

Evaluation of the adult with nontraumatic abdominal or flank pain in the emergency department

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INTRODUCTION

Abdominal and/or flank pain is the chief complaint in 5 to 10 percent of emergency department (ED) visits, and patients often require extensive evaluations, including testing, administration of analgesia, stabilization, and specialty consultation [1-4]. In many cases, the differential diagnosis is wide, ranging from benign to life-threatening conditions. Causes include medical, surgical, intra-abdominal, and extra-abdominal ailments. Associated symptoms often lack specificity, and atypical presentations of common diseases are frequent.

Despite sophisticated diagnostic modalities, undifferentiated abdominal pain remains the diagnosis for approximately 25 percent of patients discharged from the ED and between 35 and 41 percent for those admitted to the hospital [2,5-7]. Approximately 80 percent of patients discharged with undifferentiated abdominal pain improve or become pain free within two weeks of presentation [7].

Older adults, patients with immunocompromise or diabetes, and female patients of childbearing age pose special diagnostic challenges. Older adults and patients with diabetes often present with nonspecific complaints and atypical symptoms of potentially life-threatening conditions [8,9].

This topic will discuss the evaluation of the adult patient presenting to the ED with nontraumatic abdominal or flank pain. The outpatient evaluation of adults with abdominal pain, a synopsis of causes of abdominal pain, an approach to pelvic pain, and evaluation of blunt abdominal trauma are found separately.

- (See "[Evaluation of the adult with abdominal pain](#)".)
 - (See "[Causes of abdominal pain in adults](#)".)
 - (See "[Approach to acute abdominal/pelvic pain in pregnant and postpartum patients](#)".)
 - (See "[Acute pelvic pain in nonpregnant adult females: Evaluation](#)".)
 - (See "[Initial evaluation and management of blunt abdominal trauma in adults](#)".)
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OVERVIEW OF THE EVALUATION

Rapid assessment for abdominal catastrophe — The evaluation of an adult emergency department (ED) patient with abdominal or flank pain starts with obtaining a history and performing a physical examination. We simultaneously and rapidly assess if the patient may be having a life-threatening abdominal catastrophe. Potential indicators include shock (eg, hypotension, tachycardia, tachypnea), presence of peritonitis, significant distress from pain, or altered mental status; these warrant starting resuscitation simultaneously with obtaining further history and examination. (See '[Patient with suspected life-threatening abdominal catastrophe](#)' below.)

History — A thorough history focuses the differential diagnosis and helps determine the need for further testing. It is important to characterize the pain as precisely as possible, including timing of onset, prior episodes of similar pain, quality, location, radiation, aggravating and alleviating factors, and associated symptoms. Features of high-risk abdominal pain are presented in the table ([table 1](#)). Symptoms in older patients are less likely to be characteristic for the underlying cause of their pain (ie, "atypical" symptoms). (See '[Older adults](#)' below.)

- **Quality and timing of pain** — The quality and timing of the pain (eg, intensity at onset, acute versus chronic) help determine the acuity and focus the evaluation on specific organ systems. Severe, sudden-onset pain or constant, worsening pain lasting over six hours (but less than 48 hours) suggests a surgical cause, while nonsurgical causes tend to have milder, intermittent pain. Abdominal pain can be classified as visceral, parietal (ie, somatic), or referred depending on its neurologic basis, which is discussed in detail separately ([table 2](#)). (See "[Causes of abdominal pain in adults](#)", section on '[Pathophysiology of abdominal pain](#)').

Pain intensity at onset provides clues to disease severity and involved structures [1,10,11]. Pain with maximum intensity at onset is concerning for a vascular process (eg, ruptured abdominal aortic aneurysm [AAA]), obstruction of a small tubular structure (eg, nephrolithiasis), or reproductive organ pathology (eg, ovarian cyst rupture or torsion) [12]. Pain with gradual onset suggests an inflammatory or infectious process (eg, appendicitis, diverticulitis) or obstruction of a large tubular structure (eg, intestine).

The timing of pain can help to determine the urgency of further testing, although standardized definitions of acute and chronic abdominal pain do not exist.

- **First episode of pain lasting less than one week** – We consider this to be acute pain that generally requires an extensive ED evaluation unless the history and examination determine a clear cause. (See '[Cause identified by history and physical](#)' below.)
- **Recurrent presentations of acute pain** – This may be classified as acute, subacute, or chronic pain, and the ED evaluation often depends on the testing and imaging obtained during prior episodes and whether the pain has resolved. Causes may be benign (eg, irritable bowel syndrome, hernia, nephrolithiasis, abdominal migraines, cyclical vomiting syndrome, cannabis hyperemesis syndrome) or more serious (eg, intermittent ovarian torsion, mesenteric ischemia, biliary disease). High-quality evidence does not exist to define a low-risk patient subset with recurrent abdominal pain that clearly does not need computed tomography (CT) imaging [13].
- **Pain that has remained unchanged for months or years** – We consider this to be chronic pain that may not require extensive ED evaluation if the patient has had prior testing and imaging. However, a patient with chronic abdominal or flank pain can still present with an acute exacerbation of a chronic problem or a new and unrelated problem, which the history must differentiate. The diagnostic approach to chronic abdominal pain is discussed separately. (See "[Evaluation of the adult with abdominal pain](#)", section on '[Diagnostic approach to chronic abdominal pain](#)').
- **Location of pain** — The location and radiation of pain helps narrow the differential diagnosis. The provided tables summarize the causes of pain by characteristic location in the abdomen ([table 3](#)) and pelvis ([table 4](#)), and the figure demonstrates patterns of referred pain ([figure 1](#)). Causes of abdominal pain by location are discussed in detail separately. (See '[Causes of abdominal pain in adults](#)').

Localization by itself, however, is not sufficiently sensitive to definitively exclude intra-abdominal pathology [10,14,15]. As an example, in one study, 24 percent of patients diagnosed with appendicitis had no right lower quadrant pain or tenderness [15]. Right

upper quadrant pain is often associated with the liver or gallbladder, although pain from biliary colic can be poorly localized, and patients may complain of lower chest, epigastric, or back discomfort [16].

Pain location can change over time, reflecting progression of disease. As a classic example, appendicitis begins as periumbilical visceral pain (reflecting its embryologic origin) then progresses to right lower quadrant parietal pain as the inflamed appendix (if anterior or pelvic) irritates the peritoneum. Retrocecal appendicitis may not cause any focal peritoneal irritation.

Thoracic diseases, such as pneumonia, pulmonary embolism (PE), or myocardial infarction, can cause upper abdominal pain, particularly in older patients [17]. Many extra-abdominal causes of acute abdominal pain ([table 5](#)), such as diabetic ketoacidosis and hypercalcemia, often present with nonlocalizing pain.

- **Aggravating and alleviating factors** — Examples that help with the differential diagnosis include the following:

- The pain of peptic ulcer disease may improve after meals, whereas biliary colic worsens after meals.
- Pancreatitis pain may improve when the patient sits upright and worsen when the patient reclines.
- A patient with peritonitis often lies still and may note that coughing worsens their pain. Pain that worsens going over bumps during the drive to the ED suggests peritonitis and is roughly 80 percent sensitive, but only 52 percent specific, for appendicitis [18].
- A patient with nephrolithiasis is often restless and cannot find a comfortable position.
- Pain and vomiting that improves with hot showers is characteristic for cannabis hyperemesis syndrome.

- **Associated symptoms** — These include fever, chills, fatigue, weight loss, anorexia, nausea, vomiting, diarrhea, obstipation, constipation, dysuria, urinary urgency/frequency, hematuria, vaginal discharge/bleeding, penile discharge, and scrotal pain. Examples of diseases that cause abdominal pain with these symptoms are presented in the table ([table 6](#)).

Cough, dyspnea, or chest pain suggests an extra-abdominal process such as pneumonia, PE, or myocardial infarction. Selected extra-abdominal causes of acute abdominal pain are

listed in the table ([table 5](#)).

- **Past medical and social histories and medications** – Examples of medical comorbidities, prior surgeries, medications, and misused drugs that increase the risk of diseases that cause abdominal or flank pain are presented in the table ([table 7](#)).

Medications associated with constipation are provided in the table ([table 8](#)). In an ED patient, however, constipation should be a diagnosis of exclusion after appropriate imaging has been performed or the pain has resolved after a bowel movement. (See "[Etiology and evaluation of chronic constipation in adults](#)", section on 'Evaluation').

Victims of intimate partner violence may present to the ED with abdominal or pelvic pain [[19,20](#)]. (See "[Intimate partner violence: Diagnosis and screening](#)").

- **Past surgical history** – A history of previous abdominal surgery increases the risk for small bowel obstruction (SBO), which is from adhesions in 50 to 70 percent of cases. (See "[Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults](#)".)

Various complications can develop from bariatric surgery or receiving an organ transplant, even many years after the procedure. (See '[Organ transplant recipient](#)' below and '[Bariatric surgery](#)' below.)

A variety of postoperative complications can cause abdominal pain, such as ileus, surgical site infections, hematoma/seroma formation, and nerve injury. (See "[Postoperative ileus](#)" and "[Overview of the evaluation and management of surgical site infection](#)" and "[Complications of abdominal surgical incisions](#)".)

- **Trauma** – It is helpful to ask whether the patient sustained any injuries, procedures, or instrumentation in the prior month. Intra-abdominal injuries may not manifest for days to weeks after the event. Splenic rupture is an example, but delayed presentations of perforated bowel, pancreatitis, and injuries to the liver, gallbladder, and genitourinary tract have all been reported. Clinical manifestations of diaphragmatic injury, which is often not diagnosed immediately following the injury, can be delayed for months to even years. (See "[Initial evaluation and management of blunt abdominal trauma in adults](#)" and "[Initial evaluation and management of blunt thoracic trauma in adults](#)" and "[Recognition and management of diaphragmatic injury in adults](#)".)

- **Obstetric/gynecologic history** – It is critical to determine pregnancy status and gestational age, if the patient is pregnant. Pregnancy broadens the differential diagnosis

to include complications of pregnancy (such as an ectopic gestation); round ligament pain; preeclampsia; hemolysis, elevated liver enzymes, low platelet count (HELLP) syndrome; and issues related to spontaneous pregnancy loss. (See "[Approach to acute abdominal/pelvic pain in pregnant and postpartum patients](#)".)

We maintain a heightened suspicion for unsafe abortion in a reproductive-age pregnant patient with clinical findings related to the genital tract, as many patients will not report the procedure or the pregnancy. (See "[Unsafe abortion](#)", section on 'History'.)

In a nonpregnant female, it is important to ask about menstrual history (eg, last menstrual period, last normal menstrual period, cycle length), dyspareunia, and dysmenorrhea. Recurrent, acute pain related to menstrual cycles suggests a reproductive organ-related etiology. (See "[Acute pelvic pain in nonpregnant adult females: Evaluation](#)" and "[Chronic pelvic pain in adult females: Evaluation](#)".)

Females undergoing ovulation induction can develop ovarian hyperstimulation syndrome from multiple, large ovarian cysts precipitating acute fluid shifts with depletion of intravascular fluid. (See "[Pathogenesis, clinical manifestations, and diagnosis of ovarian hyperstimulation syndrome](#)".)

- **Family history** – Examples of family history that may be relevant to the differential diagnosis include the following:

- Inflammatory bowel disease in a patient with abdominal pain and bloody diarrhea (see "[Definitions, epidemiology, and risk factors for inflammatory bowel disease](#)")
- Familial Mediterranean fever in a patient with recurring attacks of fever and serosal inflammation of the peritoneum, pleura, or synovium (see "[Clinical manifestations and diagnosis of familial Mediterranean fever](#)")
- Hereditary angioedema in a patient with recurrent abdominal pain and pseudo-obstruction (see "[Hereditary angioedema: Epidemiology, clinical manifestations, exacerbating factors, and prognosis](#)")

- **Sick contacts and travel history** – Recent travel or similar symptoms among family or friends are important clues indicative of an infectious or food-borne etiology. Patients are often in contact with a person with gastroenteritis before developing symptoms themselves. (See "[Acute viral gastroenteritis in adults](#)" and "[Causes of acute infectious diarrhea and other foodborne illnesses in resource-abundant settings](#)".)

- **Occupational history** – We do not routinely obtain an occupational history in ED patients, but this may help to identify unusual causes of pain. For example, lead poisoning in an adult (eg, construction worker) can present with abdominal pain, constipation, and anorexia. (See "[Overview of occupational and environmental health](#)" and "[Lead exposure, toxicity, and poisoning in adults](#)", section on 'Clinical manifestations'.)

Physical examination

- **General appearance and vital signs**

- **Temperature** – Fever increases the suspicion for infection or inflammatory process. Pain often causes tachypnea, which can cause a falsely lower oral temperature measurement [21]. We check a rectal temperature if there is concern about an inaccurate reading. Certain patient populations, such as older adults and those with immunocompromise, may be unable or less likely to develop a fever. (See "[Pathophysiology and treatment of fever in adults](#)".)
- **Blood pressure and heart rate** – Hypotension is an ominous finding in a patient with abdominal or flank pain and may reflect a shock state (eg, hemorrhagic, hypovolemic, septic, endocrine) ([table 9](#)). Tachycardia is an early compensatory mechanism in a patient with shock. The presence of either should prompt resuscitation simultaneously with the evaluation. (See '[Patient with suspected life-threatening abdominal catastrophe](#)' below and "[Evaluation of and initial approach to the adult patient with undifferentiated hypotension and shock](#)".)

Some patients with acute peritoneal irritation (eg, ruptured ovarian cyst, ectopic pregnancy) and hypotension may not be tachycardic, or may even be bradycardic, likely from a parasympathetic nervous system (ie, vagal) reflex [22]. (See "[Evaluation and management of ruptured ovarian cyst](#)", section on 'Clinical findings').

- **Respiratory rate** – An elevated respiratory rate may be due to pain or from a compensatory reaction to an underlying metabolic acidosis.
- **General appearance** – The patient's general appearance not only provides clues to the diagnosis but also guides the urgency of resuscitation, analgesia, and imaging. The patient who is restless, curled up, and agitated may have renal colic. A patient lying perfectly still in bed with knees bent or experiencing worsening pain when the examiner lightly bumps the stretcher raises concern for peritonitis. Signs of shock (eg, pallor, diaphoresis, altered mental status) warrant resuscitation simultaneously with

the evaluation. Signs of systemic disease (eg, spider angioma in cirrhosis, cachexia in malignancy) are often readily apparent.

- **Abdominal examination**

- **Inspection** – General inspection may reveal signs of previous surgeries (eg, incision scar), abdominal pulsations, or distension. Periumbilical ecchymosis (Cullen sign) can occur with pancreatitis, rectus sheath hematoma, perforated ulcer, and intra-peritoneal hemorrhage. Abdominal wall pathology such as a hernia can be obvious if incarcerated but may require asking the patient to increase abdominal pressure (ie, Valsalva maneuver, cough) to elicit the bulge. (See "[Overview of abdominal wall hernias in adults](#)", section on '[Clinical features](#)').
- **Palpation** – Abdominal palpation identifies the location and degree of tenderness and detects signs of peritoneal irritation, such as involuntary guarding and muscular rigidity. Serial examinations can improve diagnostic accuracy [23].

Our approach is to lightly palpate an area away from the site of pain, then extend towards the area of maximal pain. Once the area of maximal tenderness is localized, we perform maneuvers to elicit peritoneal signs, such as percussion or releasing after deep palpation. If light palpation does not identify a specific area of tenderness, palpate deeper to identify findings such as hepatomegaly, splenomegaly, aortic dilatation, or deep tenderness (such as may occur with retrocecal appendicitis).

A rigid abdomen is cause for concern, but traditional techniques for assessing rebound tenderness have limited sensitivity and specificity for identifying peritonitis [24,25]. Gentler methods to elicit signs of peritoneal irritation include having the patient cough or stand on their toes and drop their heels to the ground [26,27]. The heel test can also be performed by striking a recumbent patient's heel. However, studies of these tests are limited, and their test characteristics remain uncertain [28,29].

Palpating the aorta is safe but generally has limited utility with the availability of point-of-care ultrasound. An abnormal width of aortic pulsation suggests an AAA. (See "[Clinical features and diagnosis of abdominal aortic aneurysm](#)", section on '[Abdominal palpation](#)' and '[Role of point-of-care ultrasound](#)' below.)

Other examination maneuvers that can be selectively performed include the following:

- Although insensitive, the psoas (right lower quadrant pain with passive right hip extension), obturator (right lower quadrant pain with passive right knee flexion

and right hip flexion/internal rotation), and Rovsing signs (right lower quadrant with palpation of the left lower quadrant) have good specificity for appendicitis. (See "[Acute appendicitis in adults: Clinical manifestations and differential diagnosis](#)", section on '[Physical examination](#)').

- Murphy sign (worsening pain and tenderness during deep inspiration with right upper quadrant palpation) is sensitive but not specific for acute cholecystitis. (See "[Acute calculous cholecystitis: Clinical features and diagnosis](#)", section on '[Physical examination](#)').
 - The presence of Carnett sign (increased abdominal tenderness when the abdominal wall muscles are contracted) suggests pathology within the abdominal wall instead of intraperitoneal. In one small study, Carnett sign was found to be 95 percent accurate at differentiating abdominal wall pain from visceral pain [30].
- **Abdominal auscultation** – In the ED, this is generally of limited utility since bowel sound findings do not alter the decision to image a patient with abdominal distension. We will occasionally auscultate with light to deep pressure as a means to elicit tenderness with the patient distracted. Periodic rushes of high-pitched "tinkling" bowel sounds or the complete absence of bowel sounds, in the presence of abdominal distention, are signs of bowel obstruction [31].

- **Extra-abdominal examination** — Examining the following organ systems can provide clues to intra-abdominal and extra-abdominal causes of pain:

- **Genital** – In a male with lower abdominal or flank pain, examine the scrotum for testicular edema and tenderness, epididymal tenderness, scrotal masses, and cremasteric reflexes. (See "[Acute scrotal pain in adults](#)".)

Perform a pelvic examination in a female with pain and tenderness in the lower half of the abdomen (with shared decision-making with the patient if they believe this exam is unnecessary). There are no pre-examination criteria to determine if the pelvic examination can be deferred or will provide useful information [4]. (See "[The gynecologic history and pelvic examination](#)", section on '[Pelvic examination](#)').

- **Rectal** – We selectively perform a rectal examination, since this has questionable utility in a patient with undifferentiated abdominal or flank pain without gastrointestinal bleeding [32,33]. The rectal examination is useful when there is a concern for gastrointestinal bleeding, when there is obstipation (to exclude fecal impaction), or

when identifying rectal tenderness may change management (eg, a patient may have rectal tenderness and not abdominal tenderness with retrocecal appendicitis).

- **Heart and lungs** – Auscultate the heart and lungs and palpate a pulse. Atrial fibrillation increases suspicion for mesenteric ischemia. Localized decreased or coarse breath sounds raise suspicion for pneumonia.
- **Musculoskeletal, back, and flank** – Percuss the costovertebral angles as tenderness suggests pyelonephritis. Passively range the hips since intra-articular, retroperitoneal, or psoas-related infectious and inflammatory processes can refer pain to the lower abdomen or flank. Flank ecchymosis (Grey-Turner sign ([image 1](#))) can occur with retroperitoneal hemorrhage, such as from a ruptured AAA or hemorrhagic pancreatitis.
- **Eyes** – Examine the sclera for icterus.
- **Skin** – Examine for rashes, especially over the abdomen, back, and perineum. Zoster presents with a rash in the dermatomal distribution of the pain, but the pain often precedes the rash by several days, complicating the diagnosis. (See "[Epidemiology, clinical manifestations, and diagnosis of herpes zoster](#)", section on '[Clinical manifestations](#)').

Role of point-of-care ultrasound — Emergency physician-performed point-of-care ultrasound has become an important diagnostic tool for patients presenting with abdominal pain. Since ultrasound is rapid and can be performed at the bedside, it is especially helpful in the unstable patient or when there is concern for abdominal catastrophe. However, test characteristics vary depending on the operator and indication [34]. Point-of-care ultrasound can guide further evaluation, initial treatment, and consultations in the following situations:

- When there is concern for hemoperitoneum, such as from ruptured ectopic pregnancy or hemorrhagic ovarian cyst ([image 2](#)) (see "[Emergency ultrasound in adults with abdominal and thoracic trauma](#)", section on '[Abdominal examination](#)')
- To identify an AAA ([image 3](#)), although ultrasound cannot exclude a leak or rupture since it has limited utility for detecting retroperitoneal bleeding (see "[Clinical features and diagnosis of abdominal aortic aneurysm](#)", section on '[Diagnosis](#)')
- In a pregnant patient to identify an intrauterine pregnancy ([image 4](#)) and potentially an adnexal or tubal ectopic pregnancy ([image 5](#)) (see "[Ultrasonography of pregnancy of unknown location](#)")

- In a hypotensive patient; in addition to hemoperitoneum, ultrasound can identify cardiac and thoracic etiologies and assess the inferior vena cava diameter as an indicator of fluids status (see "[Evaluation of and initial approach to the adult patient with undifferentiated hypotension and shock](#)", section on '[Point-of-care ultrasonography](#)' and "[Novel tools for hemodynamic monitoring in critically ill patients with shock](#)", section on '[Vena cava assessment](#)')
- In a patient with right upper quadrant pain to identify gallstones or radiographic signs of cholecystitis ([image 6](#) and [image 7](#)) (see "[Overview of gallstone disease in adults](#)", section on '[Transabdominal ultrasound](#)' and "[Acute calculous cholecystitis: Clinical features and diagnosis](#)", section on '[Ultrasonography](#)')
- In a patient with urinary retention to confirm a distended bladder (see "[Acute urinary retention](#)", section on '[Initial evaluation](#)')
- In a patient with flank pain, the presence of unilateral hydronephrosis suggests an obstructive kidney stone ([image 8](#)) (see "[Kidney stones in adults: Diagnosis and acute management of suspected nephrolithiasis](#)", section on '[Ultrasound of the kidneys and bladder](#)')

Depending on operator experience with the following indications, point-of-care ultrasound can be performed for initial screening but ultimately may need radiology confirmation:

- In a nonpregnant female to identify ovarian and uterine pathology and ovarian blood flow (on color Doppler) (see "[Ovarian and fallopian tube torsion](#)", section on '[Ultrasound](#)' and "[Adnexal mass: Ultrasound categorization](#)")
- In a male with acute scrotal pain, the absence of Doppler flow suggests testicular torsion (see "[Acute scrotal pain in adults](#)")
- In a patient with right lower quadrant pain, ultrasound can identify appendicitis, but it is often technically challenging to find the appendix (see "[Acute appendicitis in adults: Diagnostic evaluation](#)", section on '[Ultrasound](#)')
- In a patient with suspected SBO, ultrasound can identify dilated loops of bowel (see "[Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults](#)", section on '[Bedside imaging study](#)')
- Abdominal free air can be identified on ultrasound, but it is not the accepted study of choice for this indication (see "[Indications for bedside ultrasonography in the critically ill adult patient](#)", section on '[Detection of abdominal free air](#)')

Ancillary studies — These are useful adjuncts but should not be used to definitively exclude a diagnosis.

- **Laboratory tests** — We obtain laboratory studies in most patients unless the history and physical examination establish the cause of the pain (eg, incarcerated hernia with improvement of pain after reduction, zoster rash in same distribution as pain). The threshold for ordering a broader range of tests is lower in the patient with immunosuppression, older age, and significant underlying disease (eg, diabetes, cancer, human immunodeficiency virus [HIV], cirrhosis). Laboratory tests to evaluate acute abdominal and flank pain include the following:
 - **Pregnancy test** – Either a urine or serum qualitative human chorionic gonadotropin (hCG) test is required in all females of childbearing age with abdominal pain. Both tests are extremely sensitive. Patient self-assessment of pregnancy status is not reliable [35]. Obtain a quantitative serum hCG in a pregnant patient without a previously documented intrauterine pregnancy. (See "[Ectopic pregnancy: Clinical manifestations and diagnosis](#)", section on '[Human chorionic gonadotropin](#)').
 - **Complete blood count (CBC)** – Although frequently ordered, the CBC is nonspecific and rarely alters management [36-38]. While up to 80 percent of patients with acute appendicitis have a leukocytosis, 70 percent of patients with other causes of right lower quadrant abdominal pain also have a leukocytosis [38,39]. Healthy pregnant patients typically have a mild leukocytosis. (See "[Maternal adaptations to pregnancy: Hematologic changes](#)", section on '[White blood cells](#)').
 - **Basic electrolytes** – Electrolytes are frequently measured but rarely alter management. They can identify metabolic acidosis and electrolyte or free water losses and assess for impaired kidney function, which is a risk factor for contrast-induced acute kidney injury. (See "[Prevention of contrast-induced acute kidney injury associated with computed tomography](#)", section on '[Risk factors](#)').
 - **Serum lactate** – Although nonspecific, an elevated serum lactate can indicate sepsis or bowel ischemia and can be used to follow the response to resuscitation. (See "[Overview of intestinal ischemia in adults](#)", section on '[Laboratory studies](#)' and "[Sepsis syndromes in adults: Epidemiology, definitions, clinical presentation, diagnosis, and prognosis](#)", section on '[Laboratory signs](#)').
 - **Liver and pancreatic enzymes** – Measure these in a patient with upper abdominal pain. As compared with amylase, serum lipase is more sensitive and specific for pancreatitis, but elevations may be caused by other diseases. Marked liver enzyme

elevation suggests acute hepatitis (eg, viral) but can occur with underlying chronic liver disease (eg, Wilson disease), ischemic or drug-induced liver injury (eg, [acetaminophen](#)), rhabdomyolysis, malignancy, or an autoimmune disorder. Elevation in the serum total bilirubin and alkaline phosphatase concentrations suggest a cholestatic pattern and are uncommon in uncomplicated cholecystitis. (See ["Approach to the patient with abnormal liver biochemical and function tests"](#) and ["Clinical manifestations and diagnosis of acute pancreatitis"](#) and ["Approach to the patient with elevated serum amylase or lipase"](#).)

- **Coagulation studies and blood type** – Obtain these in a patient with gastrointestinal bleeding or with a high index of suspicion that an operation will be necessary. A pregnant patient with vaginal bleeding should have a blood type and Rh checked.
- **Urinalysis** – The presence of pyuria or hematuria suggests a urinary tract infection (UTI) but can also occur with any inflammatory process adjacent to a ureter. For example, 20 to 48 percent of patients with appendicitis have blood, leukocytes, or bacteria in their urine [40,41]. Many older adults have chronic, mild pyuria. Hematuria may be present in as many as 87 percent of patients with AAA, which can lead to a misdiagnosis of nephrolithiasis [42]. (See ["Acute simple cystitis in adult and adolescent females"](#) and ["Acute simple cystitis in adult and adolescent males"](#).)
- **Sexually transmitted infection (STI) testing** – During the pelvic examination in a female with lower abdominal pain, swabs can be obtained for nucleic acid amplification testing for gonorrhea, chlamydia, and trichomas. (See ["Clinical manifestations and diagnosis of *Neisseria gonorrhoeae* infection in adults and adolescents"](#), section on 'Nucleic acid amplification' and ["Clinical manifestations and diagnosis of *Chlamydia trachomatis* infections"](#), section on 'Nucleic acid amplification testing (test of choice)' and ["Trichomoniasis: Clinical manifestations and diagnosis"](#), section on 'Preferred tests'.)
- **Chest radiograph (CXR)** — Obtain a CXR in a patient with abdominal pain who also has associated cardiothoracic symptoms (eg, cough, dyspnea, chest pain) to assess for pneumonia, pneumothorax, or other pleural-based processes. Pleural irritation from a basilar lung infiltrate can cause sharp abdominal pain that is aggravated by cough or deep inspiration. An upright CXR can also visualize pneumoperitoneum occurring from hollow viscous perforation. (See ["Clinical evaluation and diagnostic testing for community-acquired pneumonia in adults"](#) and 'Imaging' below.)

- **Electrocardiogram (ECG)** – Obtain an ECG in a patient with upper abdominal pain who has older age, immunosuppression, or significant underlying disease (eg, diabetes, cancer, HIV, cirrhosis). Some patients with an acute coronary syndrome, especially older adults and those with diabetes, present with epigastric pain, nausea, or vomiting rather than chest pain. Abdominal pain is the presenting complaint for an acute myocardial infarction in approximately one-third of these atypical cases. Newly diagnosed atrial fibrillation raises concern for acute mesenteric arterial occlusion caused by embolism from dislodged thrombus from the left atrium. (See "[Initial evaluation and management of suspected acute coronary syndrome \(myocardial infarction, unstable angina\) in the emergency department](#)", section on '[Atypical presentations](#)' and "[Acute mesenteric arterial occlusion](#)", section on '[Arterial embolism](#)').
- **Abdominal paracentesis** – In a patient with ascites and abdominal pain or tenderness, a diagnostic paracentesis should be performed and ascitic fluid analyzed to exclude spontaneous bacterial peritonitis. (See "[Diagnostic and therapeutic abdominal paracentesis](#)" and "[Spontaneous bacterial peritonitis in adults: Diagnosis](#)", section on '[Obtaining ascitic fluid](#)').

Overview of common imaging modalities — The decision to image an ED patient with abdominal or flank pain is a clinical judgement based on whether there are entities on the differential diagnosis that must be excluded during the current visit or can wait for outpatient follow-up. This is often a complex decision-making process and may require shared decision-making with the patient in equivocal cases. Decisions regarding the need and timing of imaging are based on suspected etiologies and are discussed in more detail below. (See '[Patient with suspected life-threatening abdominal catastrophe](#)' below and '[Patient without abdominal catastrophe](#)' below.)

Most patients with abdominal tenderness or distension, pain requiring multiple opioid doses, high-risk features ([table 1](#)), or leukocytosis will require imaging. It can be helpful to have a discussion with the radiologist if unsure which study to order or whether contrast administration is necessary. Common ED imaging modalities include the following:

- **CT scan** — This is the modality of choice in the ED evaluation of undifferentiated abdominal pain [43]. Approximately two-thirds of patients presenting to the ED with acute abdominal pain have a disease that can be diagnosed by CT [44]. One small study found that CT correctly diagnosed the cause of pain among patients with an "acute abdomen" in 90 percent of cases compared with 76 percent of cases diagnosed correctly by history and physical examination alone [45]. CT is particularly useful in older adults, establishing or

suggesting the diagnosis in 75 percent of cases and 85 percent of emergency surgical conditions [8]. Unenhanced CT is extremely sensitive in identifying free air [43].

- **Role of intravenous (IV) contrast** — Routine administration of IV contrast improves the diagnostic accuracy of CT for many diagnoses [46]. However, acute kidney injury may develop after administration of iodinated contrast material, primarily in patients with an estimated glomerular filtration rate (eGFR) <30 mL/min/1.73 m². If unsure, the radiologist can help determine if IV contrast is necessary. (See "[Patient evaluation prior to oral or iodinated intravenous contrast for computed tomography](#)" and "[Prevention of contrast-induced acute kidney injury associated with computed tomography](#)".)
- **Role of oral contrast** — Improvements in the image quality provided by multislice helical CT scanners have raised questions about the need for oral contrast. Most institutions do not routinely use oral contrast because of associated delays in study acquisition, need for nasogastric tube insertion in a patient unable to tolerate orally administered contrast, and prolonged ED stay with questionable diagnostic benefit [47,48]. The CT can be repeated with oral contrast in the rare case of an equivocal IV contrast-enhanced CT.

One prospective study compared the performance of noncontrast and oral contrast-enhanced CT in a convenience sample of patients with acute abdominal pain and found the two modalities had a simple agreement of 79 percent (95% CI 70-87) [49]. Another prospective study of a convenience sample of 72 ED patients presenting with acute nontraumatic abdominal pain who were initially evaluated with a noncontrast CT found no missed consequential diagnoses (defined as causing death or requiring abdominal surgery) in the seven days following ED evaluation [50].

- **Radiology-performed ultrasound** – Ultrasound is the study of choice to evaluate the biliary tract, pregnancy, and reproductive organs but can also be used to identify appendicitis and obstructive uropathy (such as from nephrolithiasis).
- **Magnetic resonance imaging (MRI)** – MRI is an accurate alternative to CT for excluding intra-abdominal pathology (eg, appendicitis) when trying to avoid radiation exposure (eg, pregnancy). (See "[Approach to acute abdominal/pelvic pain in pregnant and postpartum patients](#)", section on 'Imaging'.)

Magnetic resonance angiography (MRA) is an option in patients with an allergy to iodinated contrast and a heightened concern for mesenteric ischemia. (See "[Overview of intestinal ischemia in adults](#)", section on 'Advanced abdominal imaging').

- **Plain abdominal radiographs** — We do not routinely obtain plain abdominal radiographs for abdominal or flank pain as this practice is extremely low yield [51,52]. Plain radiographs can expedite the evaluation when bowel obstruction, bowel perforation, or a radiopaque foreign body is suspected but cannot be relied upon to exclude these disorders [53]. In an ED patient without these indications and for whom a CT is planned, plain abdominal radiographs are unhelpful, may delay definitive diagnosis, and can sometimes be misleading [54,55].

PATIENT WITH SUSPECTED LIFE-THREATENING ABDOMINAL CATASTROPHE

Differential diagnosis of abdominal catastrophe — The following are abdominal processes that can cause ischemia, sepsis, or hemorrhage and become a life-threatening abdominal catastrophe (manifestations and risk factors are summarized in the table ([table 10](#))):

- **Abdominal aortic aneurysm (AAA)** - Can present with abdominal, back, or flank pain and/or hematuria while rupture typically produces acute, severe pain and hypotension. (See "[Clinical features and diagnosis of abdominal aortic aneurysm](#)" and "[Epidemiology, risk factors, pathogenesis, and natural history of abdominal aortic aneurysm](#)", section on '[Risk factors for the development of AAA](#)').
- **Descending aortic dissection** - Abdominal pain can develop if the dissection causes splenic, kidney, or bowel infarction. (See "[Clinical features and diagnosis of acute aortic dissection](#)").
- **Mesenteric ischemia** – This can be differentiated into four entities (see "[Overview of intestinal ischemia in adults](#)"):
 - Mesenteric arterial occlusion (embolic or thrombotic) (see "[Acute mesenteric arterial occlusion](#)")
 - Nonocclusive mesenteric ischemia (low flow state or vasoconstriction) (see "[Nonocclusive mesenteric ischemia](#)")
 - Venous thrombosis (see "[Mesenteric venous thrombosis in adults](#)")
 - Chronic mesenteric ischemia (intestinal angina) (see "[Chronic mesenteric ischemia](#)")
- **Hollow viscous perforation and/or peritonitis** – The most common cause of stomach and duodenal perforation is peptic ulcer disease, but perforation can also complicate appendicitis, diverticulitis, bowel obstruction, ischemic bowel, toxic megacolon, severe retching (ie, esophageal perforation, Boerhaave syndrome), and other processes. Mortality increases in older adults (who are often unaware they have peptic ulcer disease until a

complication develops) and with delays in diagnosis. (See "Overview of gastrointestinal tract perforation" and "Overview of complications of peptic ulcer disease" and "Management of acute appendicitis in adults", section on 'Unstable patients or patients with free perforation' and "Acute colonic diverticulitis: Surgical management", section on 'Free (frank) perforation' and "Boerhaave syndrome: Effort rupture of the esophagus".)

- **Bowel strangulation and/or intestinal gangrene** – When this complicates processes such as bowel obstruction, volvulus, or incarcerated hernia, mortality rates increase with increasing delays in surgery. (See "Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults" and "Large bowel obstruction" and "Gastric volvulus in adults" and "Cecal volvulus" and "Sigmoid volvulus" and "Overview of abdominal wall hernias in adults" and "Clinical manifestations, diagnosis, and prognosis of Crohn disease in adults", section on 'Clinical features').
- **Intra-abdominal abscess** - Diverticulitis is the most common cause, and other common sites include liver, kidney, genital tract, and psoas muscle. (See "Pyogenic liver abscess" and "Invasive liver abscess syndrome caused by Klebsiella pneumoniae" and "Renal and perinephric abscess" and "Management and complications of tubo-ovarian abscess" and "Posthysterectomy pelvic abscess" and "Psoas abscess" and "Clinical manifestations and diagnosis of acute colonic diverticulitis in adults", section on 'Abscess').
- **Biliary sepsis** – Can be from cholangitis or acute cholecystitis. (See "Acute cholangitis: Clinical manifestations, diagnosis, and management" and "Acute calculous cholecystitis: Clinical features and diagnosis").
- **Splenic rupture** – Some causes include infectious mononucleosis, trauma, and endoscopic manipulation. (See "Management of splenic injury in the adult trauma patient" and "Infectious mononucleosis", section on 'Splenomegaly and splenic rupture').
- **Necrotizing pancreatitis** – This complication of acute pancreatitis increases risk for organ failure and shock and has a higher mortality. (See "Clinical manifestations and diagnosis of acute pancreatitis" and "Management of acute pancreatitis", section on 'Management of complications').
- **Urinary sepsis** – Common causes include pyelonephritis, obstructing nephrolithiasis, urinary tract abnormalities, and recent instrumentation. (See "Acute complicated urinary tract infection (including pyelonephritis) in adults and adolescents", section on 'Complications' and "Kidney stones in adults: Diagnosis and acute management of suspected nephrolithiasis", section on 'Complications').

- **Ectopic pregnancy** - Classic triad amenorrhea, pelvic pain, and vaginal bleeding is often not present. (See "[Ectopic pregnancy: Clinical manifestations and diagnosis](#)" and "[Ectopic pregnancy: Epidemiology, risk factors, and anatomic sites](#)".)
- **Other pregnancy complications** - These include acute placental abruption, necrotic retained products of conception leading to sepsis or toxic shock syndrome, complications of pregnancy termination (including unsafe abortion), and uterine rupture. (See "[Acute placental abruption: Pathophysiology, clinical features, diagnosis, and consequences](#)" and "[Retained products of conception in the first half of pregnancy](#)", section on 'Patients who are hemodynamically unstable' and "[Overview of pregnancy termination](#)", section on 'Complications' and "[Unsafe abortion](#)", section on 'Management' and "[Uterine rupture: Unscarred uterus](#)" and "[Uterine rupture: After previous cesarean birth](#)".)
- **Spontaneous bacterial peritonitis (SBP)** - SBP should be excluded with a diagnostic abdominal paracentesis in a patient with cirrhosis and fever, hypothermia, abdominal pain, altered mental status, diarrhea, ileus, or hypotension. (See "[Spontaneous bacterial peritonitis in adults: Clinical manifestations](#)" and "[Spontaneous bacterial peritonitis in adults: Diagnosis](#)".)
- **Fournier gangrene** - This is a necrotizing fasciitis of the perineum that begins abruptly with severe pain, redness, edema, and induration and spreads rapidly to the anterior abdominal wall and the gluteal muscles. (See "[Necrotizing soft tissue infections](#)".)
- **Toxic megacolon** - This typically presents with at least one week of severe bloody diarrhea followed by acute colonic dilatation. (See "[Toxic megacolon](#)".)
- **Toxic shock syndrome** - Commonly includes abdominal pain, nausea, vomiting, and diarrhea in addition to the characteristic manifestations of fever, rash, hypotension, and multiorgan dysfunction. (See "[Staphylococcal toxic shock syndrome](#)".)
- **Ruptured hemorrhagic ovarian cyst** - Most hemorrhagic cysts stop bleeding spontaneously, and shock is uncommon. (See "[Evaluation and management of ruptured ovarian cyst](#)", section on 'Hemodynamic instability').

Resuscitation — Rapidly initiate treatment when there is a concern for an abdominal catastrophe. This includes emergency department (ED) patients with peritonitis, hypotension or other signs of shock, or toxic appearance. Algorithms summarizing the approach to abdominal pain in adult males, nonpregnant females ([algorithm 1](#)), and pregnant females with hemodynamic instability or peritonitis ([algorithm 2](#)) are provided. The resuscitation is performed simultaneously with the initial evaluation and includes the following:

- **Address airway, breathing, and circulation ("ABCs") and obtain laboratory studies –** Stabilize airway and breathing as needed. Place the patient on a cardiac monitor and provide supplemental oxygen. Establish venous access to obtain laboratory studies and start intravenous (IV) fluids (ie, crystalloid). Vasopressors may be needed for suspected sepsis when fluids do not improve hemodynamics. Administer stress-dose glucocorticoids (eg, [hydrocortisone](#)) if adrenal insufficiency is suspected (eg, chronic glucocorticoid therapy, history of primary adrenal insufficiency). Perform a bedside fingerstick glucose in any seriously ill patient or a patient with known diabetes to assess for hyperglycemia and possible diabetic ketoacidosis. (See '[Ancillary studies](#)' above and "[The decision to intubate](#)" and "[Evaluation and management of suspected sepsis and septic shock in adults](#)", section on '[Initial therapy](#)' and "[Treatment of adrenal insufficiency in adults](#)", section on '[Adrenal crisis](#)').
- **Perform point-of-care ultrasound –** We rapidly perform a bedside ultrasound to examine for an AAA, free intraperitoneal fluid (concerning for hemoperitoneum), pericardial effusion, or hydronephrosis and to measure the inferior vena cava diameter as an indicator of fluids status. (See '[Role of point-of-care ultrasound](#)' above and "[Novel tools for hemodynamic monitoring in critically ill patients with shock](#)", section on '[Vena cava assessment](#)').
- **Transfuse blood products if concern for hemorrhage –** Transfuse blood products in a hemodynamically unstable patient suspected to be hemorrhaging (eg, ruptured AAA, gastrointestinal hemorrhage, ectopic pregnancy, ovarian cyst). (See "[Massive blood transfusion](#)" and "[Use of blood products in the critically ill](#)".)
- **Administer empiric antibiotics –** Administer empiric broad-spectrum antimicrobial therapy as soon as possible to a critically ill patient with concern for abdominal sepsis or peritonitis. In general, empiric regimens for intra-abdominal infections include antimicrobial activity against enteric streptococci, coliforms, and anaerobes. Tables summarizing empiric antibiotic regimens for high-risk ([table 11](#)) and health care-associated intra-abdominal infections ([table 12](#)) are provided. A table and algorithm for empiric broad-spectrum antimicrobial regimens for urinary sources are also provided ([table 13](#) and [algorithm 3](#)). (See "[Antimicrobial approach to intra-abdominal infections in adults](#)", section on '[Empiric antimicrobial therapy](#)' and "[Acute complicated urinary tract infection \(including pyelonephritis\) in adults and adolescents](#)", section on '[Empiric antimicrobial therapy](#)').

Specialty consultation — We consult procedural specialists early in the patient's ED course since surgical intervention and/or percutaneous drainage are often necessary to obtain source

control of intra-abdominal infections (other than spontaneous bacterial peritonitis [SBP]) or to obtain hemostasis of intra-peritoneal hemorrhage. Do not delay consultation while awaiting definitive imaging when there is high clinical suspicion for an abdominal catastrophe. Depending on the preliminary diagnosis, we consult either a general or vascular surgeon, gynecologist, urologist, gastroenterologist, or interventional radiologist, such as in the following circumstances:

- Percutaneous abscess drainage is preferred for an intrabdominal abscess, but surgical intervention may be required to close an anatomic breach or debride infected necrotic tissue. (See "[Antimicrobial approach to intra-abdominal infections in adults](#)", section on '[Source control and drainage](#)').
- An obstructing infected kidney stone is a urologic emergency that requires rapid decompression either by a ureteral stent or a percutaneous nephrostomy tube. (See "[Kidney stones in adults: Surgical management of kidney and ureteral stones](#)", section on '[Emergency surgery](#)').
- A ruptured AAA or ectopic pregnancy will often require definitive surgical hemostasis. (See "[Management of symptomatic \(non-ruptured\) and ruptured abdominal aortic aneurysm](#)", section on '[Ruptured AAA](#)' and "[Tubal ectopic pregnancy: Surgical treatment](#)", section on '[Indications](#)').
- Septic shock from cholecystitis is typically treated with percutaneous cholecystostomy or surgical cholecystectomy. (See "[Treatment of acute calculous cholecystitis](#)", section on '[Gallbladder drainage](#)').
- Cholangitis often requires biliary drainage with an endoscopic retrograde cholangiopancreatography (ERCP). (See "[Acute cholangitis: Clinical manifestations, diagnosis, and management](#)", section on '[Biliary drainage](#)').

Imaging — In a patient with concern for an abdominal catastrophe, the choice of imaging (beyond point-of-care ultrasound) depends upon the acuity of the presentation, the patient's capacity to tolerate a study, stability for transport to radiology, risk of not diagnosing the etiology versus risk of transport to radiology, and consultant requirements for operative planning. The timing of imaging may need to be coordinated with the procedural consultant and/or intensivist, since resuscitation may need to be continued until the patient is stable for advanced imaging or a definitive procedure.

- In a patient who stabilizes with initial resuscitation, it is reasonable to follow the imaging approach discussed below. (See '[Patient without abdominal catastrophe](#)' below.)

- In a patient with concern for sepsis of abdominal origin or hollow viscous perforation, obtain a portable upright chest radiograph (CXR), which is the initial screening study for pneumoperitoneum ([image 9](#)). Immediate surgical consultation is required if pneumoperitoneum is identified. An upright CXR detects as little as 1 to 2 mL of free air after the patient has been upright for 5 to 10 minutes compared with approximately 5 mL detected by a plain abdominal radiograph [44,56]. An upright lateral CXR is even more sensitive for pneumoperitoneum ([image 10](#) and [image 11](#)) [57]. (See "[Overview of gastrointestinal tract perforation](#)", section on '[Chest imaging](#)').

The location of the perforation determines the likelihood of detecting pneumoperitoneum, which is present in only two-thirds of gastroduodenal perforation and in only one-third of perforation of the distal small bowel or large bowel. Sensitivity decreases further in patients with previous abdominal surgery or a walled-off perforation [56].

A left lateral decubitus radiograph can be obtained in patients too ill for upright films and may detect pneumoperitoneum under the diaphragm above the liver edge ([image 12](#)). Detection can be improved by placing a nasogastric tube and injecting 50 mL of air or water-soluble contrast, but this is rarely performed unless the patient is too unstable to be moved for computed tomography (CT) scan.

- In a patient without a diagnosis and management plan after point-of-care ultrasound and/or upright CXR (if performed), we obtain an abdominopelvic CT scan, which is the imaging modality most likely to provide the diagnosis in a patient with an abdominal catastrophe. In a hemodynamically stable patient, the risk of not diagnosing the etiology will often outweigh the risk of transporting the patient to radiology. IV contrast is preferred if concerned for an AAA, aortic dissection, or mesenteric ischemia, but hemorrhage from leaking or ruptured AAA can also be visualized on nonenhanced CT ([image 13](#)). (See '[Overview of common imaging modalities](#)' above.)

In a patient suspected of having a ruptured AAA, CT confirms the rupture and evaluates feasibility of endovascular repair. However, in a hemodynamically unstable patient with a known AAA or point-of-care ultrasound-visualized AAA, CT imaging is desirable for the surgeon but is not absolutely required prior to intervention. Imaging decisions in the unstable patient should be made in consultation with the surgeon or proceduralist. (See "[Clinical features and diagnosis of abdominal aortic aneurysm](#)", section on '[Imaging symptomatic patients](#)').

- In a patient with biliary, kidney, pregnancy-related, or ovarian pathology, the surgeon or proceduralist may request a radiology-performed ultrasound for further evaluation. If the

patient is hemodynamically unstable and point-of-care ultrasound images confirm a diagnosis, we discuss with the surgeon or proceduralist whether the risks of definitive treatment delay and patient transport to radiology for an additional study are outweighed by any additional information that study may provide.

PATIENT WITHOUT ABDOMINAL CATASTROPHE

Evaluation in pregnant patients — The approach to acute abdominal or pelvic pain in a hemodynamically stable pregnant patient without peritonitis is provided in the algorithm ([algorithm 4](#)) and discussed in detail separately. (See "[Approach to acute abdominal/pelvic pain in pregnant and postpartum patients](#)".)

Testing decisions must account for the physiologic changes that occur in pregnancy and the desire to avoid ionizing radiation exposure. As examples, a pregnant patient can have fewer clinical findings and may not demonstrate peritoneal signs, possibly because the peritoneum is desensitized to irritation from the gradual growth and stretching [58,59]. Round ligament pain, nausea, and vomiting can occur early in pregnancy. White blood cell counts increase to a normal range of 10,000 to 14,000 cells/mm³. (See "[Approach to acute abdominal/pelvic pain in pregnant and postpartum patients](#)", section on 'Physiologic changes of pregnancy that impact differential diagnosis'.)

The enlarged uterus can make localizing pain challenging, although with appendicitis, the area around the McBurney point is still the most common location of tenderness regardless of gestational age. (See "[Acute appendicitis in pregnancy](#)", section on 'Clinical features').

- **Abdominal and pelvic ultrasound** – We start with an ultrasound to evaluate the pregnancy (if documented intrauterine pregnancy), to evaluate for ectopic pregnancy (if undocumented intrauterine pregnancy), and to assess for other causes such as appendicitis, nephrolithiasis, gallbladder disease, and uterine rupture. (See "[Approach to acute abdominal/pelvic pain in pregnant and postpartum patients](#)", section on 'Imaging' and "[Ultrasonography of pregnancy of unknown location](#)" and "[Ectopic pregnancy: Clinical manifestations and diagnosis](#)", section on 'Transvaginal ultrasound').
- **Abdominopelvic magnetic resonance imaging (MRI)** – If the cause of abdominal pain is not consistent with an obstetric etiology (eg, appendicitis), or other potentially serious abdominal pathology cannot be excluded clinically or by ultrasound, we obtain an abdominopelvic MRI (without gadolinium), which is as accurate as computed tomography (CT) for the diagnosis of many disorders but does not expose the patient to ionizing

radiation. CT can be performed when clinical findings and ultrasound examination are equivocal and MRI is not available. (See ["Approach to acute abdominal/pelvic pain in pregnant and postpartum patients"](#), section on 'Imaging'.)

Evaluation in nonpregnant patients — An algorithm summarizing the approach to abdominal pain in adult males and nonpregnant females ([algorithm 1](#)) is provided.

Cause identified by history and physical — In a patient in whom the history, examination, and laboratory studies (if performed) identify a clear etiology, further testing can often be deferred or avoided. Examples of such scenarios include the following:

- A patient with umbilical or inguinal pain and bulge that resolves after reduction of the hernia. However, an incarcerated hernia that is not easily reduced can cause severe pain and require immediate surgical consultation. (See ["Overview of abdominal wall hernias in adults"](#) and ["Classification, clinical features, and diagnosis of inguinal and femoral hernias in adults"](#).)
- A patient with a zoster rash in the dermatomal distribution of the pain. (See ["Epidemiology, clinical manifestations, and diagnosis of herpes zoster"](#), section on 'Clinical manifestations'.)
- A patient with crampy diffuse abdominal pain, no abdominal tenderness, and complete resolution of pain after a bowel movement. However, constipation is a diagnosis of exclusion in an emergency department (ED) patient with ongoing pain. (See ["Etiology and evaluation of chronic constipation in adults"](#), section on 'Evaluation').)
- A patient with non-bloody diarrhea (with or without vomiting and fever) that is more prominent than the abdominal pain, especially if there was recent travel or similar symptoms among close contacts. Although common, gastroenteritis and foodborne diseases are typically diagnoses of exclusion in the ED, but imaging can often be avoided in a patient with improving symptoms and a low suspicion for alternate etiology. (See ["Acute viral gastroenteritis in adults"](#) and ["Approach to the adult with acute diarrhea in resource-abundant settings"](#) and ["Approach to the adult with acute diarrhea in resource-limited settings"](#) and ["Causes of acute infectious diarrhea and other foodborne illnesses in resource-abundant settings"](#).)
- A young patient (eg, <40 years old) with intermittent, burning epigastric pain that occurs several hours after meals, associated gastroesophageal reflux, normal laboratory studies, and a nontender abdominal examination. However, we do not definitively diagnose an ED patient with gastritis, reflux, or peptic ulcer disease since upper gastrointestinal

endoscopy confirms the diagnosis and is not routinely performed in the ED. Also, intermittent upper abdominal pain can be a symptom of other diseases, such as biliary colic and acute coronary syndrome. In these circumstances, especially when imaging is deferred, it is prudent to diagnose nonspecific abdominal pain, provide clear ED return precautions, and encourage outpatient follow-up for re-evaluation. (See "[Peptic ulcer disease: Clinical manifestations and diagnosis](#)".)

- A young male patient with right lower quadrant pain/tenderness or a patient with left lower quadrant pain/tenderness and a prior history of diverticular disease may be diagnosed clinically with appendicitis or diverticulitis, respectively. These scenarios are discussed further below. (See '[Other patients \(eg, lower abdominal pain\)](#)' below.)

Cause not identified by history and physical

Suspected acute vascular process — A patient with severe, sudden-onset abdominal pain that is out of proportion to findings on examination, especially with a history of atherosclerosis or dysrhythmia, should be evaluated for an acute vascular process. (See '[Differential diagnosis of abdominal catastrophe](#)' above.)

- **Preferred imaging: CT angiography (CTA)** – We obtain an intravenous (IV) contrast-enhanced chest/abdomen/pelvis CTA in a patient with heightened concern for mesenteric ischemia, aortic dissection, or abdominal aortic aneurysm (AAA). A CTA accurately visualizes the mesenteric vasculature, shows changes consistent with bowel infarction, and is less invasive compared with standard angiography [60]. A CTA also reliably identifies other abdominal pathology when ischemia is not the cause of abdominal pain [61]. (See "[Overview of intestinal ischemia in adults](#)", section on '[Advanced abdominal imaging](#)' and "[Chronic mesenteric ischemia](#)", section on '[Vascular imaging](#)' and "[Clinical features and diagnosis of acute aortic dissection](#)", section on '[Cardiovascular imaging](#)').

• Alternative imaging options

- **Abdominopelvic CT (non-angiography)** – Although not as accurate as a CTA, an IV contrast-enhanced or nonenhanced CT can still be diagnostic. CT has a sensitivity of nearly 100 percent in diagnosing AAA, and compared with ultrasound, it is not limited by bowel gas or body habitus. Hemorrhage from leaking or ruptured AAA can be visualized on nonenhanced CT, making IV contrast unnecessary in emergency situations or when IV contrast may be contraindicated. (See "[Clinical features and diagnosis of abdominal aortic aneurysm](#)", section on '[Imaging symptomatic patients](#)').

An IV contrast-enhanced abdominopelvic CT will screen for ischemia and evaluate for other potential etiologies in a patient with a less specific clinical presentation [47]. (See "Overview of intestinal ischemia in adults", section on 'Advanced abdominal imaging'.)

- **Magnetic resonance angiography (MRA)** – MRA may be necessary in a patient with an allergy to iodinated contrast and a heightened concern for mesenteric ischemia. MRA is also more sensitive than CT for diagnosing mesenteric venous thrombosis. (See "Overview of intestinal ischemia in adults", section on 'Advanced abdominal imaging' and "Mesenteric venous thrombosis in adults", section on 'Imaging'.)

Plain radiographs in patients with mesenteric ischemia are often unremarkable and therefore should not be obtained in patients with a suspected acute vascular process. The presence of radiographic findings suggests late disease and correlates with increased mortality. Findings include ileus, "thumbprinting" (large bowel wall thickening with edematous haustra at regular intervals), and intramural air (pneumatosis intestinalis). In one study, patients with these findings had a mortality of 78 percent compared with 29 percent in patients with normal radiographs [62].

Suspected intestinal obstruction — Signs and symptoms suggesting bowel obstruction include nausea, vomiting, cramping periumbilical or diffuse abdominal pain, increased belching, obstipation, and abdominal distension. (See "Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults", section on 'Clinical presentations' and "Large bowel obstruction", section on 'Clinical presentations'.)

Imaging decisions are guided by the acuity of the presentation and history of prior episodes of obstruction, especially if abdominopelvic CT scans were obtained during prior episodes. We obtain plain abdominal radiographs (including upright chest radiograph [CXR]) in a patient suspected of having a bowel obstruction to quickly confirm the diagnosis, expedite consultation, and exclude findings that indicate the need for immediate intervention (eg, pneumoperitoneum, volvulus, pneumatosis intestinalis). This is typically followed by abdominopelvic CT to further characterize the nature, severity, and potential etiologies of the obstruction. (See "Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults", section on 'Preferred initial studies for most patients' and "Large bowel obstruction", section on 'Imaging'.)

- **Initial imaging in most patients: Plain abdominal radiographs** — These are approximately 80 percent sensitive and 70 to 80 percent specific for diagnosing a small bowel obstruction (SBO) but can be "normal, nonspecific, or misleading" in 10 to 20 percent of patients. An SBO is likely if the small bowel is dilated >2.5 cm, there is gaseous

distention, or air-fluid levels are present ([image 14](#) and [image 15](#)) [63]. The radiographic finding of a curvilinear array of small gas bubbles ("string of beads" sign), which occurs from air collecting between the valvulae conniventes floating in a fluid-filled bowel, is pathognomonic for SBO [56]. (See ["Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults"](#), section on 'Plain radiography'.)

It is reasonable to not obtain plain radiographs if CT will be performed regardless, especially if the patient does not have clinical signs of bowel ischemia or perforation and has not had prior CT imaging showing obstruction. Obtaining radiographs may prolong the ED evaluation. Additionally, abdominal radiographs are in the higher range of average effective radiation dose compared with plain radiographs of other areas (eg, chest) [64].

- **Additional imaging in most patients: Abdominopelvic CT** – IV-contrast enhanced abdominopelvic CT is needed in most patients to further characterize the nature, severity, and potential etiologies of the obstruction ([image 16](#) and [image 17](#)). CT without contrast enhancement can possibly diagnose SBO. In a patient with suspected partial or intermittent SBO, the surgeon may request an oral and IV contrast-enhanced CT since the presence or absence of contrast distal to the site of suspected obstruction helps guide management. (See ["Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults"](#), section on 'Abdominal CT'.)

However, in a patient with plain radiographs confirming obstruction, a CT may not be necessary and should be obtained in discussion with the consulting surgeon. For example, plain radiographs may be sufficient in a patient with recurrent intermittent obstructions, especially if they are followed closely by a surgeon and have had multiple prior CT scans in the setting of prior obstructions that have resolved with conservative measures. (See ["Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults"](#), section on 'Recurrent intermittent obstruction').

Right upper quadrant or epigastric pain — Imaging of a patient with right upper quadrant or epigastric pain depends on the results of liver enzymes and lipase and whether the patient has had a cholecystectomy. Causes of right upper quadrant pain ([table 14](#)) and epigastric pain ([table 15](#)) often include diseases of the liver and biliary system, pancreas, and stomach and are discussed in detail separately. (See ["Causes of abdominal pain in adults"](#), section on 'Upper abdominal pain syndromes').

- **Patient without previous cholecystectomy or with elevation of liver enzymes or lipase: Right upper quadrant ultrasound** – A right upper quadrant ultrasound is the first-line study in these patients. An ultrasound can help delineate pathology within the

gallbladder and liver, assess for biliary dilatation, and determine whether gallstones are the cause of acute pancreatitis. For detection of gallstones, an ultrasound is more sensitive than CT, which has a sensitivity that ranges from 55 to 80 percent and can miss gallstones that are isodense with bile. (See "[Overview of gallstone disease in adults](#)", section on '[Transabdominal ultrasound](#)' and "[Clinical manifestations and diagnosis of acute pancreatitis](#)", section on '[Abdominal ultrasound](#)').

- **Patient with previous cholecystectomy and normal liver enzymes and lipase or as second-line study: Abdominal CT** – An abdominal CT (IV-contrast enhanced) is the typical second-line study if the right upper quadrant ultrasound does not identify the cause of pain and the patient is felt to need further imaging (eg, high-risk features ([table 1](#)), persistent pain or tenderness, leukocytosis, pain is not consistent with gastritis). A CT can identify causes and complications of pancreatitis or a contained duodenal perforation. In general, a CT obtained for right upper quadrant pain is less likely to be abnormal compared with other indications [15]. (See "[Overview of gallstone disease in adults](#)", section on '[General approach](#)').

Flank pain or abnormal testicular exam — A table summarizing the differential diagnosis of flank pain in an adult patient with a normal genitourinary examination is provided ([table 16](#)). An abnormal scrotal examination suggests genitourinary pathology, which can present with lower abdominal pain, flank pain, and/or hematuria. The presence of hematuria suggests renal, ureteral, or bladder pathology. (See "[Acute scrotal pain in adults](#)" and "[Etiology and evaluation of hematuria in adults](#)").

- **Abnormal scrotal examination: Scrotal ultrasound** – We obtain a scrotal ultrasound in a male with an abnormal scrotal examination to evaluate for torsion, epididymitis, or masses. Testicular torsion is more common in younger males but can still occur in older males, in whom an incarcerated inguinal hernia is more common. In a patient with high clinical suspicion for torsion, we consult a urologist prior to imaging confirmation. (See "[Acute scrotal pain in adults](#)".)
- **Suspected nephrolithiasis: Kidney ultrasound or abdominopelvic CT** – Most patients with suspected nephrolithiasis should have imaging to identify the stone and/or assess for hydronephrosis. However, renal colic can be a clinical diagnosis; thus, we may forego imaging in young patients without suspicion for a serious alternative diagnosis (eg, cholecystitis, appendicitis, AAA) or patients with recurrent stones who have been previously managed conservatively (eg, analgesia, hydration). We prefer kidney ultrasound in patients with kidney stones visualized on imaging during prior episodes, pregnant patients, and those felt to be at low risk for serious alternative diagnoses. In other

patients, those with high-risk features (eg, obesity [males >129 kg, females >113 kg], kidney transplant, dialysis dependency, a solitary kidney, and age >76 years [65]), and patients with a urinalysis suggesting infection, we perform a noncontrast abdominopelvic CT. If ultrasound or CT is available, we do not perform abdominal radiography (ie, kidneys-ureters-bladder radiograph) because it has low sensitivity for detecting nephrolithiasis (72 percent for stones >5 mm but only 8 to 29 percent for a stone of any size) [66,67].

- **Kidney ultrasound** – An ultrasound-first approach (either emergency physician point-of-care or radiology performed) is safe and effective, and it limits cumulative radiation exposure in low-risk populations with suspected nephrolithiasis [65]. However, compared with noncontrast abdominopelvic CT, ultrasound is less accurate at identifying kidney ([image 18](#)) and ureteral calculi. In patients presenting with acute flank pain, ultrasound is nearly 100 percent sensitive for obstructive uropathy (ie, hydronephrosis ([image 8](#)), ureteral dilatation ([image 19](#)), perinephric fluid). A larger ureteral calculi (>5 mm) is less likely to be present if ultrasound does not visualize hydronephrosis, but these secondary obstructive signs of nephrolithiasis may not develop in the first two hours or with a smaller calculi [68]. Thus, a CT is sometimes performed after a negative ultrasound if a definitive diagnosis is desired, the patient has unyielding pain, or if the CT is needed for treatment planning. (See "[Kidney stones in adults: Diagnosis and acute management of suspected nephrolithiasis](#)", section on '[Ultrasound of the kidneys and bladder](#)'.)
- **Abdominopelvic CT** – A noncontrast CT reliably detects nephrolithiasis and hydronephrosis ([image 20](#) and [image 21](#)) and can aid with spontaneous passage prognosis by assessing the stone size and location. CT can also exclude ruptured AAA, a catastrophic renal colic mimic, and thus is especially valuable in patients without prior abdominal imaging and with AAA risk factors (eg, advancing age, male sex, tobacco use, other large vessel aneurysms, family history of AAA, atherosclerosis, hypertension). If we have a high suspicion that the pain is from nephrolithiasis, we perform a noncontrast CT because contrast-enhanced parenchyma with early excretion into the pelvicalyceal system can occasionally obscure calculi within the collecting system. In other patients, performing an IV contrast-enhanced CT is reasonable since it allows for evaluating other etiologies of flank pain while preserving high sensitivity for identifying calculi large enough to be at risk of not passing spontaneously [69]. (See "[Kidney stones in adults: Diagnosis and acute management of suspected nephrolithiasis](#)", section on '[Noncontrast CT](#)').

- **Other pathology suspected (eg, renal, retroperitoneal): Abdominopelvic CT or CT urography (CTU)** – In a patient who has flank pain not suspected to be from nephrolithiasis and is clinically judged to need imaging (eg, pain is not consistent with muscle strain or herpes zoster), we obtain an abdominopelvic CT (with IV contrast). This study will identify most important etiologies such as AAA, obstructive uropathy, perinephric abscess, renal infarction, and retroperitoneal hemorrhage.

A CTU is indicated in a patient with unexplained hematuria or increased risk of urinary malignancy (see "[Etiology and evaluation of hematuria in adults](#)", section on '[Risk factors for malignancy](#)'). CTU describes an imaging acquisition protocol of the abdomen and pelvis in which noncontrast images are obtained initially, followed by IV-contrast enhanced images and delayed excretory phase imaging that opacifies the collecting system, ureters, and urinary bladder. CTU protocols vary slightly with each site, and a discussion with the radiologist is likely to be helpful to determine if the contrast-enhanced images are necessary. (See "[Etiology and evaluation of hematuria in adults](#)", section on '[CT urography](#)').

Lower abdominal pain in female patient — Further evaluation is guided by history and findings on abdominal and pelvic examination. Examples of clinical factors that favor various etiologies of pain include the following:

- Dysuria, urinary urgency or frequency, pyuria, hematuria, vaginal or endocervical discharge, or cervical motion tenderness favors cervicitis, pelvic inflammatory disease (PID), or urinary tract infection (UTI) (see '[Suspected UTI, cervicitis, or PID](#)' below)
- Sudden onset of sharp, severe pain with maximal intensity at onset, pelvic location of pain, vaginal bleeding, or adnexal tenderness favors gynecologic cause other than cervicitis or pelvic inflammatory disease (see '[Other gynecologic cause suspected](#)' below)
- Migration of pain, nausea, vomiting, or anorexia favors appendicitis over a gynecologic cause [[70-72](#)] (see '[Nongynecologic cause suspected](#)' below)

The differential diagnosis of acute pelvic pain in adult females by age group ([table 17](#)) and by clinical features ([table 18](#)) are summarized in the tables and discussed in detail separately. (See "[Causes of abdominal pain in adults](#)", section on '[Females](#)').

Suspected UTI, cervicitis, or PID — A patient with a history, examination, and laboratory studies indicative of cervicitis, PID, or UTI may not need imaging and can be treated with oral antibiotics and close outpatient follow-up. Additional testing (eg, pelvic ultrasound, CT, or MRI) may be warranted for a patient who is acutely ill (eg, fever, peritonitis, hypotension), has

a presentation atypical for PID or UTI (eg, abnormal site or duration of symptoms), or has not improved significantly within 72 hours after starting empiric antibiotic therapy. These findings suggest the possibility of a complication of PID (eg, tubo-ovarian abscess) or an alternate diagnosis (eg, appendicitis), which can be difficult to differentiate from PID without imaging [70]. (See "[Pelvic inflammatory disease: Clinical manifestations and diagnosis](#)" and "[Acute simple cystitis in adult and adolescent females](#)".)

Other gynecologic cause suspected

- **First-line: Pelvic (+/- abdominal) ultrasound** – In a nonpregnant female with pelvic or lower abdominal pain whose presentation suggests a gynecologic cause of pain, we obtain a pelvic ultrasound to evaluate for ovarian torsion or ruptured ovarian cyst. If there is clinical suspicion, a concurrent abdominal ultrasound can be obtained to evaluate for appendicitis, nephrolithiasis, or a tubo-ovarian abscess. (See "[Ovarian and fallopian tube torsion](#)", section on '[Ultrasound](#)' and "[Evaluation and management of ruptured ovarian cyst](#)", section on '[Imaging studies](#)' and "[Epidemiology, clinical manifestations, and diagnosis of tubo-ovarian abscess](#)", section on '[Imaging studies](#)' and "[Kidney stones in adults: Diagnosis and acute management of suspected nephrolithiasis](#)", section on '[Ultrasound of the kidneys and bladder](#)' and "[Acute appendicitis in adults: Clinical manifestations and differential diagnosis](#)", section on '[Ultrasound findings](#)'.)
- **Second-line: abdominopelvic CT** – An abdominopelvic CT (IV-contrast enhanced) is the typical second-line study if the ultrasound does not identify the cause of pain and the patient is felt to need further imaging (eg, high-risk features ([table 1](#)), leukocytosis, persistent pain [especially if requiring multiple opioid doses], abdominal tenderness or distension).

Nongynecologic cause suspected — A nonpregnant female with a normal pelvic examination and abdominal pain concerning for a nongynecologic cause is best evaluated with an abdominopelvic CT. (See '[Other patients \(eg, lower abdominal pain\)](#)' below.)

High-risk patients

Older adults — We have a low threshold to obtain imaging in older adults with abdominal or flank pain because serious abdominal pathology is more likely, misdiagnosis is common, and associated mortality is increased. The characteristic presentation of diseases provides the initial basis for assessment and imaging, even in older patients, but clinicians must remain mindful of atypical presentations of common diseases and extra-abdominal causes of pain (eg, myocardial infarction).

- **Epidemiology** – Older patients (ie, ≥65 years) with abdominal pain have a six- to eightfold increase in mortality compared with younger patients [8,18]. Approximately one-half to two-thirds require hospitalization, one-fifth to one-third require surgical intervention, and 5 percent die within two months [3,9,18,28,73,74]. A study of the United States National Hospital Ambulatory Medical Care Survey from 2013 to 2017 found that 3.6 percent of patients 65 years or older were admitted directly from the ED to the operating room [75].

Misdiagnosis of abdominal pain is common in older adults, especially in those ≥75 years, and associated with higher mortality compared with younger patients [18,76].

- **Atypical presentations** – Older patients are more likely to have symptoms of disease that are not characteristic in younger individuals (ie, "atypical" symptoms) and clinical presentations that underestimate the severity of disease, such as not mounting a fever or tachycardia in response to infection or inflammation [74,77,78]. Older patients are more likely to take medications, such as beta-blockers and glucocorticoids, and have comorbidities such as diabetes that can mask characteristic symptoms and signs.

As examples, older adults with a perforated ulcer can present without the typical sudden onset of pain [16]. Older adults with appendicitis often present without characteristic findings (eg, pain migration) and are less likely to have a leukocytosis [16,79-81]. Older adults with an intra-abdominal infection are four times more likely than younger patients to present with hypothermia [9].

Biliary tract disease is among the most common causes of abdominal pain in older adults but also frequently presents without characteristic abdominal pain or tenderness. Older adults diagnosed surgically with cholecystitis presented more often with nausea or vomiting instead of pain; 84 percent had neither epigastric nor right upper quadrant pain [78]. A Murphy sign may not be present, and liver enzymes are less frequently abnormal in older adults with cholecystitis [82-84].

- **Physical examination differences** – Physical examination cannot reliably predict or exclude significant disease in older adults [28]. In a study of hospitalized older adults with peritonitis, only 34 percent manifested guarding or rebound tenderness [29]. With increasing age, the loss of spinal afferent innervation can limit hollow viscous and peritoneal nociception [85,86].

Malignancy — We have a low threshold to obtain imaging in a patient with an active malignancy and abdominal or flank pain. Chemotherapy and radiation therapy themselves can produce abdominal pain, but this should be a diagnosis of exclusion. For example, vincristine can cause severe, colicky abdominal pain for up to 10 days after administration. However,

serious pathology is also possible, such as neutropenic enterocolitis (typhlitis), which typically occurs during the neutrophil count nadir in a patient receiving chemotherapy for leukemia. (See "[Clinical presentation and risk factors for chemotherapy-associated diarrhea, constipation, and intestinal perforation](#)" and "[Neutropenic enterocolitis \(typhlitis\)](#)".)

HIV infection — The diagnostic evaluation of abdominal and flank pain in the adult with human immunodeficiency virus (HIV) is similar to adults without HIV but is also guided by immunologic function based on the CD4 cell count. We have a low threshold to obtain imaging in a patient with advanced immunodeficiency (CD4 cell count <100 cells/microL). Of HIV-positive patients presenting with abdominal pain, 38 percent will require admission [87]. The differential diagnosis includes common etiologies (eg, appendicitis, diverticulitis, undifferentiated abdominal pain) but also opportunistic infections (eg, cytomegalovirus [CMV], *Mycobacterium avium* complex [MAC], cryptosporidium) and neoplasms (eg, Kaposi sarcoma, lymphoma) [87,88]. Additionally, some protease inhibitors (eg, [atazanavir](#)) can cause radiolucent kidney stones that are not visualized on CT. (See "[AIDS-related cytomegalovirus gastrointestinal disease](#)" and "[Mycobacterium avium complex \(MAC\) infections in persons with HIV](#)" and "[Cryptosporidiosis: Epidemiology, clinical manifestations, and diagnosis](#)" and "[AIDS-related Kaposi sarcoma: Clinical manifestations and diagnosis](#)" and "[HIV-related lymphomas: Clinical manifestations and diagnosis](#)" and "[Crystal-induced acute kidney injury](#)", section on 'Protease inhibitors'.)

Sickle cell disease — We have a low threshold to obtain imaging if the abdominal or flank pain is not typical of previous pain episodes. A patient with sickle cell disease can have intermittent abdominal pain as part of a vaso-occlusive episode but is also at increased risk of having gallstones, cholecystitis, acute hepatic sequestration, acute splenic sequestration, renal papillary necrosis, UTI, pyelonephritis, or opioid-induced constipation. (See "[Evaluation of acute pain in sickle cell disease](#)", section on 'Abdominal pain' and "[Hepatic manifestations of sickle cell disease](#)".)

Organ transplant recipient — An organ transplant recipient with abdominal or flank pain often requires imaging (eg, CT, MRI) because transplanted organs are denervated and lose normal lymphatic drainage and thus do not have characteristic manifestations of pathology. Additionally, immunosuppressive agents can mask signs and symptoms of peritonitis or systemic infection. Common and opportunistic abdominal infections can develop, such as cytomegalovirus colitis, hepatitis B and C viral infections, gastrointestinal parasites (eg, *Cryptosporidium* and *Microsporidium*), and UTIs, particularly in kidney transplant recipients. Post-surgical undrained fluid collections or blockage or leaks of anastomoses can cause pain or become infected. Acute kidney rejection can present with allograft pain and tenderness. Kidney

transplant recipients with pain and tenderness over their kidney allograft, and selected patients diagnosed with a UTI should have an ultrasound of the allograft. (See "Urinary tract infection in kidney transplant recipients", section on 'Imaging/urologic evaluation in selected patients' and "Infection in the solid organ transplant recipient" and "Kidney transplantation in adults: Evaluation and diagnosis of acute kidney allograft dysfunction".)

Immunosuppressive agents increase risk of various malignancies that can present with abdominal or flank pain. For example, kidney transplant recipients are at increased risk of renal cell carcinoma, anogenital cancers, and post-transplant lymphoproliferative disorders that can cause abdominal pain if extranodal masses arise in the stomach or intestine. (See "Overview of care of the adult kidney transplant recipient", section on 'Malignancy' and "Epidemiology, clinical manifestations, and diagnosis of post-transplant lymphoproliferative disorders".)

Bariatric surgery — Many complications of bariatric surgery cause abdominal pain and can present weeks, months, or years after the surgery. A contrast-enhanced (often both IV and oral) abdominopelvic CT is typically necessary, but imaging decisions should be made in consultation with the patient's bariatric surgeon. Imaging with CT is essentially required if the surgeon cannot be reached or the specifics of the procedure are unavailable (eg, surgery performed internationally). Some patients will need endoscopy or laparoscopic exploration even if the CT is normal. In addition to bowel obstruction, other potential complications include (see "Bariatric operations: Early (fewer than 30 days) morbidity and mortality" and "Bariatric operations: Late complications with acute presentations" and "Bariatric operations: Late complications with subacute presentations") [89-91]:

- Roux-en-Y gastric bypass – Gastric remnant distension, stomal stenosis, marginal ulceration
- Gastric banding – Stomal obstruction, port infection, band erosion or movement
- Sleeve gastrectomy – Gastric leaks, gastric outlet syndrome

Other patients (eg, lower abdominal pain) — In a patient with abdominal or flank pain who does not fit into any of the above categories, the decision to image and choice of study differs based on the patient's sex, age, and location of pain. In general, we obtain imaging in a patient with high-risk features (table 1), leukocytosis or other laboratory abnormalities, persistent pain (especially if requiring multiple opioid doses), abdominal tenderness or distension; and at a surgeon's request. In a patient with no indications for imaging, further management is based on shared decision-making and may include discharge with clear ED return precautions or observation for serial abdominal examinations.

The differential diagnoses of lower abdominal pain (table 19), diffuse abdominal pain (table 20), and left upper quadrant pain (table 21) are provided in the tables and discussed in detail separately. (See "Causes of abdominal pain in adults", section on 'Lower abdominal pain syndromes' and "Causes of abdominal pain in adults", section on 'Diffuse abdominal pain syndromes' and "Causes of abdominal pain in adults", section on 'Left upper quadrant pain'.)

In a young male patient with a high clinical suspicion for appendicitis (right lower quadrant abdominal pain and tenderness, anorexia, nausea/vomiting, leukocytosis, modified Alvarado score ≥ 4 (table 22)), we obtain surgical consultation prior to imaging. The surgeon may request imaging based on clinical suspicion and the local acceptable nontherapeutic operative rate. (See "Acute appendicitis in adults: Diagnostic evaluation".)

Mesenteric lymphadenitis (ie, inflammation of the mesenteric lymph nodes) is a common benign cause of nonspecific abdominal pain but can mimic appendicitis [92]. It is a diagnosis of exclusion in the ED and can often be identified by the presence of enlarged lymph nodes on abdominopelvic CT or abdominal ultrasound (the latter may not be sufficient to exclude appendicitis). Causes include viral infections (the most common), bacterial infections (eg, gastroenteritis), inflammatory bowel disease, and lymphoma. If caused by a viral infection, the course is self-limited, resolving within several weeks. (See "Causes of acute abdominal pain in children and adolescents", section on 'Mesenteric lymphadenitis').

- **First-line: Abdominopelvic CT** – In a male or nonpregnant female with suspected nongynecologic etiology with lower abdominal (especially right lower quadrant), left upper quadrant, or diffuse abdominal pain, an IV contrast-enhanced abdominopelvic CT is the study with the best accuracy. Even in the absence of IV contrast, CT is still helpful to diagnose appendicitis and other conditions since inflammatory changes in mesenteric fat are a secondary finding in many processes (eg, pericecal and periappendiceal fat in case of appendicitis). However, such inflammatory changes can be obscured in young, slender patients with little retroperitoneal and mesenteric fat. We do not routinely administer oral contrast, which is discussed further above. (See 'Overview of common imaging modalities' above.)

In a patient with left lower quadrant pain, an IV contrast-enhanced abdominopelvic CT is the most accurate modality to diagnose diverticulitis [93]. While CT is not necessary for all patients with suspected diverticulitis, it is helpful to confirm the diagnosis in a patient without a previous history of diverticular disease and to assess for complications (eg, perforation, abscess formation) in a patient with known disease but severe symptoms. When symptoms are consistent with prior diverticulitis episodes, we will use shared decision-making regarding treatment and reassessment versus immediate imaging. (See

"Clinical manifestations and diagnosis of acute colonic diverticulitis in adults", section on 'Diagnostic approach'.)

- **Alternative imaging options**

- **Abdominal ultrasound** – An abdominal ultrasound, if used for the appropriate indication, is an alternative imaging option that avoids exposing the patient to ionizing radiation or IV contrast. It can evaluate the aorta, liver, spleen, biliary tract, pregnancy, reproductive organs, bladder, kidneys, and appendix but is not typically helpful in evaluating bowel pathology.

When used to diagnose appendicitis, test performance is variable and depends on patient-specific (eg, body habitus, discomfort and alertness, appendix location relative to overlying bowel) and operator-specific (eg, experience) variables. Ultrasound has a reported sensitivity of approximately 85 percent and a specificity of 90 percent. Rates of indeterminate examinations are high, with 50 to 85 percent of normal appendices not visualized. (See "Acute appendicitis in adults: Diagnostic evaluation", section on 'Ultrasound').

- **MRI** – MRI is an accurate alternative to CT for excluding intra-abdominal pathology (eg, appendicitis) when trying to avoid radiation exposure or administering CT contrast. Use of MRI to diagnose appendicitis is discussed separately. (See "Acute appendicitis in adults: Diagnostic evaluation", section on 'Magnetic resonance imaging').

ANALGESIA

We offer the patient targeted analgesia to facilitate the emergency department (ED) evaluation. The goal of analgesia is to reduce the pain to manageable levels, improve patient comfort, and possibly improve the accuracy of the abdominal examination by minimizing voluntary guarding. The goal is **not** to eliminate all pain or make the patient somnolent.

Non-opioid therapy is often preferable to minimize opioid use and avoid adverse effects. Common options include the following:

- **Acetaminophen** – This is helpful as part of multimodal analgesia for all patients with acute pain and without contraindications, such as severe hepatic insufficiency or active liver disease. (See "Nonopioid pharmacotherapy for acute pain in adults", section on 'Acetaminophen').

- **Nonsteroidal antiinflammatory drugs (NSAIDs)** – [Ketorolac](#) is a first-line analgesic for renal colic. NSAIDs, including ketorolac, can be helpful for acute abdominal pain in many other circumstances but should be used cautiously since they can exacerbate gastritis, peptic ulcer disease, and acute kidney injury. (See "[Kidney stones in adults: Diagnosis and acute management of suspected nephrolithiasis](#)", section on 'Pain control' and "[Nonopioid pharmacotherapy for acute pain in adults](#)", section on 'Nonsteroidal anti-inflammatory drugs'.)
- **Antacids** – These usually contain a combination of magnesium trisilicate, aluminum hydroxide, or [calcium carbonate](#) and can rapidly relieve pain from gastroesophageal reflux disease. The "GI cocktail" commonly used in the ED is a mixture of viscous [lidocaine](#), an antacid (eg, Maalox), and occasionally an anticholinergic agent (eg, Donnatal). However, pain improvement after an antacid is nondiagnostic since pain from biliary colic and acute coronary syndrome can resolve spontaneously, but the relief may be attributed to the effects of the antacid [94]. (See "[Antiulcer medications: Mechanism of action, pharmacology, and side effects](#)", section on 'Antacids').)

Opioid analgesia may be required for a patient with severe pain or pain that does not improve with these measures. [Morphine](#), [hydromorphone](#), or [fentanyl](#) (which is preferable when shorter duration or fewer hemodynamic effects are desired) are reasonable choices when an opioid is felt to be necessary. We give opioids in intermittent doses titrated to effect with close monitoring of respiration.

Multiple trials have disproved the notion that analgesia interferes with the assessment of abdominal pain [95-99]. Opioids can alter the physical examination of patients with acute abdominal pain, but they do not result in more frequent incorrect management decisions [98].

Alternative, less frequently used options for analgesia include the following:

- **First-generation antipsychotic agents** – In a patient with recalcitrant pain, especially associated with vomiting or the cannabis hyperemesis syndrome, [droperidol](#) (0.625 or 1.25 mg) or [haloperidol](#) (0.05 to 0.1 mg/kg, maximum single dose 2.5 mg) is often helpful. (See "[Cannabinoid hyperemesis syndrome](#)".)
- **Ketamine** – A small trial of adults with primarily nontraumatic abdominal or flank pain found that a nondissociative dose of [ketamine](#) (0.3 mg/kg) produced comparable analgesia to [morphine](#) (0.1 mg/kg) without serious adverse events [100]. (See "[Nonopioid pharmacotherapy for acute pain in adults](#)", section on 'Ketamine').)

- **Morphine with patient-controlled analgesia (PCA)** – Although not used routinely, several trials of ED patients with nontraumatic abdominal pain have found that morphine PCA produced greater reductions in pain and no differences in adverse events when compared with standard management using the same medication [101,102].

The Guidelines for Reasonable and Appropriate Care in the Emergency Department 2 (GRACE-2) recommend an opioid-minimizing approach for analgesia in patients with low-risk, recurrent, undifferentiated abdominal pain [103]. The GRACE-2 definition of recurrent pain is two or more prior similar episodes within 12 months, with the time elapsed from the first episode to the current episode being greater than 30 days. Patients with the following characteristics were excluded from the low-risk category:

- Unstable vital signs
- History and physical examination findings suggesting acute abdominal pathology
- Age <18 years or ≥65 years
- Pregnancy
- Acute trauma within seven days
- Organ transplantation
- Immunosuppression
- Abdominal surgery within 30 days
- Active cancer
- Inflammatory bowel disease
- Previous bowel obstruction
- Severe active psychiatric illness

DISPOSITION

In a patient whose cause of pain is identified, the disposition is relatively straightforward and based on management of the specific etiology. However, in a patient with an unrevealing evaluation, the disposition depends upon age, comorbidities, extent of pain, need for pain management, whether imaging was performed, certainty of imaging results, likelihood of serious disease, availability of expedited follow-up care, and reliability and social supports. This generally involves shared decision-making with the patient.

Less common causes of abdominal pain, many of which are not typically diagnosed during an emergency department (ED) visit, are discussed separately. (See "[Causes of abdominal pain in adults](#)", section on 'Less common causes'.)

- **Patient with normal cross-sectional imaging (computed tomography [CT] or magnetic resonance imaging [MRI]) and laboratory results** – We will reassure and discharge most patients with nonspecific abdominal or flank pain, even older adults, who have normal cross-sectional imaging and laboratory results. A normal abdominopelvic CT increases physician comfort with not identifying a specific cause for the abdominal pain and with discharging a patient who might otherwise be admitted for observation [104]. Discharged patients must be provided with clear, written instructions of potential danger signs and where and when to return for emergency care or re-evaluation. One common approach is to instruct the patient to follow up for re-evaluation with their primary care clinician in 12 to 48 hours or to return to the ED if they cannot not be seen by their outpatient clinician in that timeframe.

After an appropriate ED evaluation, most patients with a diagnosis of nonspecific abdominal pain have a benign condition that resolves without further intervention [7,105,106]. For example, in a study of 1411 patients discharged from the ED with nonspecific abdominal pain, 112 patients (8 percent) returned to the ED with abdominal pain [107]. Of these, 85 patients were again diagnosed with nonspecific pain while 17 (1 percent) had an operation, eight were diagnosed with cholelithiasis, five with appendicitis, and two with gastrointestinal cancer.

- **Patient with continued concern for serious pathology despite normal imaging** – If there remains doubt about the nature or seriousness of the underlying cause, especially in older adults or those with comorbidities, we will admit to the hospital or observe the patient for a prolonged period in the ED. In a patient with abdominal pain of unclear etiology, observation and reassessment can often determine the cause or exclude serious pathology. For example, several studies found that a period of observation increased the diagnostic accuracy for appendicitis [23,108].
- **Patient with uncontrolled pain** – It can be challenging to determine the disposition of a patient who is requiring multiple intravenous (IV) opioid doses for pain management without a specific diagnosis identified after a thorough ED evaluation. Guidelines suggest an opioid-minimizing approach for analgesia in patients with low-risk, recurrent, undifferentiated abdominal pain [103]. We suggest having a discussion with the patient regarding the risks of continued opioid therapy versus their limited benefit prior to making the decision to admit for pain control or discharging with a prescription for oral opioids. (See '[Analgesia](#)' above and "[Evaluation of the adult with abdominal pain](#)", section on '[Diagnostic approach to chronic abdominal pain](#)' and "[Use of opioids in the management of chronic non-cancer pain](#)", section on '[Indications for opioid therapy](#)').

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "[Society guideline links: Nontraumatic abdominal pain in adults](#)".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topic (see "[Patient education: Abdominal pain \(The Basics\)](#)")

SUMMARY AND RECOMMENDATIONS

- **Initial evaluation** – The evaluation of an adult emergency department (ED) patient with abdominal or flank pain starts with obtaining a history, performing a physical examination, and rapidly assessing if the patient may have an abdominal catastrophe (clues include hypotension or other signs of shock, peritonitis, toxic appearance). High-risk features of abdominal pain must be appreciated ([table 1](#)). (See '[Overview of the evaluation](#)' above.)
- **History** – The quality, timing, and location of pain help determine the acuity and focus the differential diagnosis ([table 2](#) and [figure 1](#) and [table 3](#) and [table 16](#)). Pain that is severe and maximum intensity at onset is concerning for a vascular emergency (eg, aortic rupture or dissection, mesenteric ischemia, pulmonary embolism), obstruction of a small tubular structure (eg, ureter), or reproductive organ pathology (eg, ovarian torsion,

ruptured ovarian cyst). The presence of associated symptoms ([table 6](#)), pre-existing medical and surgical conditions, medications, and social history ([table 7](#)) increases a patient's risk for various diseases. (See '[History](#)' above.)

- **Physical examination** – Abdominal palpation localizes the tenderness and detects signs of peritoneal irritation, such as involuntary guarding and muscular rigidity. A rigid abdomen is cause for concern, but traditional techniques for assessing rebound tenderness have limited sensitivity and specificity for identifying peritonitis. (See '[Physical examination](#)' above.)
- **Role of point-of-care ultrasound** – Emergency physician-performed point-of-care ultrasound has become an important tool for the evaluation of patients with abdominal pain. Ultrasound is especially helpful in the unstable patient or when there is concern for abdominal catastrophe. It can identify hemoperitoneum, abdominal aortic aneurysm (AAA), intrauterine pregnancy, gallstones, a distended urinary bladder, pericardial effusion, and hydronephrosis and measure inferior vena cava diameter as an indicator of fluids status. (See '[Role of point-of-care ultrasound](#)' above.)
- **Ancillary studies** – Unless the history and physical examination establish the cause of pain, most patients will need laboratory studies, which are discussed in the text. (See '[Ancillary studies](#)' above.)
- **Patient with suspected abdominal catastrophe** – Abdominal processes that can cause ischemia, sepsis, or hemorrhage and become a life-threatening abdominal catastrophe are presented in the table ([table 10](#)). An approach in a pregnant patient with hemodynamic instability or peritonitis is presented in the algorithm ([algorithm 2](#)). (See '[Differential diagnosis of abdominal catastrophe](#)' above.)

Start treatment simultaneously with the initial evaluation when there is a concern for an abdominal catastrophe. Establish venous access, start intravenous (IV) fluids (ie, crystalloid), obtain laboratory studies, and perform point-of-care ultrasound. Patients may need vasopressors, stress-dose glucocorticoids, blood product transfusion, and/or empiric broad-spectrum antibiotics. (See '[Resuscitation](#)' above.)

We consult procedural specialists early in the patient's ED course since surgical intervention and/or percutaneous drainage are usually necessary to obtain source control of intra-abdominal infections or to obtain hemostasis of intraperitoneal hemorrhage. (See '[Specialty consultation](#)' above.)

Obtain a portable upright chest radiograph (CXR) since the presence of pneumoperitoneum confirms the diagnosis of hollow viscous perforation. Abdominopelvic computed tomography (CT) is the preferred study in a patient with a suspected abdominal catastrophe and undifferentiated abdominal. (See '[Imaging](#)' above.)

- **Patient without abdominal catastrophe** – Further evaluation depends on the patient's pregnancy status. The approach to acute abdominal or pelvic pain in a hemodynamically stable pregnant patient without peritonitis is provided in the algorithm ([algorithm 4](#)) and discussed in detail separately. (See "[Approach to acute abdominal/pelvic pain in pregnant and postpartum patients](#)", section on 'Acute abdominal pain related to pregnancy or the reproductive tract'.)

The evaluation of the adult male and nonpregnant female is provided in the algorithm ([algorithm 1](#)) and discussed further in the text. (See '[Cause not identified by history and physical](#)' above.)

Further testing can sometimes be deferred or avoided when the history, examination, and laboratory studies (if performed) identify a clear etiology. Example scenarios are provided in the text. (See '[Cause identified by history and physical](#)' above.)

- **High-risk conditions** – Risk factors for serious causes of abdominal and flank pain include older age, immunocompromise, human immunodeficiency virus (HIV) infection, active malignancy, taking chronic glucocorticoids or immunosuppressants, alcohol misuse, recipient of an organ transplant, sickle cell disease, prior abdominal (especially bariatric) surgeries, cardiovascular disease, and recent instrumentation. (See '[High-risk patients](#)' above.)
- **Analgesia** – We offer the patient targeted analgesia to facilitate the ED evaluation. Analgesics, including opioids, do not interfere with the assessment of abdominal pain and do not result in more frequent incorrect management decisions. The goal of analgesia is to reduce pain to manageable levels, improve patient comfort, and possibly improve the accuracy of the examination by minimizing voluntary guarding. The goal is **not** to eliminate all pain. We minimize opioid administration in patients with low-risk, recurrent, undifferentiated abdominal pain. (See '[Analgesia](#)' above.)
- **Disposition** – In a patient who does not have a specific etiology identified, the disposition depends upon age, comorbidities, extent of pain, need for pain management, whether imaging was performed, certainty of imaging results, likelihood of serious disease, availability of expedited follow-up care, and reliability and social supports. We will reassure and discharge most patients with nonspecific abdominal pain, even older adults, who have

a normal CT and laboratory results. If there remains doubt about the nature or seriousness of the underlying cause, especially in older adults or those with high-risk conditions, we will admit to the hospital or observe the patient in the ED. (See 'Disposition' above.)

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Topic 290 Version 52.0

GRAPHICS

Features of high risk abdominal pain

History

Age over 65

Immunocompromised (eg, HIV, chronic glucocorticoid treatment)

Alcoholism (risk of hepatitis, cirrhosis, pancreatitis)

Cardiovascular disease (eg, CAD, PVD, hypertension, atrial fibrillation)

Major comorbidities (eg, cancer, diverticulosis, gallstones, IBD, pancreatitis, renal failure)

Prior surgery or recent GI instrumentation (risk of obstruction, perforation)

Early pregnancy (risk of ectopic pregnancy)

Pain characteristics

Sudden onset

Maximal at onset

Pain then subsequent vomiting

Constant pain of less than two days duration

Exam findings

Tense or rigid abdomen

Involuntary guarding

Signs of shock

CAD: coronary artery disease; HIV: human immunodeficiency virus; IBD: inflammatory bowel disease;

PWD: peripheral vascular disease.

Quality of abdominal pain and selected examples

Quality of pain	Selected examples of diseases	
Dull, poorly localized, crampy, and midline (visceral pain)	Appendicitis	<ul style="list-style-type: none"> ▪ Subtle, gradually worsening, vague perumbilical pain ▪ Subsequent migration to sharp, right lower quadrant pain (becomes parietal pain) ▪ Nausea and vomiting follows onset of pain
	Small bowel obstruction	<ul style="list-style-type: none"> ▪ Perumbilical, crampy, paroxysmal pain ▪ Associated with nausea, vomiting, obstipation, abdominal distension
Distinct, sharp, and localized (parietal pain)	Ovarian cyst rupture	<ul style="list-style-type: none"> ▪ Sudden onset of unilateral lower abdominal pain ▪ Pain often begins during strenuous physical activity (eg, exercise or sexual intercourse) ▪ May be accompanied by light vaginal bleeding
	Diverticulitis	<ul style="list-style-type: none"> ▪ Left lower quadrant (if sigmoid colon is involved) constant pain that develops over several days ▪ May have localized peritoneal signs (eg, localized guarding and rebound tenderness) ▪ Often accompanied by nausea, vomiting, and a change in bowel habits
Pain that waxes and wanes in intensity (colicky pain)	Nephrolithiasis	<ul style="list-style-type: none"> ▪ Severe, sudden-onset abdominal or flank pain ▪ Paroxysms of severe pain usually last 20 to 60 minutes ▪ Radiates to the flank or groin ▪ Associated with hematuria in most patients
Burning pain	Gastroesophageal reflux disease	<ul style="list-style-type: none"> ▪ Burning sensation, commonly retrosternal and occurring in the postprandial period ▪ May be associated with regurgitation (perception of flow of refluxed gastric content into the mouth or hypopharynx)
Tearing pain	Aortic dissection	<ul style="list-style-type: none"> ▪ Acute-onset pain commonly in chest or back ▪ Pain can extend into abdomen if abdominal aorta involved or mesenteric vasculature is compromised

Causes of abdominal pain by location

Right upper quadrant	Left upper quadrant
Hepatitis	Splenic abscess
Cholecystitis	Splenic infarct
Cholangitis	Gastritis
Biliary colic	Gastric ulcer
Pancreatitis	Pancreatitis
Budd-Chiari syndrome	
Pneumonia/empyema pleurisy	
Subdiaphragmatic abscess	
Right lower quadrant	Left lower quadrant
Appendicitis	Diverticulitis
Salpingitis	Salpingitis
Ectopic pregnancy	Ectopic pregnancy
Inguinal hernia	Inguinal hernia
Nephrolithiasis	Nephrolithiasis
Inflammatory bowel disease	Irritable bowel syndrome
Mesenteric adenitis (yersina)	Inflammatory bowel disease
Epigastric	Diffuse
Peptic ulcer disease	Gastroenteritis
Gastroesophageal reflux disease	Mesenteric ischemia
Gastritis	Metabolic (eg, DKA, porphyria)
Pancreatitis	Malaria
Myocardial infarction	Familial Mediterranean fever
Pericarditis	Bowel obstruction
Ruptured aortic aneurysm	Peritonitis
Perumbilical	Irritable bowel syndrome
Early appendicitis	
Gastroenteritis	
Bowel obstruction	

Ruptured aortic aneurysm

DKA: diabetic ketoacidosis.

Graphic 70233 Version 4.0

Causes of acute pelvic pain in adult females by organ system

Reproductive tract	Urinary tract
Gynecologic: Infectious <ul style="list-style-type: none">▪ Pelvic inflammatory disease▪ Endometritis▪ Salpingitis▪ Tubo-ovarian abscess	Cystitis Pyelonephritis Painful bladder syndrome Kidney stones Urinary retention Malignancy (bladder cancer)
Gynecologic: Noninfectious <ul style="list-style-type: none">▪ Dysmenorrhea▪ Ovarian cyst (ruptured or intact)▪ Endometriosis▪ Uterine leiomyoma (fibroid): Degenerating or not▪ Adenomyosis▪ Mittelschmerz (midcycle ovulatory pain)▪ Adnexal torsion (ovary and/or fallopian tube)▪ Ovarian hyperstimulation syndrome▪ Endosalpingiosis▪ Uterine perforation (in women who have undergone a uterine procedure)▪ Asherman's syndrome▪ Neoplasm	Vascular Abdominal aortic aneurysm and dissection Sickle cell disease crisis Septic pelvic thrombophlebitis Ovarian vein thrombosis Pelvic congestion syndrome
Pregnancy-related <ul style="list-style-type: none">First trimester<ul style="list-style-type: none">▪ Threatened abortion▪ Ectopic pregnancy, including heterotopic pregnancy▪ Corpus luteum hematoma▪ Incomplete abortion▪ Septic abortion▪ Uterine impactionSecond and third trimesters<ul style="list-style-type: none">▪ Preterm labor▪ Chorioamnionitis▪ Placental abruption▪ Degenerating uterine leiomyoma (fibroid)	Musculoskeletal Muscular strain or sprain Abdominal wall hematoma or infection Hernia (inguinal or femoral) Pelvic fracture Myofascial pain
	Neurologic Herpes zoster Anterior cutaneous nerve entrapment syndrome Abdominal epilepsy ^[5] Abdominal migraine ^[6]
	Psychiatric Depression Somatization disorder Narcotic seeking

	<ul style="list-style-type: none"> ▪ Medical complications during pregnancy, such as appendicitis ▪ Round ligament stretch
Postpartum	
	<ul style="list-style-type: none"> ▪ Endometritis ▪ Wound infection (cesarean section, laceration, or episiotomy repair) ▪ Ovarian vein thrombosis or septic pelvic thrombophlebitis
Gastrointestinal	
Appendicitis	
Irritable bowel syndrome	
Diverticulitis	
Inflammatory bowel disease	
Fecal impaction or constipation	
Gastroenteritis	
Mesenteric lymphadenitis	
Abdominopelvic adhesions	
Perforated viscus	
Bowel obstruction	
Incarcerated or strangulated hernia	
Ischemic bowel	
Hirschsprung disease ^[1]	
Intussusception ^[2]	
Meckel's diverticulum ^[3]	
Volvulus ^[4]	

This table presents common etiologies but is not meant to be exhaustive.

TNF: tumor necrosis factor; TRAPS: tumor necrosis factor receptor-associated periodic syndrome.

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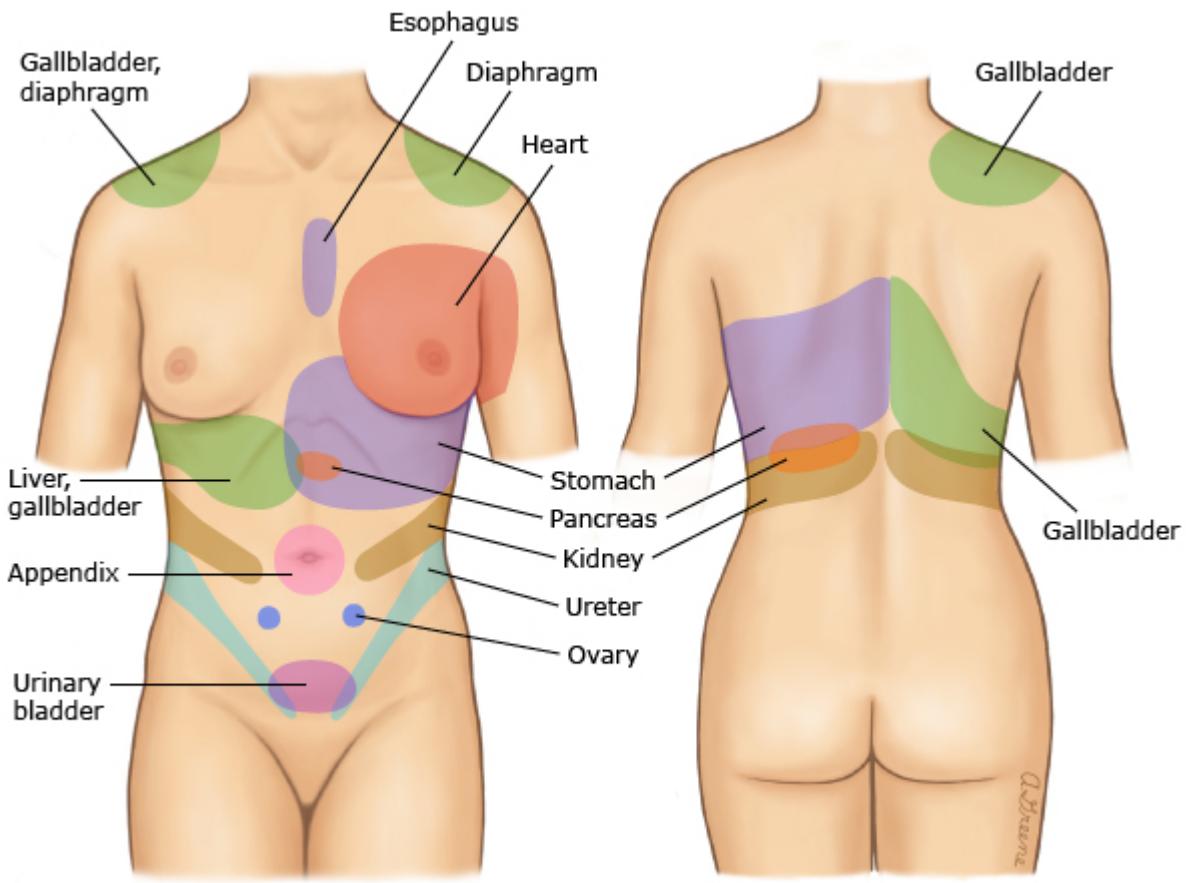
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Graphic 120867 Version 2.0

Patterns of referred abdominal pain



Pain from abdominal viscera often (but not always) localizes according to the structure's embryologic origin, with foregut structures (mouth to proximal one-half of duodenum) presenting with upper abdominal pain, midgut structures (distal one-half of duodenum to middle of the transverse colon) presenting with perumbilical pain, and hind gut structures (remainder of colon and rectum, pelvic genitourinary organs) presenting with lower abdominal pain. Radiation of pain may provide insight into the diagnosis. As examples, pain from pancreatitis may radiate to the back, while pain from gallbladder disease may radiate to the right shoulder or subscapular region.

Graphic 61375 Version 8.0

Selected extra-abdominal causes of acute abdominal pain

Cardiac	Hematologic
<ul style="list-style-type: none">▪ Myocardial ischemia and infarction▪ Myocarditis▪ Endocarditis▪ Heart failure	<ul style="list-style-type: none">▪ Sickle cell anemia▪ Hemolytic anemia▪ Henoch-Schönlein purpura▪ Acute leukemia
Thoracic	Toxins
<ul style="list-style-type: none">▪ Pneumonitis▪ Pleurodynia▪ Pulmonary embolism and infarction▪ Pneumothorax▪ Empyema▪ Esophagitis▪ Esophageal spasm▪ Esophageal rupture (Boerhaave's syndrome)	<ul style="list-style-type: none">▪ Hypersensitivity reactions: insect bites, reptile venoms▪ Heavy metals and corrosives (eg, lead or iron)
Neurologic	Infections
<ul style="list-style-type: none">▪ Radiculitis: spinal cord or peripheral nerve tumors, degenerative arthritis of spine▪ Abdominal epilepsy▪ Tabes dorsalis (tertiary syphilis)	<ul style="list-style-type: none">▪ Herpes zoster▪ Osteomyelitis▪ Typhoid fever
Metabolic	Miscellaneous
<ul style="list-style-type: none">▪ Uremia▪ Diabetic ketoacidosis▪ Porphyria▪ Acute adrenal insufficiency▪ Hyperlipidemia▪ Hyperparathyroidism▪ Hypercalcemia	<ul style="list-style-type: none">▪ Muscular contusion, hematoma, or tumor▪ Opioid withdrawal▪ Familial Mediterranean fever▪ Psychiatric disorders▪ Heat stroke

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Symptoms associated with abdominal pain

Symptoms	General notes	Selected examples of diseases
Fever and chills	<p>Although generally nonspecific, a fever suggests an infectious or inflammatory process. It can occur with an intra-abdominal process or with a systemic infection or inflammatory process that can also cause abdominal pain.</p>	<ul style="list-style-type: none">▪ Infectious mononucleosis – Most patients will have fever, while many will have splenic enlargement or mesenteric adenitis that can manifest as abdominal pain.▪ Rocky Mountain spotted fever – In the early phase, most patients have nonspecific signs and symptoms such as fever and can have abdominal pain and nausea. The onset of abdominal pain prior to the rash can lead to a misdiagnosis such as appendicitis, cholecystitis, and even bowel obstruction.
Nausea and vomiting	<p>Although these are nonspecific symptoms, the order of appearance and quality of emesis may provide a clue to the diagnosis.</p> <ul style="list-style-type: none">▪ Vomiting that starts after the onset of pain is more likely to have a surgical process.▪ Bilious emesis suggests obstruction distal to the duodenum.▪ Relatively benign etiologies tend to cause self-limited vomiting.▪ Coffee-ground emesis suggests hematemesis.	<ul style="list-style-type: none">▪ Appendicitis▪ Diverticulitis▪ Bowel obstruction▪ Gastroenteritis▪ Gastritis▪ Peptic ulcer disease
Fatigue, weight loss, anorexia	<p>These constitutional symptoms are concerning for malignancy or systemic illnesses.</p>	<ul style="list-style-type: none">▪ Ovarian cancer – This can present with abdominal distension, dyspepsia, flatulence, anorexia, pelvic pressure, back pain, rectal fullness, or urinary symptoms.▪ Colorectal cancer – This can present with abdominal pain associated with changes in

		<p>bowel habits, weight loss, and rectal bleeding.</p> <ul style="list-style-type: none"> ▪ Systemic lupus erythematosus – Up to 40% of patients will have gastrointestinal manifestations during their lifetime, which can include dysphagia, diarrhea, peptic ulcer disease, intestinal pseudo-obstruction, hepatitis pancreatitis, mesenteric vasculitis with intestinal infarction, peritonitis, and ascites. ▪ Hypercalcemia – This can present with vague abdominal pain associated with anorexia, nausea, vomiting, and constipation.
Diarrhea	This is often associated with an infectious cause but can also occur with others.	<ul style="list-style-type: none"> ▪ Gastroenteritis ▪ Diverticulitis ▪ Mesenteric ischemia (may be bloody) ▪ Bowel obstruction ▪ Inflammatory bowel disease (ie, Chron, ulcerative colitis)
Obstipation or constipation	Obstipation (ie, inability to pass flatus or stool), especially associated with increased belching and abdominal distension, is suggestive of a bowel obstruction.	<ul style="list-style-type: none"> ▪ Bowel obstruction. ▪ Constipation – This is a common cause of abdominal pain but should be a diagnosis of exclusion in an emergency department patient. ▪ Irritable bowel syndrome – This often presents with swings between diarrhea and constipation. This should be a diagnosis of exclusion that is made in the outpatient setting (instead of the emergency department) since this requires persistent symptoms for 3 months to 1 year.
Dysuria, urinary urgency, urinary frequency, hematuria	These suggest a genitourinary cause of pain.	<ul style="list-style-type: none"> ▪ Urinary tract infection – This often presents with suprapubic discomfort associated with urinary symptoms. ▪ Pyelonephritis – Fever ($>38^{\circ}\text{C}$), flank pain, costovertebral angle tenderness, and nausea or vomiting suggest upper tract infection and warrant more aggressive diagnostic and therapeutic measures. ▪ Nephrolithiasis – This causes flank pain and hematuria but can also cause lower abdominal pain if the stone is in the ureterovesical junction ▪ Prostatitis. ▪ Epididymitis.
Vaginal discharge, vaginal bleeding,	These suggest a gynecologic etiology of	<ul style="list-style-type: none"> ▪ Ectopic pregnancy – This characteristically presents with pelvic pain, vaginal bleeding, and

abnormal uterine bleeding	abdominal pain.	<p>amenorrhea.</p> <ul style="list-style-type: none"> ▪ Pelvic inflammatory disease – This commonly presents with bilateral lower abdominal pain that often starts during or shortly after menses. Pain that worsens during coitus or with jarring movement may be the only symptom. Can also cause abnormal uterine bleeding, new vaginal discharge, urethritis, and fever. This is rarely complicated by tubo-ovarian abscess or perihepatitis (Fitz-Hugh-Curtis syndrome). ▪ Endometriosis – This present with pelvic pain that is often chronic and worse during menses or ovulation, dysmenorrhea, and deep dyspareunia.
Scrotal pain	Scrotal pathology can cause lower abdominal pain that does not always localize to the scrotum.	<ul style="list-style-type: none"> ▪ Testicular torsion – This characteristically presents with severe, sudden-onset pain following vigorous activity or testicular trauma. ▪ Inguinal hernia.

Graphic 142352 Version 1.0

Past medical/social history and medications that increase the risk of diseases that cause abdominal or flank pain

Past history or medications	Selected diseases with increased risk
Past medical history	
■ Atherosclerosis ■ Peripheral vascular disease	■ Mesenteric ischemia ■ Abdominal aortic aneurysm
■ Atrial fibrillation ■ Heart failure	■ Mesenteric ischemia
■ Diabetes mellitus	■ Gastroparesis ■ Intra-abdominal infections ■ Constipation ■ Diabetic ketoacidosis
■ HIV	■ Opportunistic infections (eg, cytomegalovirus, <i>Mycobacterium avium</i> complex, cryptosporidium) ■ Neoplasms (eg, Kaposi sarcoma, lymphoma)
■ Sickle cell disease	■ Vaso-occlusive pain episode ■ Gallstones, cholecystitis ■ Acute hepatic or splenic sequestration ■ Renal papillary necrosis ■ Urinary tract infection, pyelonephritis
■ Primary (Addison disease) or secondary adrenal insufficiency	■ Adrenal crisis
Medications	
■ Nonsteroidal antiinflammatory drugs	■ Peptic ulcer disease
■ Antibiotics	■ <i>Clostridioides difficile</i> colitis
■ Glucocorticoids (chronic therapy)	■ Masking symptoms of serious pathology (eg, no mounting fever or peritoneal signs) ■ Adrenal insufficiency ■ Gastritis, peptic ulcer disease ■ Hollow viscus perforation
■ Opioids	■ Constipation ■ Withdrawal (causes abdominal cramping, nausea)

■ Anticoagulant or antiplatelet	■ Rectus sheath hematoma ■ Retroperitoneal hematoma
■ HIV antiretroviral therapy	■ Nephrolithiasis ■ Pancreatitis
■ Leukemia chemotherapy	■ Neutropenic enterocolitis (typhlitis)

Social history

■ Alcohol use disorder	■ Alcoholic ketoacidosis ■ Gastritis ■ Pancreatitis ■ Hepatitis ■ Cirrhosis (complicated by spontaneous bacterial peritonitis)
■ Tobacco use	■ Peptic ulcer disease ■ Abdominal aortic aneurysm ■ Bladder cancer (as well as other malignancies)
■ Cannabis	■ Cannabis hyperemesis syndrome
■ New or multiple sexual partners	■ Sexually transmitted infections

HIV: human immunodeficiency virus.

Graphic 142349 Version 1.0

Drugs associated with constipation

Analgesics

Anticholinergics

Antihistamines

Antispasmodics

Antidepressants

Antipsychotics

Cation-containing agents

Iron supplements

Aluminum (antacids, sucralfate)

Barium

Neurally active agents

Opiates

Antihypertensives

Ganglionic blockers

Vinca alkaloids

Calcium channel blockers

5HT3 antagonists

Graphic 62307 Version 2.0

Classification of shock

	Septic	<ul style="list-style-type: none"> ▪ Gram positive (<i>Pneumococcus, Staphylococcus, Streptococcus, Enterococcus, Listeria</i>) ▪ Gram negative (<i>Klebsiella, Pseudomonas, Escherichia, Haemophilus, Legionella, Neisseria, Moraxella, Rickettsia, Francisella [tularemia]</i>) ▪ Fungal (<i>Candida, Aspergillus</i>) ▪ Viral (influenza, cytomegalovirus, Ebola, varicella) ▪ Parasitic (<i>Plasmodium, Ascaris, Babesia</i>) ▪ Mycobacterium (<i>Mycobacterium tuberculosis, Mycobacterium abscessus</i>)
Distributive	Non-septic	<ul style="list-style-type: none"> ▪ Inflammatory shock (systemic inflammatory response syndrome) – Burns, trauma, pancreatitis, postmyocardial infarction, post coronary bypass, post cardiac arrest, viscus perforation, amniotic fluid embolism, fat embolism, idiopathic systemic capillary leak syndrome ▪ Neurogenic shock – Traumatic brain injury, spinal cord injury (quadriplegia with bradycardia or paraplegia with tachycardia), neuraxial anesthesia ▪ Anaphylactic shock – IgE-mediated (eg, foods, medications, insect bites or stings), IgE-independent (eg, iron dextran), nonimmunologic (eg, exercise or heat-induced), idiopathic ▪ Other – Liver failure, transfusion reactions, vasoplegia (eg, vasodilatory agents, cardiopulmonary bypass), toxic shock syndrome, toxicologic (eg, heavy metals), beriberi
Cardiogenic	Cardiomyopathic	<ul style="list-style-type: none"> ▪ Myocardial infarction (involving >40% of the left ventricle or with extensive ischemia) ▪ Severe right ventricle infarction ▪ Acute exacerbation of severe heart failure from dilated cardiomyopathy ▪ Stunned myocardium from prolonged ischemia (eg, cardiac arrest, hypotension, cardiopulmonary bypass) ▪ Advanced septic shock ▪ Myocarditis ▪ Myocardial contusion ▪ Drug-induced (eg, beta blockers)
	Arrhythmogenic	<ul style="list-style-type: none"> ▪ Tachyarrhythmia – Atrial tachycardias (fibrillation, flutter, reentrant tachycardia), ventricular tachycardia and fibrillation

		<ul style="list-style-type: none"> Bradyarrhythmia – Complete heart block, Mobitz type II second degree heart block
	Mechanical	<ul style="list-style-type: none"> Severe valvular insufficiency, acute valvular rupture (papillary or chordae tendineae rupture, valvular abscess), critical valvular stenosis, acute or severe ventricular septal wall defect, ruptured ventricular wall aneurysm, atrial myxoma
Hypovolemic	Hemorrhagic	<ul style="list-style-type: none"> Trauma, gastrointestinal bleeding (eg, varices, peptic ulcer), intraoperative and postoperative bleeding, retroperitoneal bleeding (eg, ruptured aortic aneurysm), aortic-enteric fistula, hemorrhagic pancreatitis, iatrogenic (eg, inadvertent biopsy of arteriovenous malformation, or left ventricle), tumor or abscess erosion into major vessels, ruptured ectopic pregnancy, postpartum hemorrhage, uterine or vaginal hemorrhage (eg, infection, tumors, lacerations), spontaneous peritoneal hemorrhage from bleeding diathesis
	Non-hemorrhagic	<ul style="list-style-type: none"> Gastrointestinal losses (eg, diarrhea, vomiting, external drainage); skin losses (eg, heat stroke, burns, dermatologic conditions); renal losses (eg, excessive drug-induced or osmotic diuresis, salt-wasting nephropathies, hypoaldosteronism); third space losses into the extravascular space or body cavities (eg, postoperative and trauma, intestinal obstruction, crush injury, pancreatitis, cirrhosis)
Obstructive	Pulmonary vascular	<ul style="list-style-type: none"> Hemodynamically significant pulmonary embolus, severe pulmonary hypertension, severe or acute obstruction of the pulmonic or tricuspid valve, venous air embolus
	Mechanical	<ul style="list-style-type: none"> Tension pneumothorax or hemothorax (eg, trauma, iatrogenic), pericardial tamponade, constrictive pericarditis, restrictive cardiomyopathy, severe dynamic hyperinflation (eg, elevated intrinsic PEEP), left or right ventricular outflow tract obstruction, abdominal compartment syndrome, aorto-caval compression (eg, positioning, surgical retraction)
Mixed/unknown		<ul style="list-style-type: none"> Endocrine (eg, adrenal insufficiency, thyrotoxicosis, myxedema coma) Metabolic (eg, acidosis, hypothermia) Other – Polytrauma with more than one shock category, acute shock etiology with pre-existing cardiac disease, late under-resuscitated shock, miscellaneous poisonings

Aortic dissection causes shock when retrograde dissection results in cardiac tamponade, acute aortic insufficiency, and myocardial infarction; please refer to the UpToDate topic text for details.

PEEP: positive end-expiratory pressure.

Graphic 99574 Version 7.0

Grey Turner sign

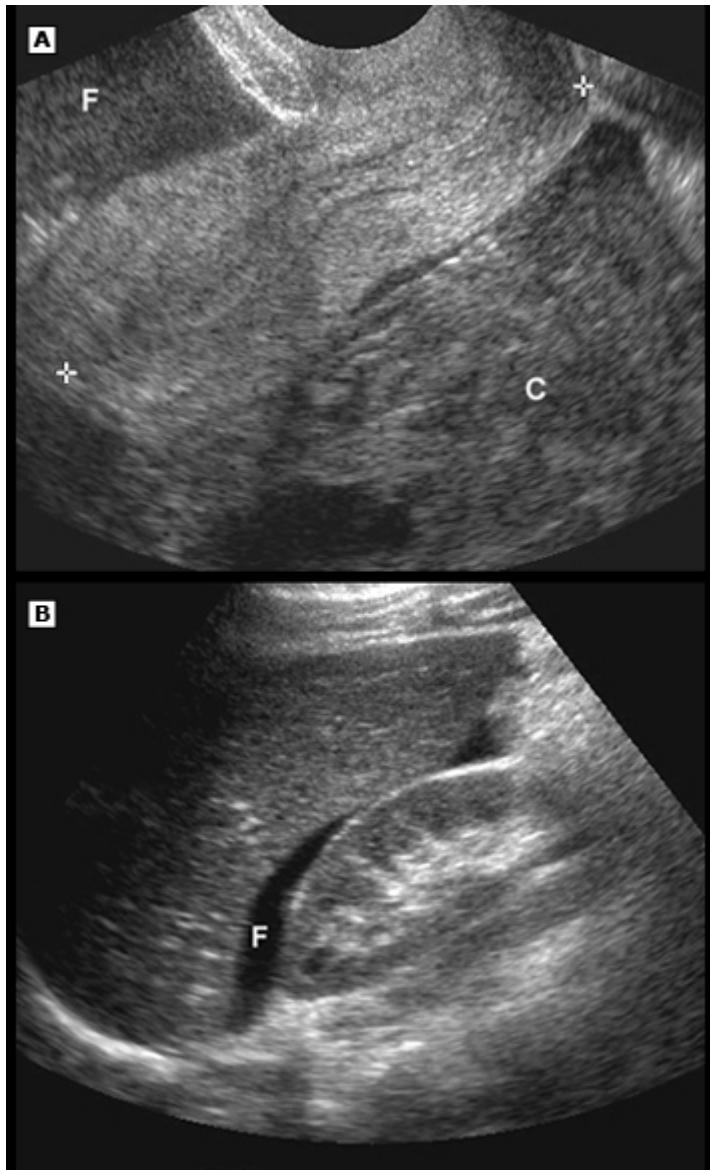


Grey Turner sign refers to flank ecchymoses that result from blood tracking subcutaneously from a retroperitoneal or intraperitoneal source.

*Reproduced from: Masha L, Bernard S. Grey Turner's sign suggesting retroperitoneal haemorrhage. Lancet 2014; 383:1920.
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Graphic 95719 Version 1.0

Female pelvic and abdominal hemoperitoneum

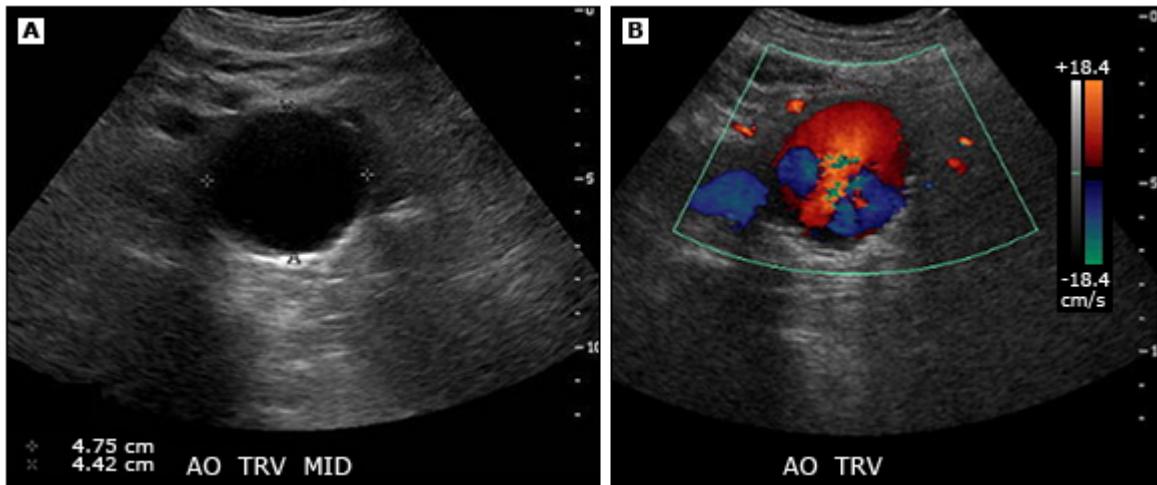


(A) Sagittal transvaginal view of pelvis shows no intrauterine pregnancy. There is a large amount of complex fluid (F) and clot (C) surrounding the uterus (calipers). The ovaries were difficult to identify due to the extent of hemorrhage and patient discomfort.

(B) Scanning of the upper abdomen showed fluid extending into Morrison's pouch. This patient was unstable and went to the operating room. The hemoperitoneum was attributed to a ruptured hemorrhagic corpus luteum.

Courtesy of Tejas S Mehta, MD, MPH.

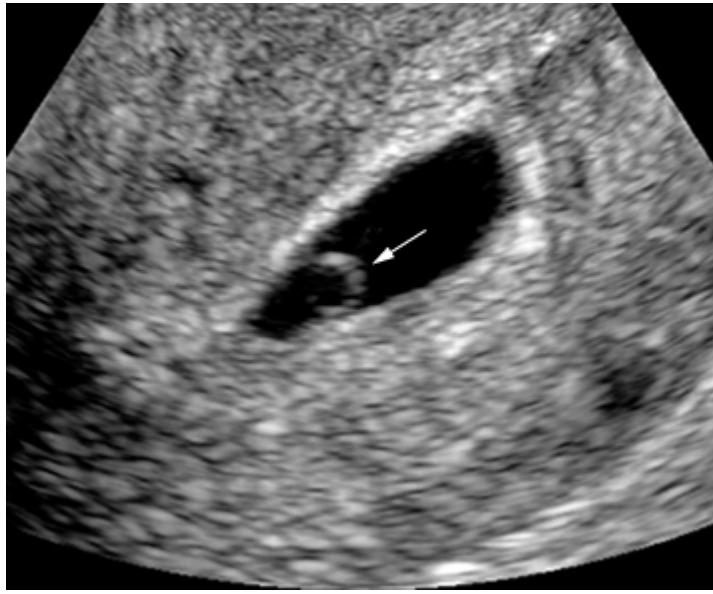
Ultrasound of an abdominal aortic aneurysm



The ultrasound examination of the abdominal aorta is shown in transverse projection (A) with Doppler interrogation (B) and reveals an abdominal aortic aneurysm measuring 4.75 cms in maximum transverse diameter. Turbulent flow in the aneurysm is reflected in the non-uniform heterogeneous Doppler pattern.

Graphic 83048 Version 2.0

Yolk sac (transvaginal ultrasound)

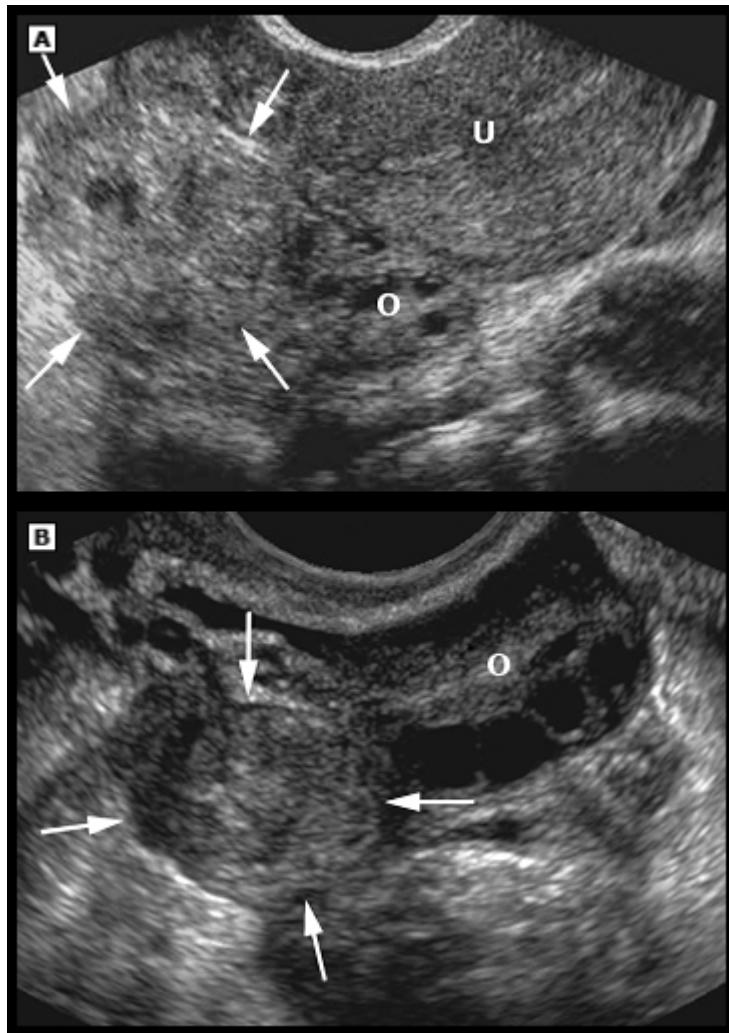


Transvaginal sagittal image shows a clear yolk sac (arrow) within the sac, diagnostic of an intrauterine pregnancy.

Courtesy of Tejas S Mehta, MD, MPH.

Graphic 65128 Version 4.0

Tubal pregnancy as adnexal mass



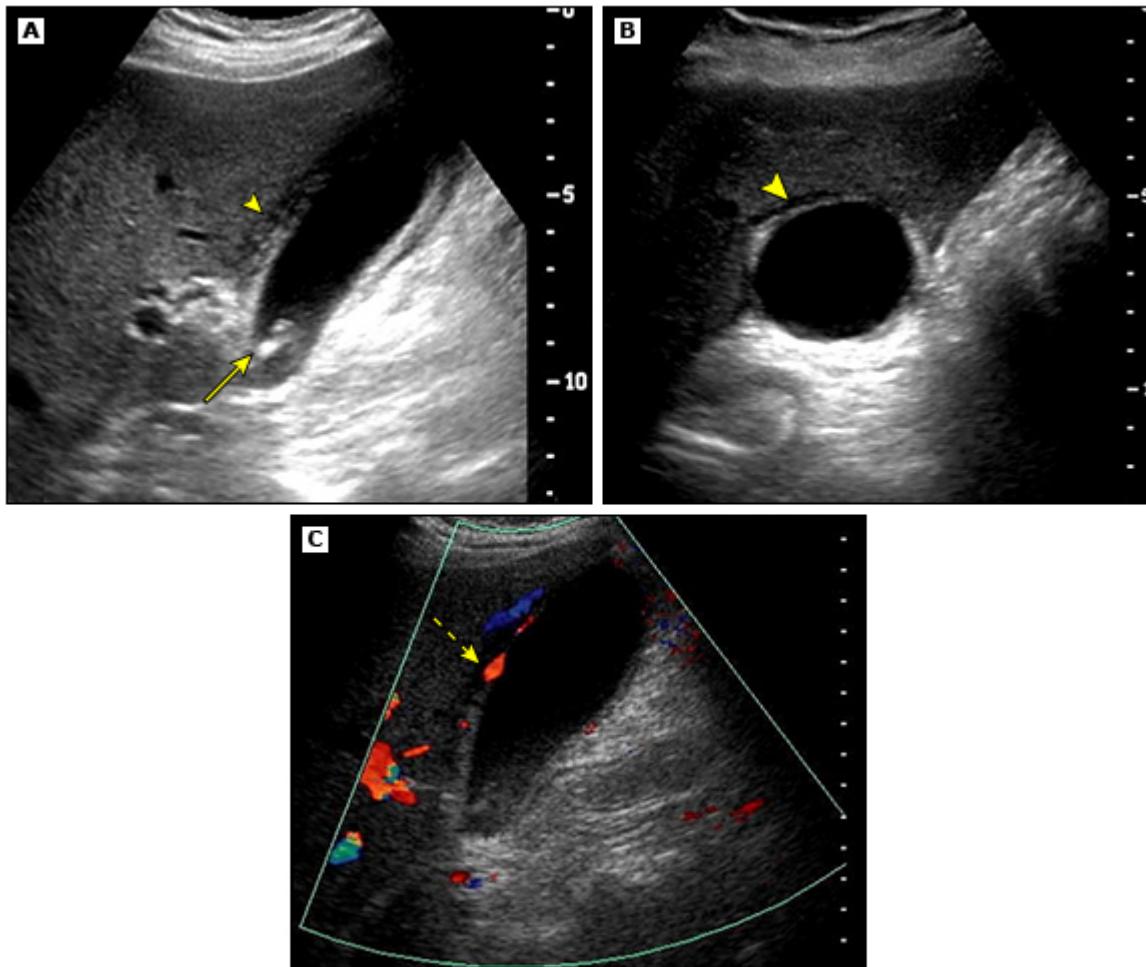
Two examples of ectopic pregnancy presenting as an extraovarian adnexal mass (arrows).

U: uterus; O: ovary.

Courtesy of Tejas S Mehta, MD, MPH.

Graphic 53149 Version 3.0

Acute cholecystitis with pericholecystic fluid seen on ultrasound

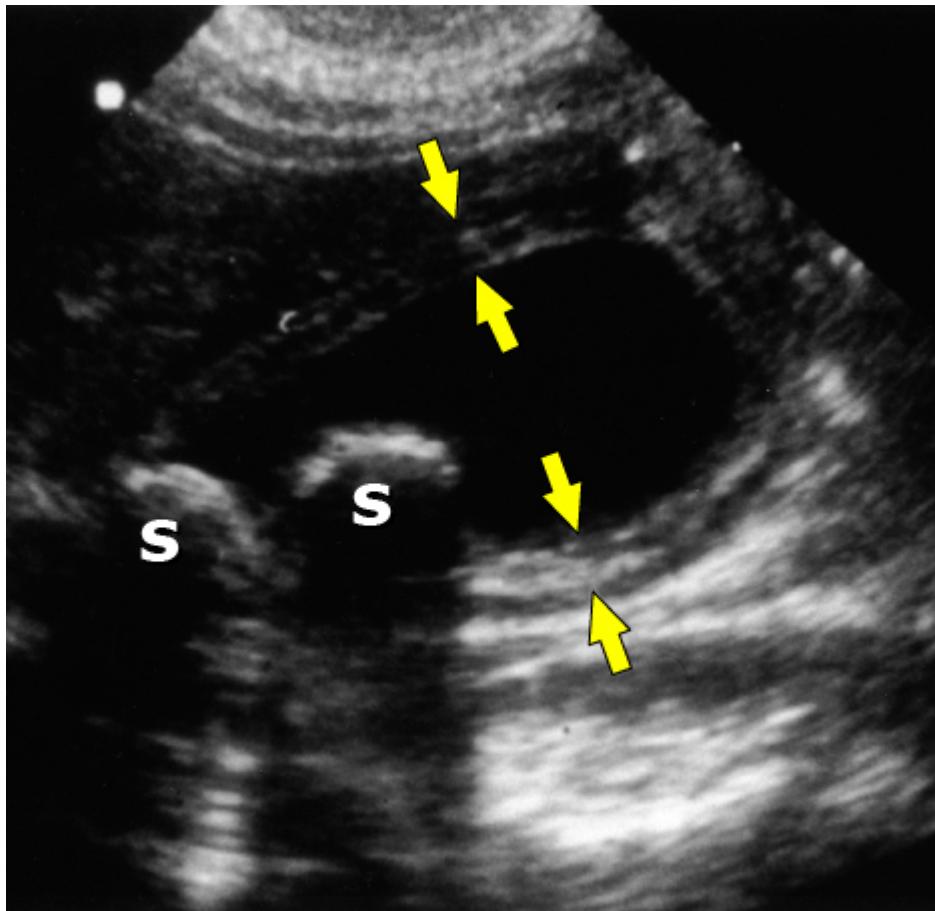


(A) Longitudinal view of the gallbladder showing small shadowing stones in the dependent part of the gallbladder (arrow). The ultrasound also shows a thickened wall in both the longitudinal projection (small arrowhead) and transverse projection (B).

(B) A small amount of pericholecystic fluid is noted (large arrowhead).

(C) The Doppler study shows an increase in blood flow to the wall (dashed arrow) reminiscent of the hyperemia of an inflammatory process. These findings are consistent with acute calculous cholecystitis.

Ultrasound image of acute calculous cholecystitis



There are two shadowing gallstones (S) lying dependently at the base of the distended gallbladder, associated with diffuse thickening of the gallbladder wall (arrows). There is no definite fluid accumulation in the gallbladder fossa. In the presence of a positive sonographic Murphy's sign, or appropriate clinical setting, a diagnosis of acute calculous cholecystitis can be established.

*Reproduced with permission from: Harwood-Nuss A, Wolfson AB, et al. *The Clinical Practice of Emergency Medicine*, 3rd Edition. Lippincott Williams & Wilkins, Philadelphia 2001. Copyright © 2001 Lippincott Williams & Wilkins.*

Graphic 83107 Version 1.0

Ultrasound demonstrating hydronephrosis



Longitudinal ultrasound of a hydronephrotic right lower quadrant kidney transplant showing dilatation of the minor and major calyces.

Courtesy of Deborah A Baumgarten, MD, MPH.

Graphic 57935 Version 4.0

Causes of potentially life-threatening abdominal catastrophe in the emergency department patient with abdominal or flank pain

Etiology	Clinical manifestations	Risk factors, common causes, or complications
Abdominal aortic aneurysm	<ul style="list-style-type: none"> ▪ Abdominal, back, or flank pain ▪ Rupture typically produces acute, severe pain and unstable hypotension from exsanguinating hemorrhage ▪ If a AAA ruptures into the retroperitoneum and tamponades, a patient can initially present normotensive ▪ AAAs can cause hematuria and be misdiagnosed as renal colic^[1,2] 	<ul style="list-style-type: none"> ▪ Risk factors include: <ul style="list-style-type: none"> • Tobacco use • Male sex • Age greater than 60 years • Hypertension • Family history of AAA • Presence of other large vessel aneurysms • Non-Hispanic White population • Peripheral vascular disease
Descending aortic dissection	<ul style="list-style-type: none"> ▪ Chest and/or upper back pain that radiates to the abdomen ▪ Approximately one-third of patients with a descending dissection will develop a malperfusion syndrome from the extension throughout the thoracoabdominal aortic branch vessels, causing splenic, kidney, or bowel infarctions 	<ul style="list-style-type: none"> ▪ Risk factors include: <ul style="list-style-type: none"> • Hypertension • Genetically mediated connective tissue disorders (eg, Marfan syndrome, Ehlers-Danlos syndrome) • Pre-existing aortic aneurysm, variant of aortic dissection, coarctation • Bicuspid aortic valve • Aortic instrumentation or surgery • Family history of aortic dissection • Turner syndrome • Vasculitis (eg, Takayasu, syphilitic) • Trauma • Pregnancy and delivery • Fluroquinolone use
Mesenteric ischemia	<ul style="list-style-type: none"> ▪ Rapid onset of severe periumbilical pain, often out of proportion to findings on physical examination (ie, lack of tenderness or peritoneal signs) ▪ Bowel emptying, nausea, and vomiting 	<ul style="list-style-type: none"> ▪ Risk factors include any conditions that: <ul style="list-style-type: none"> • Reduce perfusion to the intestine (eg, low cardiac output) • Predispose to mesenteric arterial embolism (eg, cardiac arrhythmias, valvular disease)

	<ul style="list-style-type: none"> ■ Blood in the stool and elevated serum lactate concentrations may not be present initially ■ As bowel ischemia progresses, the abdomen becomes grossly distended with peritoneal signs, a feculent odor to the breath may be appreciated, bowel movements become bloody, and shock develops 	<ul style="list-style-type: none"> • Predispose to arterial thrombosis (eg, atherosclerotic disease, abdominal trauma, hypercoagulable state, intra-abdominal malignancy or infection) • Predispose to venous thrombosis • Cause vasoconstriction
Hollow viscous perforation and/or peritonitis	<ul style="list-style-type: none"> ■ Severe, sudden-onset, diffuse abdominal pain ■ Involuntary guarding and/or rebound ■ Fever ■ Tachycardia, hypotension, signs of shock 	<ul style="list-style-type: none"> ■ Risk factors and causes include: <ul style="list-style-type: none"> • PUD • Any process that can result in frank bowel perforation leading to intraperitoneal dissemination of pus and fecal material (eg, acute appendicitis, diverticulitis)
Bowel strangulation and/or intestinal gangrene	<ul style="list-style-type: none"> ■ Diffusely distended abdomen ■ Involuntary guarding and/or rebound ■ Fever ■ Tachycardia, hypotension, signs of shock ■ Pain that progresses from crampy to constant and severe or localizes in the presence of other symptoms of obstruction is concerning for impending strangulation 	<ul style="list-style-type: none"> ■ Can occur with acute bowel obstruction, volvulus, or incarcerated hernia ■ Causes of small bowel obstruction include: <ul style="list-style-type: none"> • Adhesions (50 to 70%) • Incarcerated hernias (15%) • Neoplasms (15%) • Gallstone ileus (20% of cases among older adult patients) • Crohn disease can cause fibrotic strictures often leading to repeated episodes of small bowel obstruction ■ Risk factors for cecal volvulus include adhesions, recent surgery, congenital bands, and prolonged constipation ■ Risk factors for sigmoid volvulus include excessive use of laxatives, sedatives, anticholinergic medications, ganglionic blocking agents, and Parkinsonism medications
Intra-abdominal abscess	<ul style="list-style-type: none"> ■ Abdominal or flank pain ■ Abdominal tenderness ■ Fever 	<ul style="list-style-type: none"> ■ Diverticulitis is the most common cause ■ Other common sites of abscess formation include liver, kidney,

		genital tract, and psoas muscle
Biliary sepsis	<ul style="list-style-type: none"> ■ Acute cholecystitis – RUQ or epigastric pain that typically occurs 1 hour after fatty food ingestion ■ Acute cholangitis (Charcot triad): <ul style="list-style-type: none"> • Fever • Abdominal pain • Jaundice (frequently absent) ■ Severe (suppurative) cholangitis can also include (Reynolds pentad): <ul style="list-style-type: none"> • Hypotension (this may be the only sign in older adults or those taking glucocorticoids) • Mental status changes 	<ul style="list-style-type: none"> ■ Complications can include: <ul style="list-style-type: none"> • Sepsis (from gangrenous cholecystitis or cholangitis) • Generalized peritonitis (from free gallbladder perforation into the peritoneum) • Abdominal wall crepitus (from emphysematous cholecystitis) • Bowel obstruction ("gallstone ileus" [mechanical obstruction from passage of large gallstone])
Splenic rupture	<ul style="list-style-type: none"> ■ LUQ pain and tenderness ■ In the rare case of severe hemorrhage, can also cause tachycardia, hypotension, and shock 	<ul style="list-style-type: none"> ■ Risk factors and causes include: <ul style="list-style-type: none"> • Blunt trauma • Surgical or endoscopic manipulation (eg, colonoscopy) • Infectious mononucleosis
Necrotizing pancreatitis	<ul style="list-style-type: none"> ■ Constant upper abdominal pain ■ Often with band-like radiation to the back 	<ul style="list-style-type: none"> ■ Approximately 15 to 25% of patients with acute pancreatitis develop necrosis of the pancreas or peripancreatic tissue
Urinary sepsis (eg, obstructing nephrolithiasis or pyelonephritis)	<ul style="list-style-type: none"> ■ A complicated UTI can present with sepsis, multiorgan system dysfunction, shock, and/or acute kidney injury 	<ul style="list-style-type: none"> ■ Risk factors include: <ul style="list-style-type: none"> • Urinary tract obstruction or abnormalities • Recent urinary tract instrumentation • Older age • Diabetes mellitus • Nephrolithiasis (a patient with infected urine proximal to an obstructing ureteral stone can quickly become septic if not drained)
Ectopic pregnancy	<ul style="list-style-type: none"> ■ Female of childbearing age with the characteristic triad: <ul style="list-style-type: none"> • Amenorrhea • Abdominal/pelvic pain (severe, sudden onset) 	<ul style="list-style-type: none"> ■ Risk factors include: <ul style="list-style-type: none"> • History of pelvic inflammatory disease • Previous tubal pregnancy • Endometriosis

	<ul style="list-style-type: none"> Vaginal bleeding (30% do not have this) Hemodynamic instability can develop if the structure (eg, fallopian tube) in which the pregnancy is implanted ruptures and hemorrhages 	<ul style="list-style-type: none"> Indwelling intrauterine device
Placental abruption and other pregnancy complications	<ul style="list-style-type: none"> An acute placental abruption characteristically presents with: <ul style="list-style-type: none"> Dark vaginal bleeding (the amount of bleeding correlates poorly with the severity of separation) Abdominal pain Uterine contractions and tenderness Acute DIC can develop from a severe abruption ($\geq 50\%$ placental separation) and is life-threatening to both fetus and mother Other life-threatening pregnancy-related complications that cause abdominal pain include: <ul style="list-style-type: none"> Necrotic retained products of conception leading to sepsis or toxic shock syndrome Complications of pregnancy termination (including unsafe abortion) Uterine rupture 	<ul style="list-style-type: none"> Risk factors and causes include: <ul style="list-style-type: none"> Maternal hypertension (most common cause) Cocaine use Alcohol consumption Cigarette smoking Trauma Advanced maternal age
Spontaneous bacterial peritonitis	<ul style="list-style-type: none"> Patient with cirrhosis with any of the following: <ul style="list-style-type: none"> Fever or hypothermia Abdominal pain Altered mental status Diarrhea Ileus Hypotension 	<ul style="list-style-type: none"> Usually, there is no apparent source of infection SBP occurs in up to one-fourth of patients admitted with cirrhosis and ascites
Fournier gangrene	<ul style="list-style-type: none"> Necrotizing fasciitis of the perineum that begins abruptly with severe pain, redness, edema, and induration and spreads rapidly to the anterior 	<ul style="list-style-type: none"> Can occur as a result of a breach in the integrity of the gastrointestinal or urethral mucosa Risk factors include those for necrotizing soft tissue infection (eg,

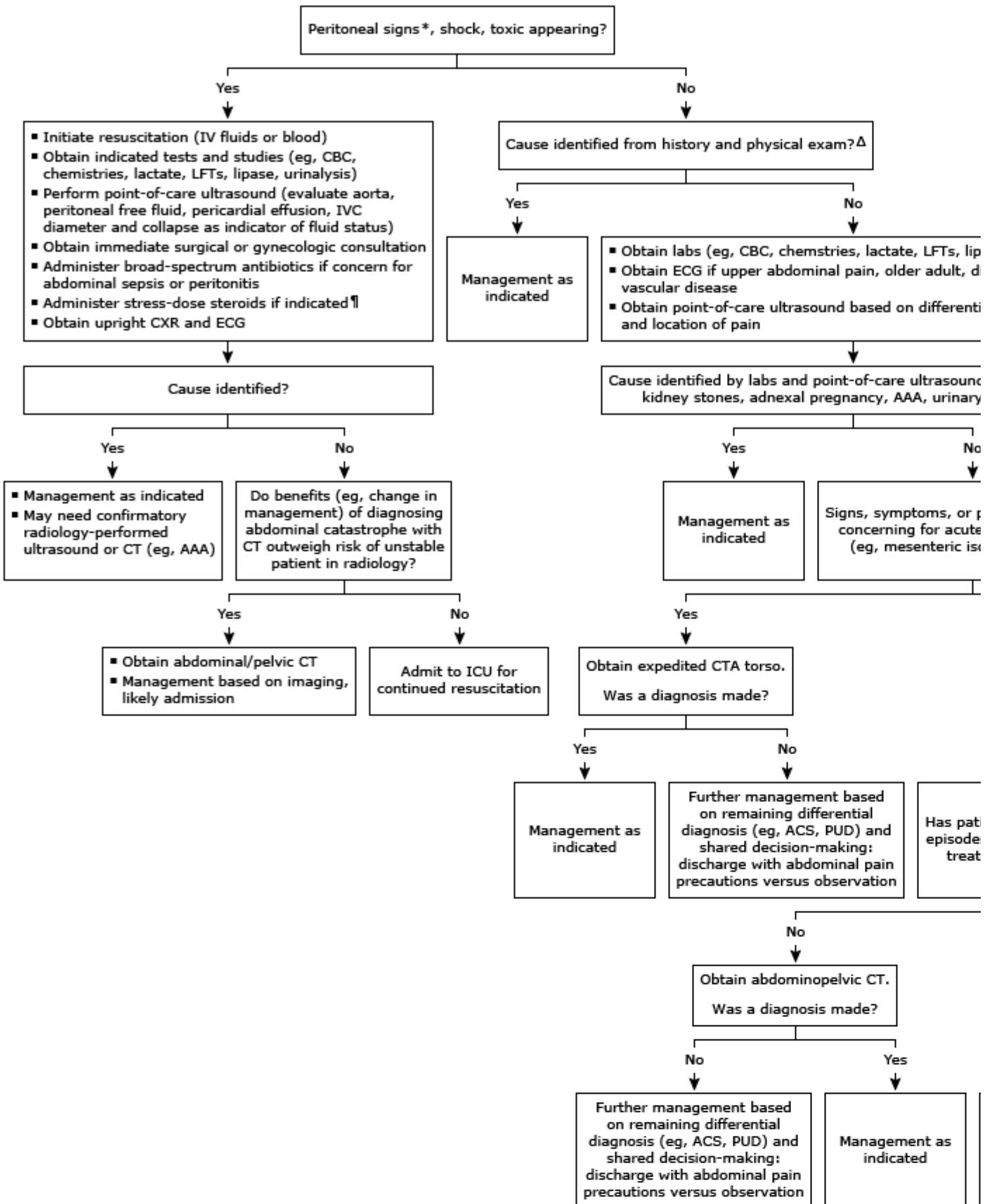
	<p>abdominal wall and the gluteal muscles</p> <ul style="list-style-type: none"> ▪ The scrotum and penis can be involved in males ▪ The labia can be involved in females 	<p>diabetes, obesity, immunosuppression, malignancy, alcohol misuse)</p>
Toxic megacolon	<ul style="list-style-type: none"> ▪ Typically presents with at least 1 week of severe, bloody diarrhea followed by acute colonic dilatation ▪ Often associated with fever, hypotension, confusion, and toxic appearance 	<ul style="list-style-type: none"> ▪ Causes include: <ul style="list-style-type: none"> • Inflammatory bowel disease • Infectious colitis (eg, <i>Clostridioide: difficile</i>, cytomegalovirus colitis) • Methotrexate therapy • Malignancy (eg, Kaposi sarcoma)
Toxic shock syndrome	<ul style="list-style-type: none"> ▪ Characteristic manifestations are fever, rash, hypotension, and multiorgan dysfunction ▪ Commonly include abdominal pain, nausea, vomiting, and diarrhea 	<ul style="list-style-type: none"> ▪ Risk factors include: <ul style="list-style-type: none"> • Use of high-absorbency tampons • Retained tampons • Wound infections • Burns
Ruptured hemorrhagic ovarian cyst	<ul style="list-style-type: none"> ▪ Sudden-onset abdominal or pelvic pain ▪ Shock is uncommon ▪ These are rarely life-threatening since most hemorrhagic cysts stop bleeding spontaneously 	<ul style="list-style-type: none"> ▪ Risk factors include: <ul style="list-style-type: none"> • Current, known cyst • Conditions that predispose to cyst formation (eg, ovulation induction, prior history of ovarian cysts) • Vaginal intercourse

AAA: abdominal aortic aneurysm; PUD: peptic ulcer disease; SBP: spontaneous bacterial peritonitis; RUQ: right upper quadrant; LUQ: left upper quadrant; UTI: urinary tract infection; DIC: disseminated intravascular coagulation.

References:

1. Marston WA, Ahlquist R, Johnson G Jr, Meyer AA. Misdiagnosis of ruptured abdominal aortic aneurysms. *J Vasc Surg* 1992; 16:17.
2. Fernando SM, Tran A, Cheng W, et al. Accuracy of presenting symptoms, physical examination, and imaging for diagnosis of ruptured abdominal aortic aneurysm: Systematic review and meta-analysis. *Acad Emerg Med* 2022; 29:486.

Approach to abdominal pain in non-pregnant patients in the emergency department



Do pain location and patient characteristics support a specific diagnosis?

Location of pain and other characteristics

RUQ/epigastric pain and patient has not had cholecystectomy

Female patient and history/exam suggest gynecologic cause[†] and patient has not had TAH-BSO

Male with lower abdominal or flank pain and abnormal testicular exam

Flank pain, suspicion for nephrolithiasis, low risk for serious alternative diagnosis

Yes

Did ultrasound identify cause

Yes

Management as indicated

- Does patient have:
- Lab abnormalities (eg, leukocytosis)
- Abdominal tenderness
- Flank pain
- Pain relief with analgesics
- Older age

Yes

Obtain abdominopelvic CT scan
Was a diagnosis made?

Yes

Management as indicated

- Reassurance
- Discharge dependent on findings

ED: emergency department; IV: intravenous; CBC: complete blood count; LFTs: liver function tests; IVC: inferior vena cava; CXR: chest radiograph; ECG: electrocardiogram; AAA: abdominal aortic aneurysm; CT: computed tomography; ICU: intensive care unit; ACS: acute coronary syndrome; PUD: peptic ulcer disease; UTI: urinary tract infection; PID: pelvic inflammatory disease; RUQ: right upper quadrant; TAH-BSO: total abdominal hysterectomy with bilateral salpingo-oophorectomy; HIV: human immunodeficiency virus.

* Peritoneal signs include rigidity, involuntary muscle guarding, severe or rebound tenderness, and pain with coughing or shaking stretcher.

¶ Stress-dose glucocorticoids (eg, hydrocortisone) should be administered if adrenal insufficiency is suspected (eg, chronic glucocorticoid therapy, history of primary adrenal insufficiency).

Δ For example, pain that resolves with reduction of incarcerated hernia.

◊ Concerning signs, symptoms, and history for acute vascular process include pain out of proportion to exam, sudden onset of pain, associated syncope, new onset or prior history of atrial fibrillation, and prior history of atherosclerotic vascular disease or hypertension.

§ Signs and symptoms suggesting obstruction include vomiting, increased belching, obstipation, and abdominal distension.

¥ Signs and symptoms of UTI include dysuria, urinary urgency/frequency, and pyuria. Signs and symptoms of cervicitis/PID include lower abdominal pain, abnormal uterine bleeding, vaginal discharge, cervical motion and/or adnexal tenderness, and vaginal/endocervical discharge.

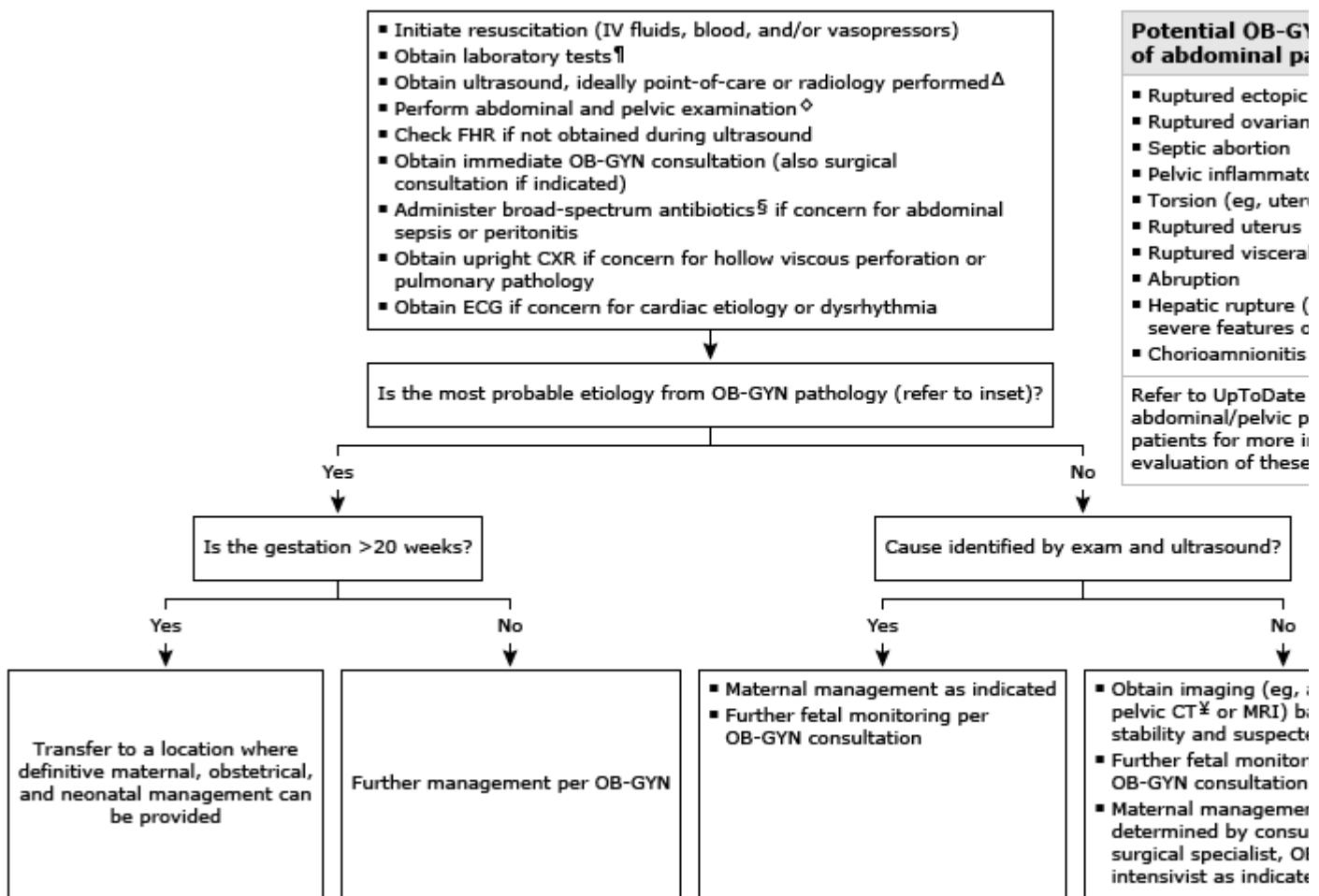
‡ Either point-of-care or radiology-performed depending on available equipment and expertise with specific study.

† Signs and symptoms suggesting a gynecologic cause include sudden onset of maximal intensity of pain, lower abdominal/pelvic location of pain, associated vaginal discharge or bleeding, and adnexal or cervical motion tenderness.

** High-risk features include previous bariatric surgery, active malignancy, taking glucocorticoids or immunosuppressives, organ transplant recipient, sickle cell disease, HIV. Refer to related UpToDate content for further discussion.

Graphic 142358 Version 1.0

Approach to abdominal pain in pregnant patients with hemodynamic instability or peritonitis in the emergency department*



Most patients with pregnancy-related bleeding who are RhD negative should receive anti-D immune globulin. Refer to UpToDate content on RhD alloimmunization prevention in pregnant and postpartum patients.

IV: intravenous; FHR: fetal heart rate; OB-GYN: obstetrics and gynecology; CXR: chest radiograph; ECG: electrocardiogram; CT: computed tomography; MRI: magnetic resonance imaging; HELLP: hemolysis, elevated liver enzymes, and low platelets; CBC: complete blood count; hCG: human chorionic gonadotropin; IUP: intrauterine pregnancy; IVC: inferior vena cava.

* Use this algorithm for a pregnant patient with peritoneal signs (eg, rigidity, involuntary muscle guarding, severe or rebound tenderness, pain with coughing or shaking stretcher), shock/hemodynamic instability, or toxic appearance.

¶ Laboratory tests include CBC, basic metabolic panel, lactate, liver enzymes, lipase, urinalysis, type and cross, coagulation studies, and quantitative hCG (if IUP has not been documented).

△ Ultrasound should evaluate for:

- Intrauterine pregnancy
- Adnexal mass or pelvic mass

- Peritoneal free fluid
- Gallstones/cholecystitis
- Nephrolithiasis/hydronephrosis
- Pericardial effusion/tamponade
- IVC diameter and collapse (as indicator of fluid status)

◊ Digital vaginal examination should **not** be performed in a patient with vaginal bleeding after 20 weeks of gestation unless placenta previa has been excluded by ultrasound examination.

§ Antimicrobial choice is empiric and should be tailored to each individual. Reasonable options include vancomycin and either piperacillin-tazobactam, meropenem, cefepime and metronidazole, or gentamicin and metronidazole. Refer to UpToDate content on the evaluation and management of suspected sepsis and septic shock in adults for examples of other empiric strategies and dosing.

¥ The choice of imaging study or studies is best made jointly by the clinical (medical, surgical, obstetric) providers and the radiologist, who can sometimes modify the technique to minimize fetal risk without significantly compromising the information needed for maternal diagnostic evaluation and management. Refer to UpToDate content on diagnostic imaging in pregnant patients.

Graphic 142455 Version 2.0

Empiric antibiotic regimens for high-risk community-acquired intra-abdominal infections in adults

	Dose
Single-agent regimen	
Imipenem-cilastatin	500 mg IV every 6 hours
Meropenem	1 g IV every 8 hours
Doripenem	500 mg IV every 8 hours
Piperacillin-tazobactam	4.5 g IV every 6 hours
Combination regimen with metronidazole	
ONE of the following:	
Cefepime	2 g IV every 8 hours
OR	
Ceftazidime	2 g IV every 8 hours
PLUS:	
Metronidazole	500 mg IV or orally every 8 hours

High-risk community-acquired intra-abdominal infections are those that are severe or in patients at high risk for adverse outcomes or antimicrobial resistance. These include patients with recent travel to areas of the world with high rates of antibiotics-resistant organisms, known colonization with such organisms, advanced age, immunocompromising conditions, or other major medical comorbidities. Refer to the UpToDate topic on the antimicrobial treatment of intra-abdominal infections for further discussion of these risk factors.

For empiric therapy of high-risk community-acquired intra-abdominal infections, we cover streptococci, Enterobacteriaceae resistant to third-generation cephalosporins, *Pseudomonas aeruginosa*, and anaerobes. Empiric antifungal therapy is usually not warranted but is reasonable for critically ill patients with an upper gastrointestinal source.

Local rates of resistance should inform antibiotic selection (ie, agents for which there is >10% resistance among Enterobacteriaceae should be avoided). If the patient is at risk for infection with an extended-spectrum beta-lactamase (ESBL)-producing organism (eg, known colonization or prior infection with an ESBL-producing organism), a carbapenem should be chosen. When beta-lactams or carbapenems are chosen for patients who are critically ill or are at high risk of infection with drug-resistant pathogens, we favor a prolonged infusion dosing strategy. Refer to other UpToDate content on prolonged infusions of beta-lactam antibiotics.

The combination of vancomycin, aztreonam, and metronidazole is an alternative for those who cannot use other beta-lactams or carbapenems (eg, because of severe reactions).

The antibiotic doses listed are for adult patients with normal renal function. The duration of antibiotic therapy depends on the specific infection and whether the presumptive source of infection has been controlled; refer to other UpToDate content for details.

IV: intravenous.

Graphic 106949 Version 12.0

Empiric antibiotic regimens for health care-associated intra-abdominal infections in adults

	Dose
Single-agent regimen	
Imipenem-cilastatin	500 mg IV every 6 hours
Meropenem	1 g IV every 8 hours
Doripenem	500 mg IV every 8 hours
Piperacillin-tazobactam	4.5 g IV every 6 hours
Combination regimen	
ONE of the following:	
Cefepime	2 g IV every 8 hours
OR	
Ceftazidime	2 g IV every 8 hours
PLUS:	
Metronidazole	500 mg IV or orally every 8 hours
PLUS ONE of the following (in some cases*):	
Ampicillin	2 g IV every 4 hours
OR	
Vancomycin	15 to 20 mg/kg IV every 8 to 12 hours

For empiric therapy of health care-associated intra-abdominal infections, we cover streptococci, enterococci, Enterobacteriaceae that are resistant to third-generation cephalosporins and fluoroquinolones, *Pseudomonas aeruginosa*, and anaerobes. We include coverage against methicillin-resistant *Staphylococcus aureus* (MRSA) with vancomycin in those who are known to be colonized, those with prior treatment failure, and those with significant prior antibiotic exposure. Empiric antifungal coverage is appropriate for patients at risk for infection with *Candida* spp, including those with upper gastrointestinal perforations, recurrent bowel perforations, surgically treated pancreatitis, heavy colonization with *Candida* spp, and/or yeast identified on Gram stain of samples from infected peritoneal fluid or tissue. Refer to other UpToDate content on treatment of invasive candidiasis.

If the patient is at risk for infection with an extended-spectrum beta-lactamase (ESBL)-producing organism (eg, known colonization or prior infection with an ESBL-producing organism), a carbapenem should be chosen. For patients who are known to be colonized with highly resistant gram-negative bacteria, the addition of an aminoglycoside, polymyxin, or novel beta-lactam combination (ceftolozane-tazobactam or ceftazidime-avibactam) to an empiric regimen may be warranted. In such cases, consultation with an expert in infectious diseases is advised.

When beta-lactams or carbapenems are chosen for patients who are critically ill or are at high risk of infection with drug-resistant pathogens, we favor a prolonged infusion dosing strategy. Refer to other UpToDate content on prolonged infusions of beta-lactam antibiotics.

The combination of vancomycin, aztreonam, and metronidazole is an alternative for those who cannot use other beta-lactams or carbapenems (eg, because of severe reactions).

The antibiotic doses listed are for adult patients with normal kidney function. The duration of antibiotic therapy depends on the specific infection and whether the presumptive source of infection has been controlled; refer to other UpToDate content for details.

IV: intravenous.

* We add ampicillin or vancomycin to a cephalosporin-based regimen to provide enterococcal coverage, particularly in those with postoperative infection, prior use of antibiotics that select for *Enterococcus*, immunocompromising condition, valvular heart disease, or prosthetic intravascular materials. Coverage against vancomycin-resistant enterococci (VRE) is generally not recommended, although it is reasonable in patients who have a history of VRE colonization or in liver transplant recipients who have an infection of hepatobiliary source.

Graphic 106950 Version 12.0

Empiric antimicrobial agent selection for acute complicated urinary tract infection

Patient population	Risk for MDR?*	Empiric regimens	Comments
Hospitalized with: <ul style="list-style-type: none"> ▪ Critical illness warranting intensive care (eg, severe sepsis) or ▪ Urinary tract obstruction 	N/A	<p>In regions where community prevalence of ESBL-producing organisms is high or uncertain:</p> <ul style="list-style-type: none"> ▪ An antipseudomonal carbapenem: <ul style="list-style-type: none"> • Imipenem 500 mg IV every 6 hours infused over 3 hours or • Meropenem 1 g IV every 8 hours infused over 3 hours <p>plus</p> <ul style="list-style-type: none"> ▪ Vancomycin 15 to 20 mg/kg IV every 8 to 12 hours with or without a loading dose <hr/> <p>In regions where community prevalence of ESBL-producing organisms is low:</p> <ul style="list-style-type: none"> ▪ Select a regimen based on individual MDR risk, as listed for "Other hospitalized patients" 	<ul style="list-style-type: none"> ▪ The rationale for broad coverage is the high risk of adverse outcomes with insufficient antimicrobial therapy. ▪ When broad-spectrum regimens are used empirically, it is important to tailor the regimen if culture and susceptibility testing indicate that a narrower agent would be active.
Other hospitalized patients	No	<ul style="list-style-type: none"> ▪ Ceftriaxone 1 g IV once daily ▪ Alternatives: <ul style="list-style-type: none"> • Levofloxacin 750 mg IV or orally daily • Ciprofloxacin 400 mg IV twice daily • Ciprofloxacin 500 mg orally twice daily • Ciprofloxacin extended-release 1000 	<p>Concern for particular pathogens (eg, because of prior isolates) should further inform antibiotic selection:</p> <ul style="list-style-type: none"> ▪ If <i>Enterococcus</i> is suspected (eg, based on prior isolates), piperacillin-tazobactam is active against this and gram-negative pathogens.

		mg orally once daily	<ul style="list-style-type: none"> ▪ If drug-resistant gram-positive organisms are suspected, vancomycin (for MRSA) or linezolid or daptomycin (for VRE) should be added to the gram-negative agent (eg, ceftriaxone). ▪ If <i>Pseudomonas</i> is suspected, piperacillin-tazobactam, ceftazidime, or a fluoroquinolone are appropriate options.
	Yes	<ul style="list-style-type: none"> ▪ Piperacillin-tazobactam 3.375 g IV every 6 hours or ▪ Cefepime 2 g IV every 12 hours (not for ESBL risk) or ▪ An antipseudomonal carbapenem (if recent ESBL isolate): <ul style="list-style-type: none"> • Imipenem 500 mg IV every 6 hours infused over 3 hours or • Meropenem 1 g IV every 8 hours infused over 3 hours 	<ul style="list-style-type: none"> ▪ If VRE or MRSA are suspected (eg, based on prior isolates), vancomycin (for MRSA) or daptomycin or linezolid (for VRE) is added.
Outpatients	No, and no concerns with fluoroquinolones (eg, at low risk for adverse effects)	<p>For patients with low risk of fluoroquinolone resistance/toxicity:</p> <ul style="list-style-type: none"> ▪ Ciprofloxacin 500 mg orally twice daily for 5 to 7 days or ▪ Ciprofloxacin extended-release 1000 mg orally once daily for 5 to 7 days or ▪ Levofloxacin 750 mg orally once daily for 5 to 7 days 	<ul style="list-style-type: none"> ▪ If the community prevalence of fluoroquinolone resistance in <i>Escherichia coli</i> is known to be >10%, give one dose of a long-acting parenteral agent prior to the fluoroquinolone: <ul style="list-style-type: none"> • Ceftriaxone 1 g IV or IM once • Ertapenem 1 g IV or IM once • Gentamicin 5 mg/kg IV or IM once • Tobramycin 5 mg/kg IV or IM once

No, but with concerns with fluoroquinolones (eg, at risk for adverse effects)	<p>For patients who cannot use a fluoroquinolone:</p> <ul style="list-style-type: none"> ■ One dose of a long-acting parenteral agent: <ul style="list-style-type: none"> • Ceftriaxone 1 g IV or IM once or • Ertapenem 1 g IV or IM once or • Gentamicin 5 mg/kg IV or IM once or • Tobramycin 5 mg/kg IV or IM once ■ Followed by one of the following: <ul style="list-style-type: none"> • TMP-SMX one double-strength tablet orally twice daily for 7 to 10 days or • Amoxicillin-clavulanate 875 mg orally twice daily for 7 to 10 days or • Cefpodoxime 200 mg orally twice daily for 7 to 10 days or • Cefadroxil 1 g orally twice daily for 7 to 10 days 	<ul style="list-style-type: none"> ■ In outpatients who are systemically ill or are at risk for more severe illness, we favor continuing the parenteral agent until culture and susceptibility testing results can guide selection of an appropriate oral agent.
Yes	<ul style="list-style-type: none"> ■ Ertapenem 1g IV or IM once ■ Followed by: <ul style="list-style-type: none"> • Ciprofloxacin 500 mg orally twice daily for 5 to 7 days or • Ciprofloxacin extended-release 1000 mg orally once daily for 5 to 7 days or • Levofloxacin 750 mg orally daily for 5 to 7 days 	<ul style="list-style-type: none"> ■ If the patient cannot take a fluoroquinolone or has high risk for fluoroquinolone resistance (fluoroquinolone-resistant isolate or fluoroquinolone use in prior three months) <ul style="list-style-type: none"> • Ertapenem 1 g IV or IM once daily until cultures and susceptibility testing return

These antibiotic regimens represent our approach to empiric treatment for acute complicated UTI. Once culture and susceptibility testing results are available, the regimen should be tailored to those results. If feasible, an antibiotic with a narrow spectrum of activity should be chosen to complete the antibiotic course.

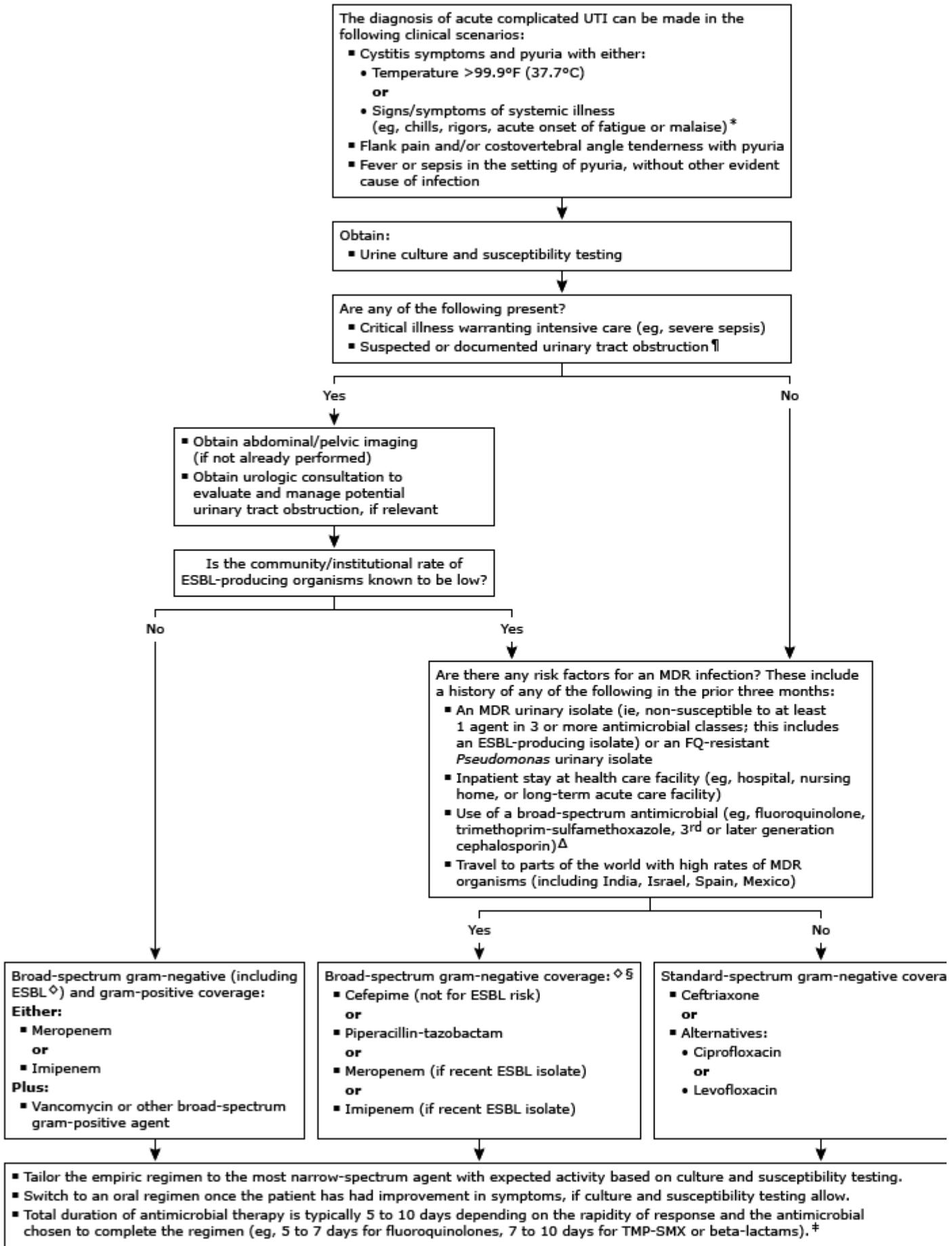
IM: intramuscular; IV: intravenous; MDR: multidrug resistance; MRSA: methicillin-resistant *Staphylococcus aureus*; TMP-SMX: trimethoprim-sulfamethoxazole; UTI: urinary tract infection; VRE: vancomycin-resistant *Enterococcus*.

* Risk factors for MDR gram-negative UTIs include any one of the following in the prior three months:

- An MDR, gram-negative urinary isolate, including a fluoroquinolone-resistant *Pseudomonas* urinary isolate
 - Inpatient stay at a health care facility (eg, hospital, nursing home, long-term acute care facility)
 - Use of a fluoroquinolone, TMP-SMX, or broad-spectrum beta-lactam (eg, third- or later-generation cephalosporin)
 - Travel to parts of the world with high rates of MDR organisms
-

Graphic 131022 Version 4.0

Empiric antimicrobial selection for acute complicated urinary tract infection in adults in the inpatient setting



- This algorithm reflects our approach to the selection of empiric antimicrobial therapy for patients hospitalized (or expected to be hospitalized) with an acute complicated UTI. Ultimately, the selection of antimicrobial therapy should be individualized based on severity of illness, individual and community risk factors for resistant pathogens, and specific host factors.
- The decision to hospitalize a patient is usually clear in the setting of critical illness or sepsis. Otherwise, general indications for inpatient management include persistently high fever (eg, >101°F/>38.4°C) or pain, marked debility, inability to maintain oral hydration or take oral medications, suspected urinary tract obstruction, and concerns regarding adherence to therapy. If outpatient management is anticipated following therapy in the emergency department, refer to other UpToDate content on antimicrobial therapy selection for the outpatient setting.
- In addition to antimicrobial therapy, the possibility of urinary obstruction should be considered and managed, if identified. Patients who have anatomical or functional urinary tract abnormalities (including neurogenic bladder, indwelling bladder catheters, nephrostomy tubes, ureteral stents) may warrant additional management, such as more frequent catheterization to improve urinary flow, exchange of a catheter, and/or urologic or gynecologic consultation.
- Doses listed are for patients with normal renal function and may require adjustment in the setting of renal impairment.

ESBL: extended-spectrum beta-lactamase; FQ: fluoroquinolone; IV: intravenous; MDR: multi-drug resistant; MRSA: methicillin-resistant *Staphylococcus aureus*; PO: oral; TMP-SMX: trimethoprim sulfamethoxazole; UTI: urinary tract infection; VRE: vancomycin-resistant enterococci.

* We consider individuals who have pyuria with only cystitis symptoms to have acute simple cystitis and manage them differently. Fever or systemic symptoms suggest that infection has extended beyond the bladder and is a complicated UTI. The possibility of prostatitis should also be considered in males with urinary and systemic symptoms. The temperature threshold used to determine whether to treat a patient as simple cystitis versus complicated UTI is not well defined and should take into account baseline temperature, other potential contributors to an elevated temperature, and the risk of poor outcomes should empiric antimicrobial therapy be inappropriate.

¶ Features that should raise suspicion for urinary tract obstruction include a decline in the renal function below baseline, a decline in urine output, or colicky abdominal pain suggestive of nephrolithiasis.

Δ This includes a single antimicrobial dose given for prophylaxis prior to prostate procedures.

◊ Advanced cephalosporin or carbapenem combinations with beta-lactamase inhibitors and the advanced aminoglycoside plazomicin also have activity against some ESBL-producing and, in some cases, MDR *Pseudomonas aeruginosa* isolates and are effective for acute complicated UTI; however, these should only be used in select cases of highly resistant infections. If carbapenem resistance is suspected based on prior susceptibility testing results, an infectious diseases consult should be obtained.

§ The choice among these agents depends on susceptibility of prior urinary isolates, patient circumstances (allergy or expected tolerability, history of recent antimicrobial use), local community resistance prevalence (if known), drug toxicity and interactions, availability, and cost. If drug-resistant gram-positive organisms are suspected because of previous urinary isolates or other risk factors, vancomycin (for MRSA) or linezolid or daptomycin (for VRE) should be added.

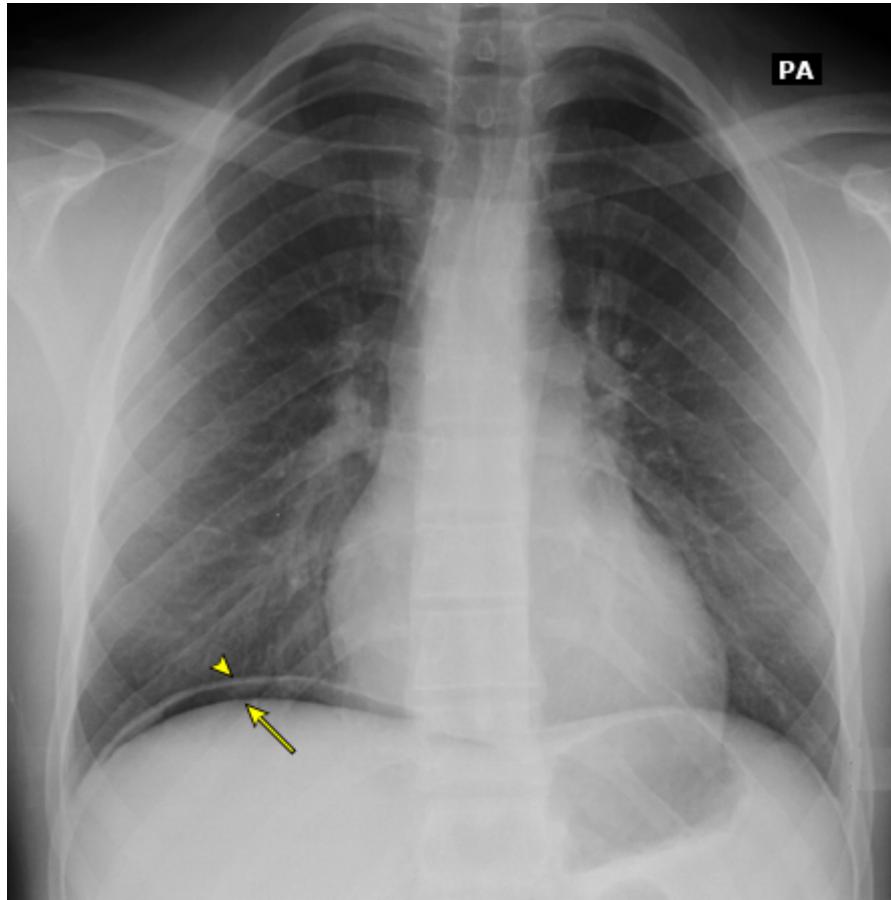
¥ Concern for particular pathogens (eg, because of prior urinary isolates) should further inform antibiotic selection. If *Enterococcus* species are suspected, piperacillin-tazobactam has activity against these

organisms in addition to typical gram-negative pathogens. If drug-resistant gram-positive organisms are suspected, vancomycin (for MRSA) or linezolid or daptomycin (for VRE) should be added to the gram-negative agent. If there is a risk of *P. aeruginosa*, piperacillin-tazobactam, ceftazidime, or a fluoroquinolone is an appropriate option.

‡ A longer duration of therapy may be warranted in patients who have a nidus of infection that cannot be removed. Patients who have worsening symptoms following initiation of antimicrobials, persistent symptoms after 48 to 72 hours of appropriate antimicrobial therapy, or recurrent symptoms within a few weeks of treatment should have additional evaluation including abdominal/pelvic imaging, if not already performed) for factors that might be compromising clinical response.

Graphic 115994 Version 13.0

Chest radiograph of intraperitoneal free air

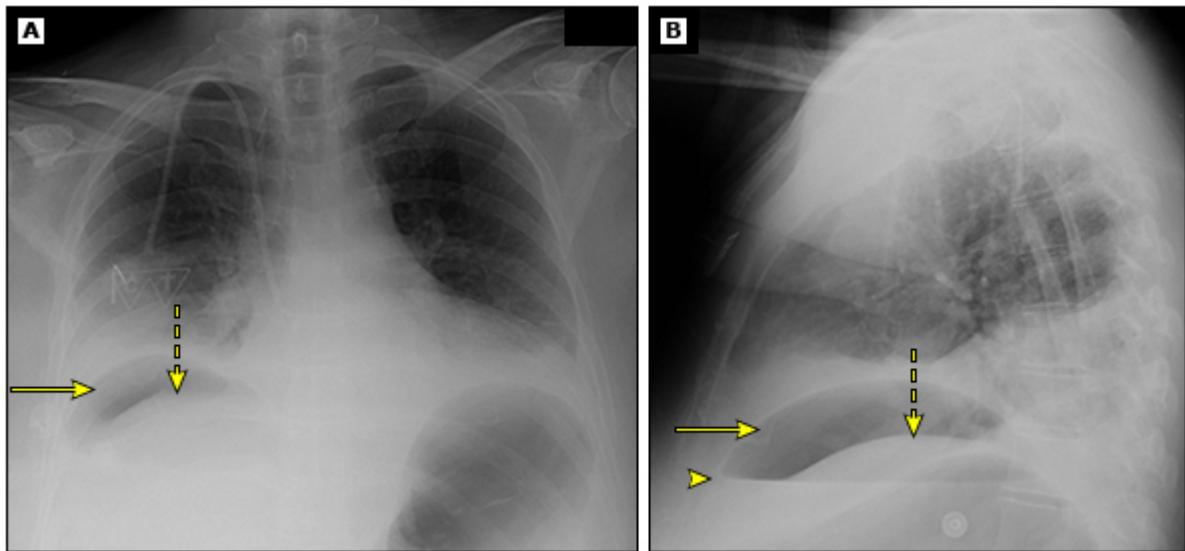


This plain PA radiograph of the chest taken with the patient upright reveals a small amount of free air under the right hemidiaphragm confirming the diagnosis of a perforated abdominal viscus. The lucent, crescent-shaped free air is noted between the arrows. The dome of the liver (arrow) and the soft tissue shadow of the right hemidiaphragm (arrowhead) border the free air.

PA: posterior-anterior.

Graphic 83050 Version 4.0

Free air and air-fluid level on x-ray

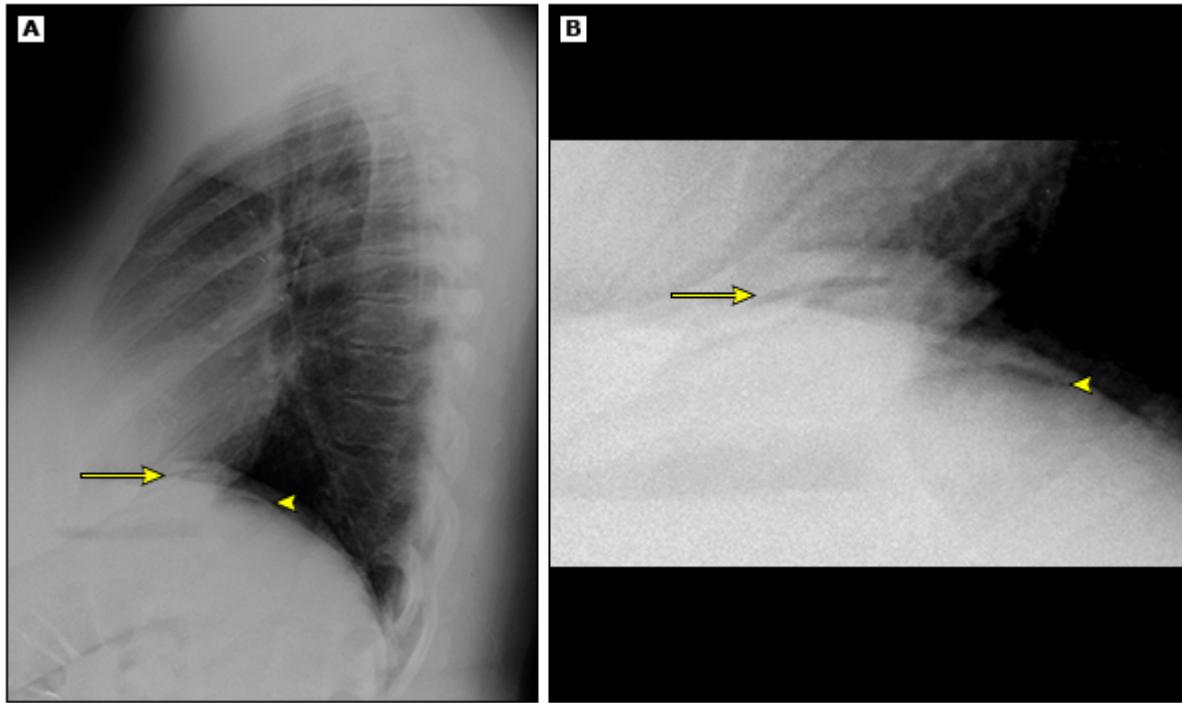


An A-P x-ray (A) shows free air under the diaphragm, a well-defined liver edge (dashed arrow), but no obvious free fluid. A lateral examination (B) shows an air fluid level (arrowhead) that was not obvious on the A-P examination. The free air above (arrow) outlines the liver edge with greater clarity (dashed arrow).

A-P: anteroposterior.

Graphic 93368 Version 1.0

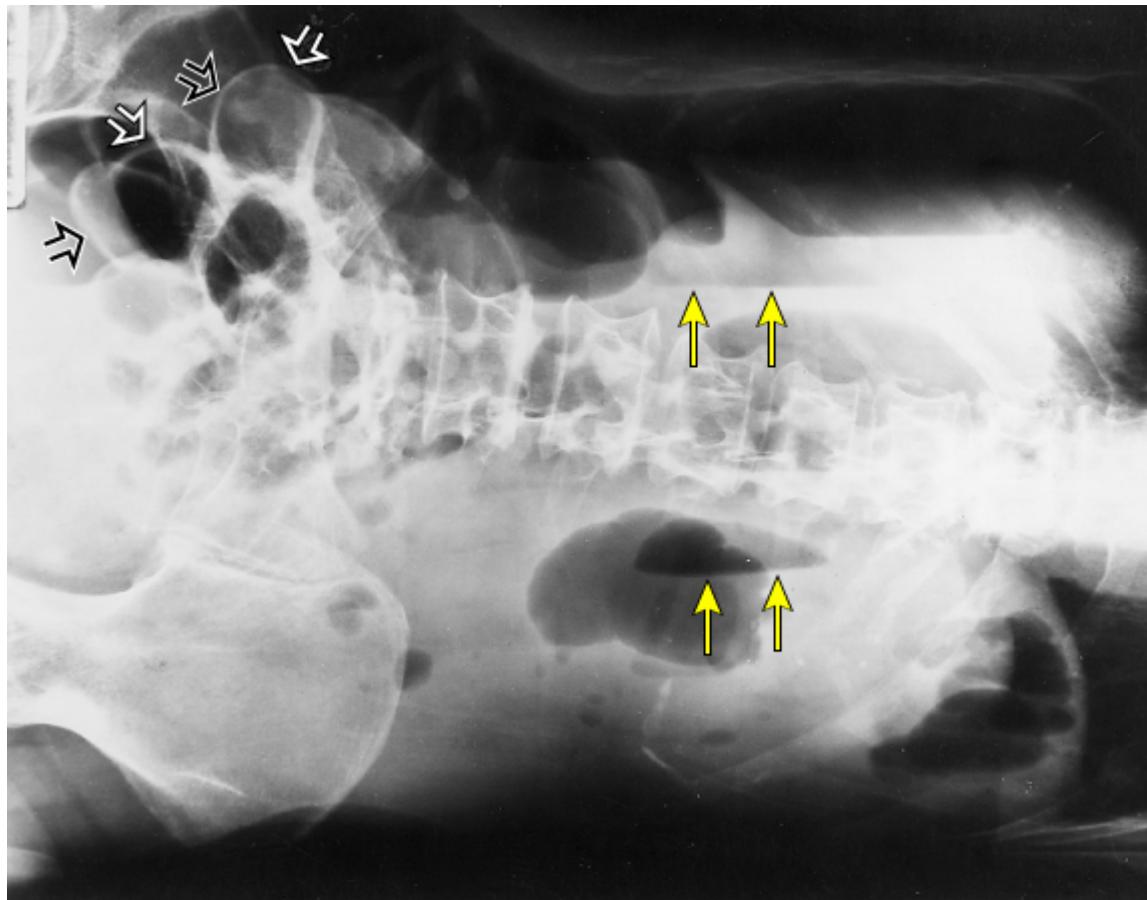
Free air lateral x-ray



A lateral examination (A) shows a small amount of air under the right hemidiaphragm (arrow) and a small amount of air under the left hemidiaphragm (arrowhead). Image B is a magnified view and highlights the small amount of air under the right hemidiaphragm (arrow) and a small amount of air under the left hemidiaphragm (arrowhead).

Graphic 93366 Version 1.0

Decubitus x-ray of intraperitoneal free air

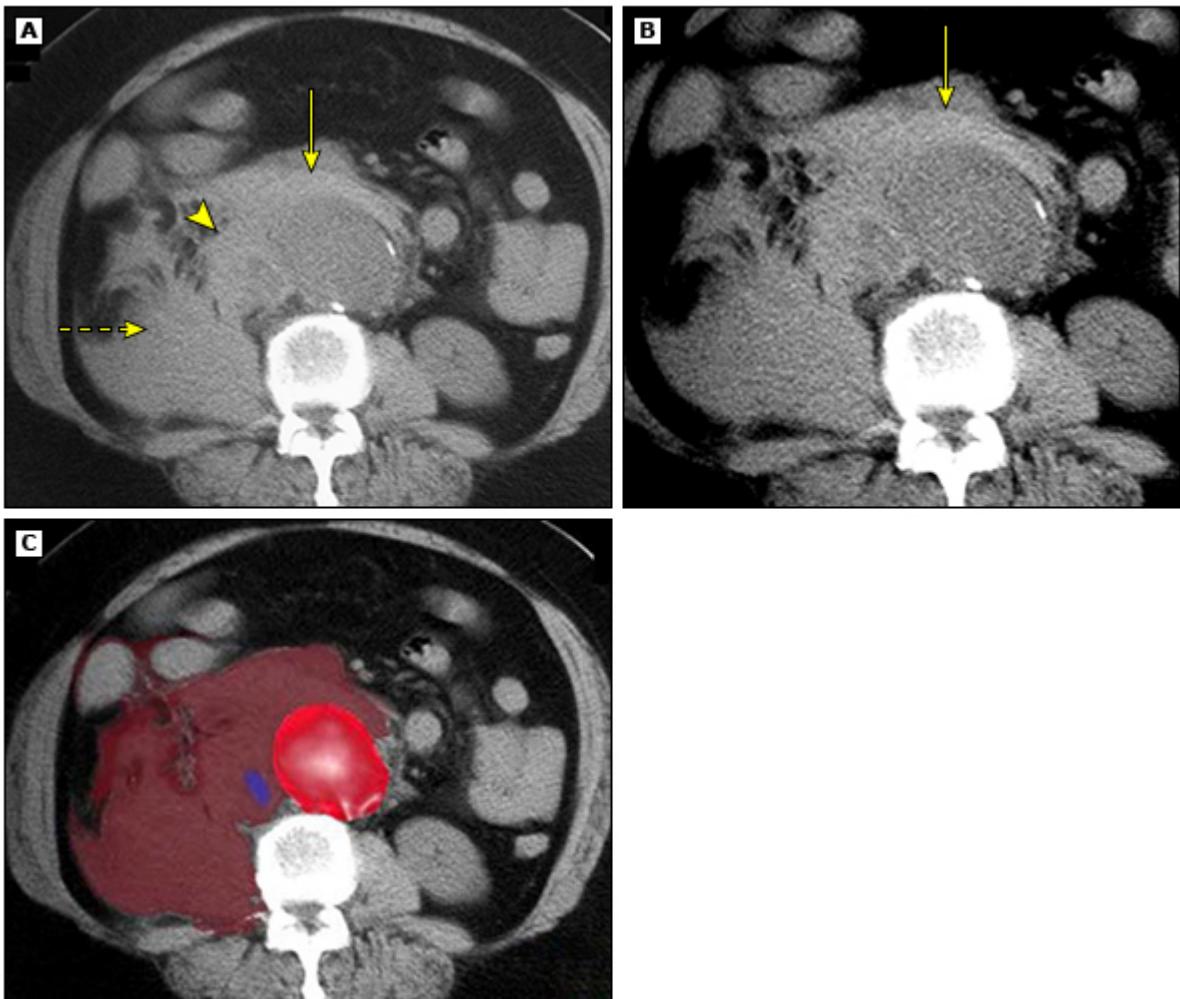


The plain film examination of the abdomen in decubitus position reveals a large amount of free air collecting in the right flank, clearly outlining the bowel wall (open arrows). When air is present on both sides of the bowel, the wall is outlined with clear distinction because of the contrast differences created on both sides. This is called Rigler's sign and is pathognomonic for free air in the peritoneal cavity. The yellow arrows show air-fluid levels in distended bowel.

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Graphic 83043 Version 1.0

Ruptured abdominal aortic aneurysm

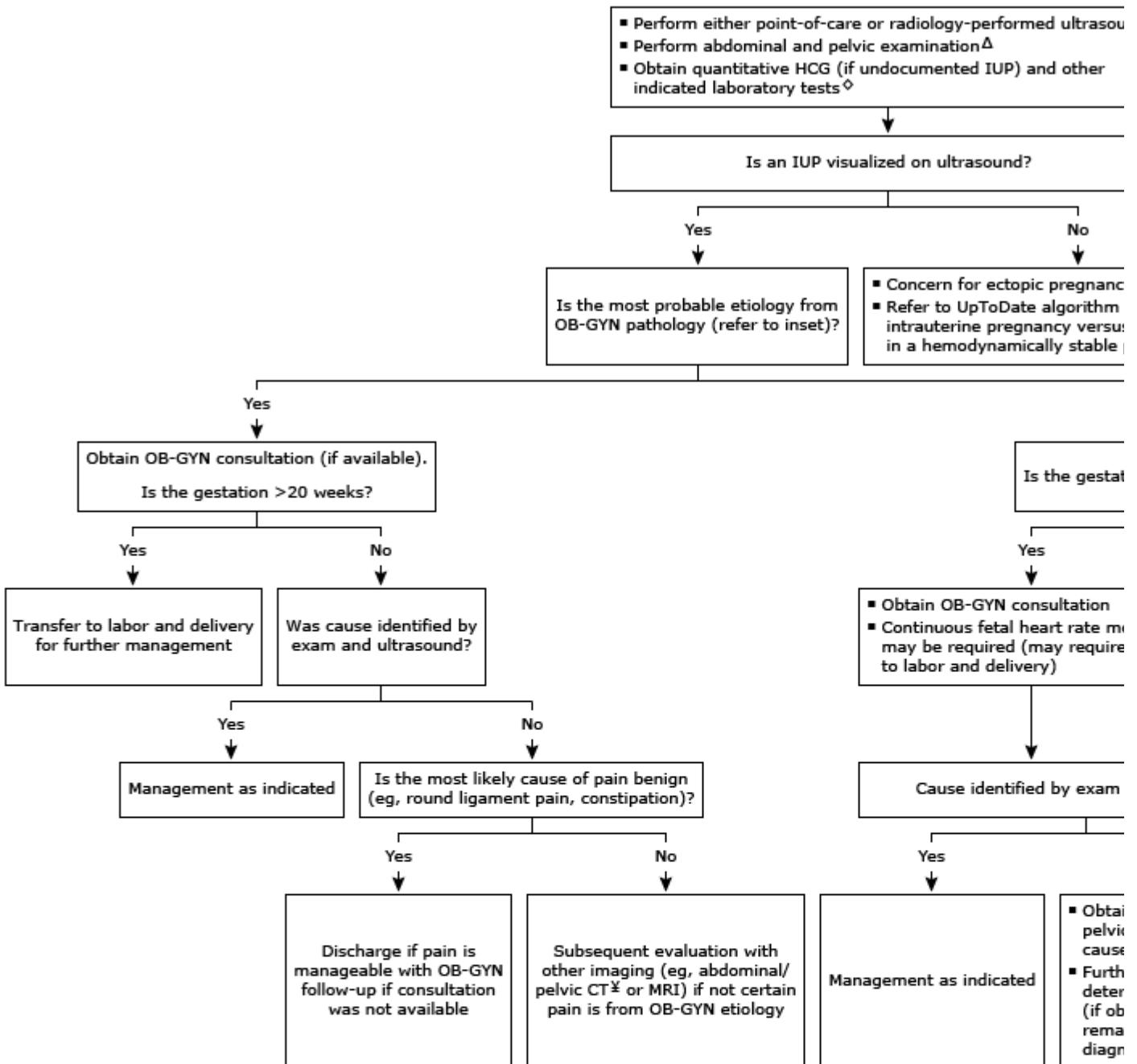


The CT scan of the abdomen shows an acute rupture of a 5 cm infrarenal abdominal aortic aneurysm. The high density acute blood obliterates the periaortic fat plane (arrow in A). The blood dissects into the retroperitoneum and obliterates the fat plane around the IVC (arrowhead) and the right psoas muscle in the posterior pararenal space (dashed arrow). The high density acute blood is better appreciated with narrowed windows (arrow in B). The full extent of the bleed is demonstrated by the maroon overlay in image C. The aneurysm is overlaid in bright red and the compressed IVC in blue.

CT: computed tomography; IVC: inferior vena cava.

Graphic 87665 Version 2.0

Approach to abdominal pain in hemodynamically stable pregnant patients without peritonitis in the emergency department*



Potential OB-GYN causes of abdominal pain during pregnancy

	Life-threatening	Non-life-threatening common
Before 20 weeks gestation	<ul style="list-style-type: none"> Ectopic pregnancy Septic abortion 	<ul style="list-style-type: none"> Round ligament pain Spontaneous abortion
After 20 weeks gestation	<ul style="list-style-type: none"> Placental abruption Preeclampsia with severe features HELLP syndrome Acute fatty liver of pregnancy 	<ul style="list-style-type: none"> Labor Chorioamnionitis Fetal position or movement
Before or after 20 weeks gestation	<ul style="list-style-type: none"> Uterine rupture 	<ul style="list-style-type: none"> Fibroid degeneration or torsion Bleeding ovarian cyst Constipation

Refer to UpToDate content on approach to acute abdominal/pelvic pain in pregnant and postpartum women for information on the diagnostic evaluation of these conditions.

Most patients with pregnancy-related bleeding who are RhD negative should receive anti-D immune globulin. Refer to UpToDate content on RhD alloimmunization prevention in pregnant and postpartum patients.

HCG: human chorionic gonadotropin; IUP: intrauterine pregnancy; OB-GYN: obstetrics and gynecology; CT: computed tomography; MRI: magnetic resonance imaging; HELLP: hemolysis, elevated liver enzymes, and low platelets; CBC: complete blood count.

* Use this algorithm for a pregnant patient without peritoneal signs, shock/hemodynamic instability, or toxic appearance.

¶ Ultrasound indications are based on gestational age, previous documented IUP, and location of pain. Should evaluate for peritoneal free fluid and for the following:

- If <20 weeks gestation, undocumented IUP, and lower abdominal pain: evaluate for IUP
- If lower abdominal pain: also evaluate for peritoneal free fluid, adnexal/pelvic mass or torsion, and appendicitis
- If flank or right upper quadrant pain: evaluate for nephrolithiasis/hydronephrosis and gallstones/cholecystitis
- If >20 weeks gestation, can evaluate for all of the above and abruption and uterine rupture

Δ Digital vaginal examination should **not** be performed in a patient with vaginal bleeding after 20 weeks of gestation unless placenta previa has been excluded by ultrasound examination.

◊ Laboratory tests may include CBC, basic metabolic panel, lactate, liver enzymes, lipase, urinalysis, type and cross, and coagulation studies.

§ Suspect ectopic pregnancy if no IUP visualized and quantitative HCG is greater than discriminatory zone for HCG. Refer to UpToDate content on the approach to the patient with pregnancy of unknown location.

¥ The choice of imaging study or studies is best made jointly by the clinical (medical, surgical, obstetric) providers and the radiologist, who can sometimes modify the technique to minimize fetal risk without significantly compromising the information needed for maternal diagnostic evaluation and management. Refer to UpToDate content on diagnostic imaging in pregnancy.

Upright abdominal x-ray of small bowel obstruction

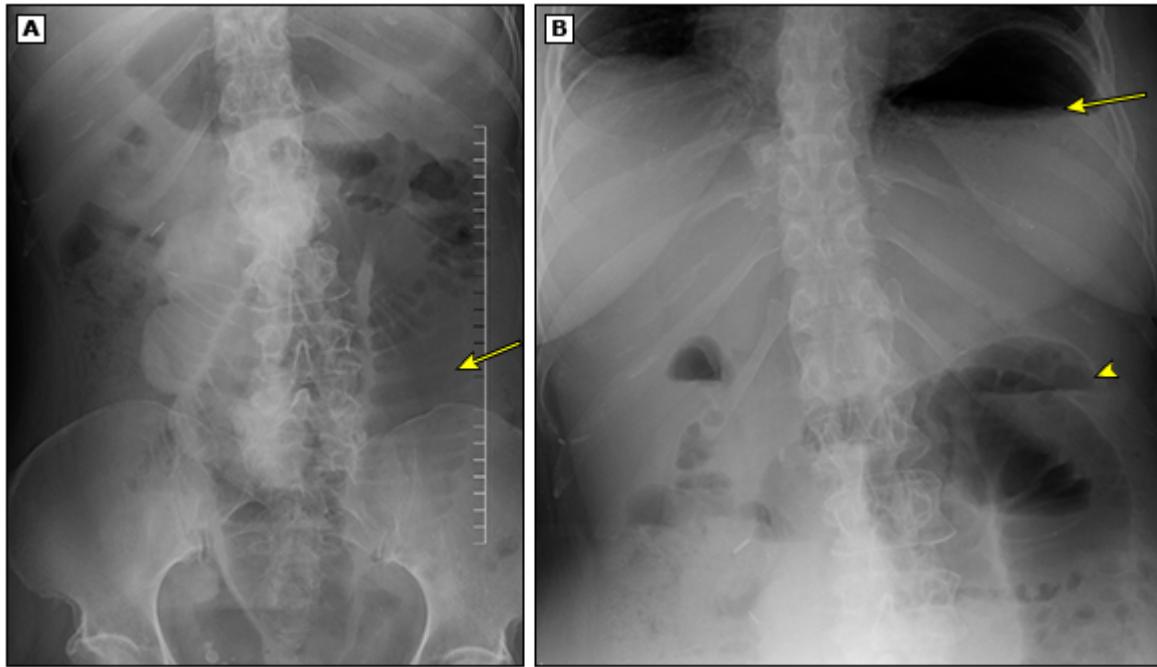


This plain, upright abdominal radiograph shows dilated loops of small bowel with air-fluid levels consistent with a diagnosis of small bowel obstruction.

Courtesy of Richard A Hodin, MD.

Graphic 68738 Version 4.0

Small bowel obstruction on x-ray of the abdomen



A supine examination of the abdomen (A) shows a dilated loop of small bowel on the left side of the abdomen (arrow). The upright examination (B) shows an air fluid level in the stomach (arrow) and in the small bowel (arrowhead).

Graphic 88524 Version 2.0

Small bowel obstruction CT



Small bowel obstruction seen on CT scan showing dilated, fluid-filled loops of small bowel.

CT: computed tomography.

Courtesy of Richard A Hodin, MD.

Graphic 81165 Version 3.0

Small bowel obstruction CT (coronal images)



Small bowel obstruction seen by CT scan (coronal images) showing dilated, fluid-filled loops of small intestine.

CT: computed tomography.

Courtesy of Richard A Hodin, MD.

Graphic 61824 Version 4.0

Causes of right upper quadrant (RUQ) abdominal pain

RUQ	Clinical features	Comments
Biliary		
Biliary colic	<p>Intense, dull discomfort located in the RUQ or epigastrium. Associated with nausea, vomiting, and diaphoresis. Generally lasts at least 30 minutes, plateauing within one hour. Benign abdominal examination.</p>	<p>Patients are generally well-appearing.</p>
Acute cholecystitis	<p>Prolonged (>4 to 6 hours) RUQ or epigastric pain, fever. Patients will have abdominal guarding and Murphy's sign.</p>	
Acute cholangitis	<p>Fever, jaundice, RUQ pain.</p>	<p>May have atypical presentation in older adults or immunosuppressed patients.</p>
Sphincter of Oddi dysfunction	<p>RUQ pain similar to other biliary pain.</p>	<p>Biliary type pain without other apparent causes.</p>
Hepatic		
Acute hepatitis	<p>RUQ pain with fatigue, malaise, nausea, vomiting, and anorexia. Patients may also have jaundice, dark urine, and light-colored stools.</p>	<p>Variety of etiologies include hepatitis A, alcohol, and drug-induced.</p>
Perihepatitis (Fitz-Hugh-Curtis syndrome)	<p>RUQ pain with a pleuritic component, pain is sometimes referred to the right shoulder.</p>	<p>Aminotransferases are usually normal or only slightly elevated.</p>
Liver abscess	<p>Fever and abdominal pain are the most common symptoms.</p>	<p>Risk factors include diabetes, underlying hepatobiliary or pancreatic disease, or liver transplant.</p>
Budd-Chiari syndrome	<p>Symptoms include fever, abdominal pain, abdominal distention (from ascites), lower extremity edema, jaundice, gastrointestinal bleeding, and/or hepatic encephalopathy.</p>	<p>Variety of causes.</p>

Portal vein thrombosis	Symptoms include abdominal pain, dyspepsia, or gastrointestinal bleeding.	Clinical manifestations depend on extent of obstruction and speed of development. Most commonly associated with cirrhosis.
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Graphic 106199 Version 3.0

Causes of epigastric abdominal pain

Epigastric	Clinical features	Comments
Acute myocardial infarction	May be associated with shortness of breath and exertional symptoms.	Consider particularly in patients with risk factors for coronary artery disease.
Acute pancreatitis	Acute-onset, persistent upper abdominal pain radiating to the back.	
Chronic pancreatitis	Epigastric pain radiating to the back.	Associated with pancreatic insufficiency.
Peptic ulcer disease	Epigastric pain or discomfort is the most prominent symptom.	Occasionally, discomfort localizes to one side.
Gastroesophageal reflux disease	Associated with heartburn, regurgitation, and dysphagia.	
Gastritis/gastropathy	Abdominal discomfort/pain, heartburn, nausea, vomiting, and hematemesis.	Variety of etiologies including alcohol and nonsteroidal antiinflammatory drugs (NSAIDs)
Functional dyspepsia	The presence of one or more of the following: postprandial fullness, early satiation, epigastric pain, or burning.	Patients have no evidence of structural disease.
Gastroparesis	Nausea, vomiting, abdominal pain, early satiety, postprandial fullness, and bloating.	Most causes are idiopathic, diabetic, or postsurgical.

Graphic 106200 Version 2.0

Causes of flank pain in an adult with a normal genitourinary examination

Common causes

Nephrolithiasis

Pyelonephritis

Herpes zoster

Rib fracture

Muscle strain

Lower lobe pneumonia

Less frequent causes

Obstructive uropathy (from processes such as urothelial/bladder carcinoma, thrombi, tumors, or retroperitoneal fibrosis)

Perinephric abscess

Abdominal aortic aneurysm (AAA)

Pulmonary embolism

Malignancy (eg, renal cell carcinoma)

Renal infarction (from renal artery thrombosis, embolism, or dissection)

Renal vein thrombosis

Renal papillary necrosis

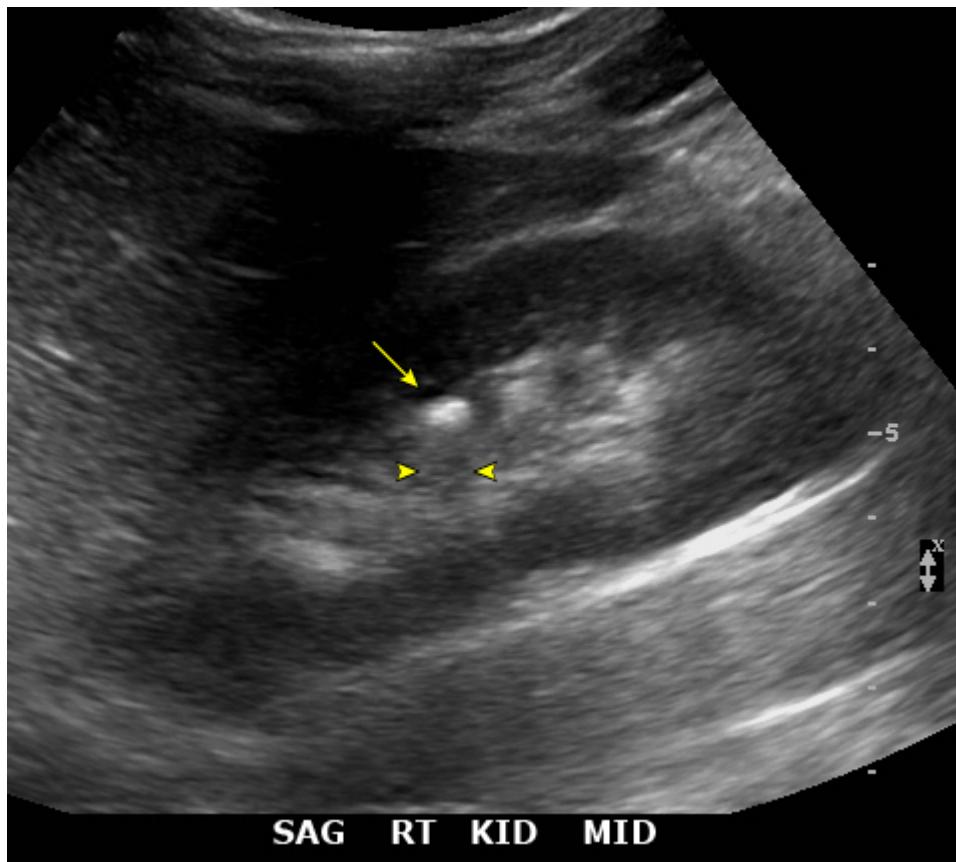
Loin pain-hematuria syndrome

Renal laceration/hemorrhage (due to trauma)

Retroperitoneal hemorrhage, abscess, or mass

Psoas abscess

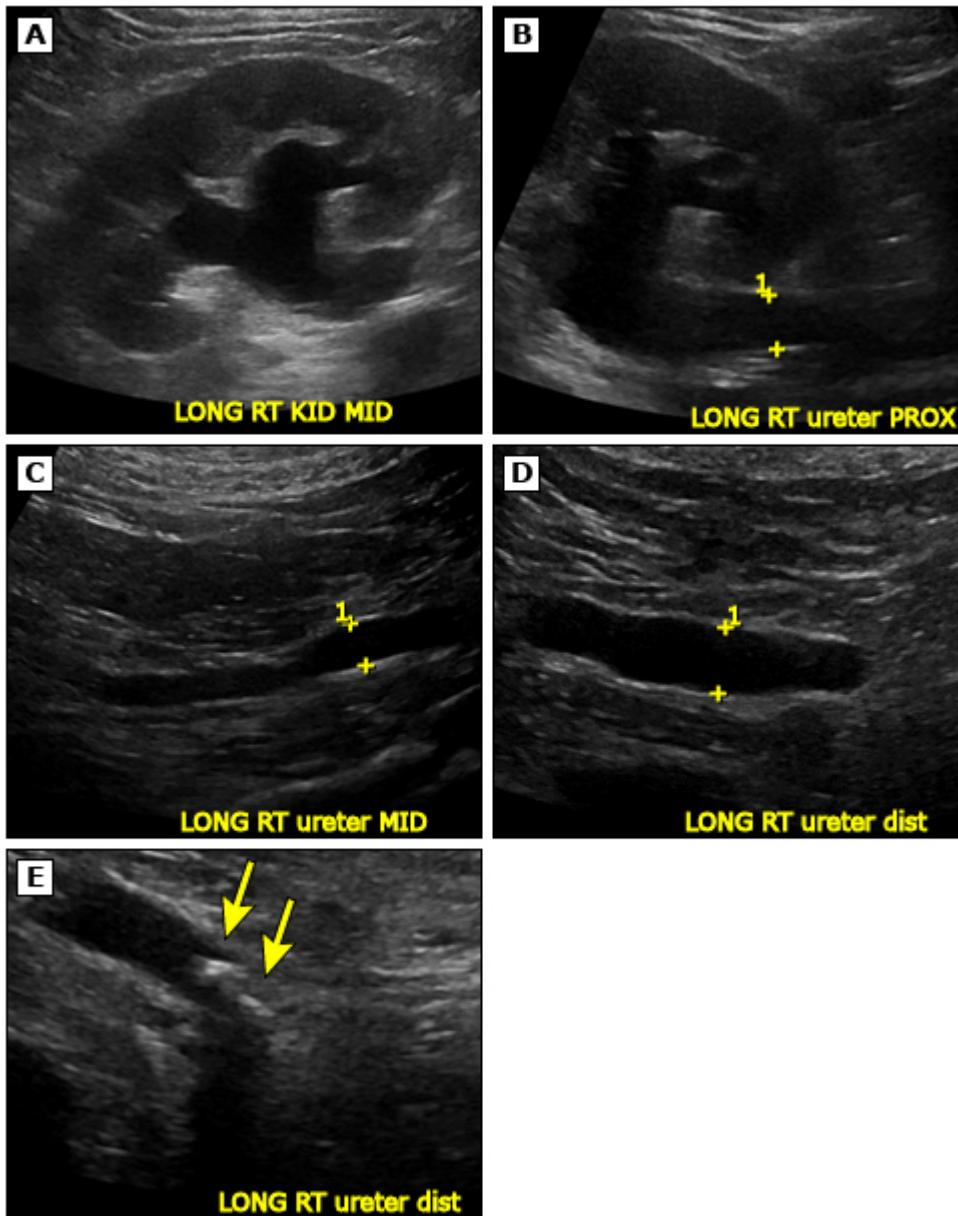
Kidney stone detected by ultrasonography



The sagittal view of the right kidney reveals a 7 mm shadowing stone in mid-portion of the kidney, characteristic of a non-obstructing stone. The echogenic focus (arrow) represents the stone. The calcified stone inhibits transmission of sound waves, resulting in a shadow behind the stone (arrowheads).

Graphic 57549 Version 4.0

Hydronephrosis and hydroureter



Longitudinal ultrasound image of the right kidney (A) showing hydronephrosis. Multiple longitudinal images (B-E) following the dilated right ureter to the point of obstruction, a cluster of echogenic distal ureteral stones with shadowing (arrows).

DIST: distal; KID: kidney; LONG: longitudinal; MID: midline; RT: right; PROX: proximal.

Courtesy of Deborah A Baumgarten, MD, MPH.

CT of a ureteral stone



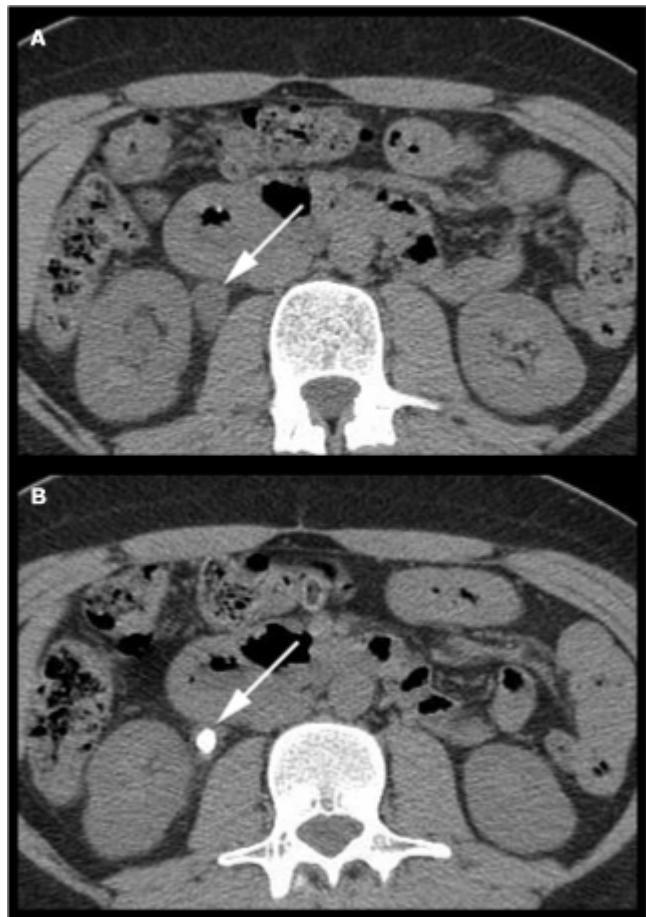
Ureterolithiasis with obstruction. Image of the abdomen from a CT with intravenous contrast shows a stone (arrow) in the proximal left ureter with slight delayed enhancement and mild hydronephrosis of the left kidney. The right kidney is normal with high density contrast excretion in the right ureter (arrowhead).

CT: computed tomography.

Courtesy of Jonathan Kruskal, MD.

Graphic 69052 Version 6.0

Ureteral obstruction



Sequential transverse images from a noncontrast CT scan. Panel A shows hydronephrosis in the lower pole of the right kidney and a dilated ureter (arrow). The stone obstructing the ureter is visible (arrow) in Panel B.

Courtesy of Deborah A Baumgarten, MD, MPH.

Graphic 55251 Version 2.0

Potential causes of acute pelvic pain in nonpregnant adult women by age group

Patient category	Common diagnoses	Less common diagnoses	Rare diagnoses
Reproductive age (not pregnant)	<ul style="list-style-type: none"> ▪ Dysmenorrhea ▪ Endometriosis or endometrioma, including ruptured ▪ Ovarian cyst, including ruptured ▪ Pelvic inflammatory disease, including salpingitis or tubo-ovarian abscess 	<ul style="list-style-type: none"> ▪ Adenomyosis ▪ Ovarian torsion ▪ Endometritis (postprocedure) ▪ Leiomyoma (degenerating) ▪ Mittelschmerz ▪ Sickle cell crisis in menstruating women with sickle cell disease ▪ Urinary retention (related to medications or underlying conditions, such as surgery) 	<ul style="list-style-type: none"> ▪ Asherman's syndrome (months postprocedure or delivery) ▪ Endosalpingiosis ▪ Neoplasm/malignancy including gynecologic, gastrointestinal, and urologic ▪ Ovarian vein thrombosis, including septic pelvic thrombophlebitis ▪ Pelvic congestion syndrome ▪ Torsion of subserosal fibroid ▪ Uterine perforation (typically after uterine procedure or intrauterine device insertion)
Reproductive age (undergoing fertility treatment)	<ul style="list-style-type: none"> ▪ Ectopic pregnancy ▪ Ovarian follicular cyst ▪ Ovarian hyperstimulation syndrome 	<ul style="list-style-type: none"> ▪ Ovarian torsion 	<ul style="list-style-type: none"> ▪ Heterotopic pregnancy
Reproductive age (postpartum or postprocedure)	<ul style="list-style-type: none"> ▪ Wound infection ▪ Endometritis 	<ul style="list-style-type: none"> ▪ Abdominal wall hematoma, infection, seroma, dehiscence ▪ Ureteral obstruction 	<ul style="list-style-type: none"> ▪ Anterior cutaneous nerve entrapment syndrome ▪ Ovarian vein thrombosis ▪ Septic pelvic thrombophlebitis
Postmenopausal women	<ul style="list-style-type: none"> ▪ Malignancy (gynecologic, 	<ul style="list-style-type: none"> ▪ Ischemic colitis 	<ul style="list-style-type: none"> ▪ Endometriosis

	gastrointestinal, or urologic)		■ Pelvic inflammatory disease, tubo-ovarian abscess
All groups	<ul style="list-style-type: none"> ■ Appendicitis ■ Diverticulitis ■ Gastroenteritis ■ Inflammatory bowel disease ■ Irritable bowel syndrome ■ Musculoskeletal pelvic pain ■ Urinary tract infection (cystitis, pyelonephritis) ■ Urolithiasis 	<ul style="list-style-type: none"> ■ Bowel obstruction ■ Fecal impaction or constipation ■ Inguinal or femoral hernia ■ Interstitial cystitis/painful bladder ■ Muscular strain or sprain ■ Pelvic adhesive disease (postoperative scarring) ■ Perforated viscus ■ Perirectal abscess ■ Postoperative pelvic abscess ■ Urethral diverticulum ■ Ureteral obstruction ■ Urinary retention 	<ul style="list-style-type: none"> ■ Abdominal epilepsy ■ Abdominal migraine ■ Abdominal aortic aneurysm ■ Bladder cancer ■ Depression (while depression is common, it is uncommonly a cause of acute pelvic pain) ■ Domestic violence ■ Fracture of pelvis or hip ■ Familial Mediterranean Fever ■ Herpes Zoster ■ Hirschsprung disease ■ Incarcerated or strangulated hernia ■ Intussusception ■ Lead poisoning ■ Malingering ■ Meckel's diverticulum ■ Mesenteric adenitis ■ Narcotic seeking ■ Ovarian torsion ■ Ovarian vein thrombosis ■ Pelvic congestion syndrome ■ Porphyria ■ Septic pelvic thrombophlebitis ■ Sexual abuse ■ Sickle cell crisis ■ Somatization disorder ■ TRAPS ■ Uterine rupture ■ Volvulus

- Vulvar varicosities
- Wandering spleen

TRAPS: tumor necrosis factor receptor-associated periodic syndrome.

Adapted from: Bhavsar AK, Gelner EJ, Shorma T. Common Questions About the Evaluation of Acute Pelvic Pain. Am Fam Physician 2016; 93:41.

Graphic 120883 Version 1.0

Pelvic causes of abdominal pain in women

Pelvic causes of abdominal pain in women	Lateralization	Clinical features	Comments
Ectopic pregnancy	Either side or diffuse abdominal pain	Vaginal bleeding with abdominal pain, typically six to eight weeks after last menstrual period.	Patients can present with life-threatening hemorrhage if ruptured.
Pelvic inflammatory disease	Lateralization uncommon	Characterized by the acute onset of lower abdominal or pelvic pain, pelvic organ tenderness, and evidence of inflammation of the genital tract. Often associated with cervical discharge.	Wide spectrum of clinical presentations
Ovarian torsion	Localized to one side	Acute onset of moderate-to-severe pelvic pain, often with nausea and possibly vomiting, in a woman with an adnexal mass.	Generally not associated with vaginal discharge.
Ruptured ovarian cyst	Localized to one side	Sudden-onset unilateral lower abdominal pain. The classic presentation is sudden onset of severe focal lower quadrant pain following sexual intercourse.	Generally not associated with vaginal discharge.
Endometriosis		Associated with dysmenorrhea, pelvic pain, dyspareunia, and/or infertility, but other symptoms may also be present (eg, bowel or bladder symptoms).	Patients may present with one symptom or a combination of symptoms.
Acute endometritis		Most often preceded by pelvic inflammatory disease.	Diagnostic criteria the same as pelvic inflammatory disease.
Chronic endometritis		Present with abnormal uterine bleeding, which may consist of intermenstrual bleeding, spotting, postcoital bleeding, menorrhagia, or amenorrhea. Vague, crampy lower abdominal	

		pain accompanies the bleeding or may occur alone.	
Leiomyomas (fibroids)		Symptoms related to bulk or infrequently acute pain from degeneration or torsion of pedunculate tumor. Pain may be associated with a low-grade fever, uterine tenderness on palpation, elevated white blood cell count, or peritoneal signs.	
Ovarian hyperstimulation		Abdominal distention/discomfort, nausea/vomiting, and diarrhea. More severe cases can have severe abdominal pain, ascites, intractable nausea, and vomiting.	Women undergoing fertility treatment.
Ovarian cancer		Abdominal or pelvic pain. May have associated symptoms of bloating, urinary urgency or frequency, or difficulty eating/feeling full quickly.	
Ovulatory pain (Mittelsmerz)		Occurs mid-cycle, coinciding with timing of ovulation.	May be right- or left-sided, depending on site of ovulation during that cycle.
Pregnancy and related complications*			

* Refer to the UpToDate topics on abdominal pain.

Graphic 106204 Version 3.0

Causes of lower abdominal pain

Lower abdomen	Localization	Clinical features	Comments
Appendicitis	Generally right lower quadrant	Periumbilical pain initially that radiates to the right lower quadrant. Associated with anorexia, nausea, and vomiting.	Occasional patients present with epigastric or generalized abdominal pain.
Diverticulitis	Generally left lower quadrant, although right-sided symptoms are not uncommon	Pain usually constant and present for several days prior to presentation. May have associated nausea and vomiting.	Clinical presentation depends on severity of underlying inflammatory process and whether or not complications are present.
Nephrolithiasis	Either	Pain most common symptom, varies from mild to severe. Generally flank pain, but may have back or abdominal pain.	Cause symptoms as stone passes from renal pelvis to ureter.
Pyelonephritis	Either	Associated with dysuria, frequency, urgency, hematuria, fever, chills, flank pain, and costovertebral angle tenderness.	
Acute urinary retention	Suprapubic	Present with lower abdominal pain and discomfort; inability to urinate.	
Cystitis	Suprapubic	Associated with dysuria, frequency, urgency, and hematuria.	
Infectious colitis	Either	Diarrhea as the predominant symptom, but may also have associated abdominal pain, which may be severe.	Patients with <i>Clostridioides difficile</i> infection can present with an acute abdomen and peritoneal signs in the setting of perforation and fulminant colitis.

Testicular torsion	Can begin in lower abdomen, localizing to side ipsilateral to testicle	Often associated with nausea and vomiting.	Usually in boys or adolescents.
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Graphic 106202 Version 5.0

Causes of diffuse abdominal pain

Diffuse/poorly characterized	Clinical features	Comments
Bowel obstruction	Most common symptoms are nausea, vomiting, crampy abdominal pain, and obstipation. Distended, tympanic abdomen with high-pitched or absent bowel sounds.	Multiple etiologies.
Perforation of the gastrointestinal tract	Severe abdominal pain, particularly following procedures.	Can present acutely or in an indolent manner, particularly in immunosuppressed patients.
Acute mesenteric ischemia	Acute and severe onset of diffuse and persistent abdominal pain, often described as pain out of proportion to examination.	May occur from either arterial or venous disease. Patients with aortic dissection can have abdominal pain related to mesenteric ischemia.
Chronic mesenteric ischemia	Abdominal pain after eating ("intestinal angina"), weight loss, nausea, vomiting, and diarrhea.	May occur from either arterial or venous disease.
Inflammatory bowel disease (ulcerative colitis/Crohn disease)	Associated with bloody diarrhea, urgency, tenesmus, bowel incontinence, weight loss, and fevers.	May have symptoms for years before diagnosis. Associated extraintestinal manifestations (eg, arthritis, uveitis).
Viral gastroenteritis	Diarrhea accompanied by nausea, vomiting, and abdominal pain.	
Spontaneous bacterial peritonitis	Fever, abdominal pain, and/or altered mental status.	Most often in cirrhotic patients with advanced liver disease and ascites.
Dialysis-related peritonitis	Abdominal pain and cloudy peritoneal effluent. Other symptoms and signs include fever, nausea, diarrhea, abdominal tenderness, and rebound tenderness.	Only in peritoneal dialysis patients.
Colorectal cancer	Variable presentation, including obstruction and perforation.	
Other malignancy	Vary depending on malignancy.	
Celiac disease	Abdominal pain in addition to including diarrhea with bulky, foul-smelling,	

	floating stools due to steatorrhea and flatulence.	
Ketoacidosis	Diffuse abdominal pain and nausea and vomiting.	
Adrenal insufficiency	Diffuse abdominal pain and nausea and vomiting.	Patients with adrenal crisis may present with shock and hypotension.
Foodborne illness	Mixture of nausea, vomiting, fever, abdominal pain and diarrhea.	
Irritable bowel syndrome	Chronic abdominal pain with altered bowel habits.	
Constipation		Associated with a variety of neurologic and metabolic disorders, obstruction lesions of the gastrointestinal tract, endocrine disorders, psychiatric disorders, and side effect of medications
Diverticulosis	May have symptoms of abdominal pain and constipation.	Often an asymptomatic and incidental finding on colonoscopy or sigmoidoscopy.
Lactose intolerance	Associated with abdominal pain, bloating, flatulence, and diarrhea. Abdominal pain may be cramping in nature.	

Graphic 106203 Version 3.0

Causes of left upper quadrant (LUQ) abdominal pain

LUQ	Clinical features	Comments
Splenomegaly	Pain or discomfort in LUQ, left shoulder pain, and/or early satiety.	Multiple etiologies.
Splenic infarct	Severe LUQ pain.	Atypical presentations common. Associated with a variety of underlying conditions (eg, hypercoagulable state, atrial fibrillation, and splenomegaly).
Splenic abscess	Associated with fever and LUQ tenderness.	Uncommon. May also be associated with splenic infarction.
Splenic rupture	May complain of LUQ, left chest wall, or left shoulder pain that is worse with inspiration.	Most often associated with trauma.

Graphic 106201 Version 2.0

Modified Alvarado score for diagnosis of appendicitis

Feature	Points
Migratory right lower quadrant pain	1
Anorexia	1
Nausea or vomiting	1
Tenderness in the right lower quadrant	2
Rebound tenderness in the right lower quadrant	1
Fever $>37.5^{\circ}\text{C}$ ($>99.5^{\circ}\text{F}$)	1
Leukocytosis of white blood cell count $>10 \times 10^9/\text{liter}$	2
Total	9

Score of 0 to 3 indicates appendicitis is unlikely and other diagnoses should be pursued. Score of ≥ 4 indicates that the patient should be further evaluated for appendicitis.

C: centigrade; F: Fahrenheit.

Modified from: Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med 1986; 15:557.

Graphic 111766 Version 2.0

