloxacin) may be combined with metronidazole for the initial dose of antibiotics in the ED. Other noncephalosporin, β-lactam agents with β-lactamase antagonists (e.g., ampicillin-sulbactam, piperacillin-tazobactam, ticarcillin-clavulanate) are alternatives.
- Many enteric gram-negative bacilli mutate rapidly to produce β-lactamases that are poorly antagonized by specific drug combinations containing clavulanate, sulbactam, or tazobactam. A carbapenem (e.g., imipenem, meropenem) or zefepime is an alternative for patients who may have recently received other antibiotics.

Whether to provide coverage for Enterococcus species is still a subject of debate, and the decision to treat for these bacteria specifically can be made after consultation. Immunocompromised patients may require antifungal agents.

DISPOSITION

Because up to 40% of patients with acute abdominal pain receive the diagnosis of nonspecific abdominal pain, decisions regarding disposition can be as difficult as the diagnosis in these patients. Categories for disposition may include surgical versus nonsurgical consultation and management, admission for observation, and discharge to home with follow-up evaluation. The decision to admit a patient to an observation unit or a hospital bed factors in the following:

- Information gained from the history, physical examination, and test results
- The likelihood of any suspected disease
- Any potential ramifications of progression of a known disease, or of incorrect diagnosis or management
- The likelihood of appropriate and timely follow-up after hospital discharge
- The ability of the patient to return if symptoms worsen

Clinically stable patients may be discharged from the ED with appropriate follow-up care, possibly to include repeated physical examination or additional diagnostic imaging if indicated.

In the case of nonspecific abdominal pain that is considered potentially worrisome, CT scan, observation (i.e., in the ED observation unit), or follow-up reevaluation after 8 to 12 hours all are valid options. Follow-up evaluation can be done through a return visit to the ED, via an appointment with a primary care physician, or as part of an observation unit protocol.

Before discharge of a patient with an undiagnosed cause of nonspecific abdominal pain, several conditions should be met. The abdominal examination findings should not indicate serious organ pathology or peritoneal irritation, and the patient should have normal or near-normal vital signs. Pain and nausea should be controlled, and the patient should be able to take fluids by mouth. If a patient is to be discharged home without a specific diagnosis, clear instructions are given and include the following information:

- What to do for relief of symptoms or to maximize chances of resolution of the condition (e.g., avoiding exacerbating food or activities, taking medications as prescribed)
- Under what circumstances, with whom, and in what time frame to seek follow-up evaluation, if all goes as desired on the basis of what is known when the patient is in the ED
- Under what conditions to seek more urgent care because of unexpected changes in the condition (such as with natural progression of the process before improvement, incorrect diagnosis made in the ED, or untoward reactions to medications)

The references for this chapter can be found online by accessing the accompanying Expert Consult website.
References


