

Acute Surgical abdomen

The Basics

When a patient presents to the ED with acute abdominal pain, the emergency physician's role in taking a history, performing an exam, selecting the appropriate imaging modality, and calling for surgical consultation, if needed, cannot be underestimated. The authors review the most common etiologies of acute surgical abdomen and the emergency physician's pivotal responsibility in ensuring the best outcomes.

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Abdominal pain is a common complaint seen in emergency departments nationwide. According to the CDC, stomach and abdominal pain are the leading reasons for visits to the ED, accounting for 6.8% of all visits in 2006.¹ An adult patient with an acute abdomen generally appears ill and has abnormal findings on physical exam. Many of these patients need immediate surgery, as several of the underlying disease processes that result in an acute abdomen are associated with high morbidity and/or mortality. The emergency physician must rapidly identify those patients who require early surgical intervention and appropriately resuscitate them, order the necessary tests, consult the surgical team early on, and notify surgical staff or arrange for a transfer,

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depending on the capabilities of the home institution. This article reviews key points in the evaluation of adult patients with abdominal pain, discusses disease processes that require emergent surgical evaluation and treatment, and highlights the importance of facilitating early surgical intervention. Although there are many causes of abdominal pain, this article will focus on etiologies that often lead to an acute *surgical* abdomen, ie, those cases in which a patient needs emergent evaluation and treatment and likely requires emergent operative treatment.

HISTORY

Every clinician learns that history is the key to diagnosing most illness, and this is especially true for patients with abdominal pain. The standard questions of location, onset, frequency, quality, severity, radiation, exacerbating/relieving features, and previous episodes and treatments are all pertinent in patients presenting with abdominal pain. Additional questions should address nonabdominal diseases that

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can present atypically with abdominal pain, such as pneumonia, acute myocardial infarction, and pulmonary embolism.

It is important to consider the stage of the patient's disease process at the time of presentation, as symptoms can change over time. Migration of pain, for instance, can be characteristic of certain entities or disease progression. Consider the classic presentation of appendicitis, which starts as generalized or right-sided abdominal pain and then localizes to McBurney's point (one-third of the distance from the right anterior superior iliac spine to the umbilicus). With further disease progression (perhaps rupture), pain from appendicitis may again generalize as peritonitis develops.

It is also important to ask about pertinent medical and family history, including vascular disease, hypertension, coagulation disorders, collagen vascular disease, previous surgeries, and history of gastrointestinal illnesses (including Crohn's disease and ulcerative colitis). Social history should not be forgotten, as alcohol and smoking can contribute to many disease processes. Patients often do not voluntarily report illicit drug use, so the physician should specifically ask about it. Muniz and Evans describe several cases of ischemic bowel associated with recent cocaine use that required bowel resection.² Review of systems should also include questions regarding fever, nausea/vomiting, decreased appetite, pain/relief after eating, pain/relief after bowel movement (BM), last normal BM, bloody BM, menstrual history/symptoms, dysuria, and hematuria. At times, the history can be limited by the patient's clinical condition or inability to adequately describe the pain due to poor localization and potential radiation of visceral pain.

EXAMINATION

The goals of the physical exam are to determine the overall condition of the patient, assess the severity of the intra-abdominal disease process, and identify the likely cause of the pain. As always, vital signs help differentiate a "sick" versus "not sick" patient. The abdominal exam can provide immediate feedback to the emergency physician regarding the severity and underlying etiology of abdominal pain. Palpation yields the most useful information, particularly when it is performed by experienced physicians. Systematically work your way around the abdomen, feeling for masses and localizing the pain. Sometimes, in order

to minimize guarding, which is a natural response to significant intra-abdominal discomfort, it is beneficial to begin palpation away from the area where the patient reports that the pain is located.

Many patients with an acute surgical abdomen have peritoneal signs, which include involuntary guarding, pain with light palpation, and rebound tenderness. Patients may also describe symptoms suggestive of peritonitis during the history-taking process. These include pain elicited by walking, driving over bumps in the road, shaking of the bed during rest, and/or coughing. In the absence of an exam suggesting frank peritonitis, localizing the pain on exam can help form and narrow the differential diagnosis. Furthermore, serial abdominal exams should be performed, especially in patients with an uncertain diagnosis after initial evaluation. Changes in the exam findings can narrow the differential diagnosis and also help determine appropriate timing of treatments and/or consultations.

Additional components of the abdominal exam include auscultation, skin exam, and several specific maneuvers. Auscultation for bowel sounds is not specific or sensitive, but absent bowel sounds may suggest peritonitis and high-pitched bowel sounds may support diagnosis of an obstructive process. A thorough skin exam is important, as some patients will have discolorations that point to a diagnosis. Periumbilical ecchymosis (Cullen sign) and flank ecchymosis (Turner sign) are suggestive of retroperitoneal hemorrhage and, more specifically, pancreatic hemorrhage. Patients with acute appendicitis can exhibit Rovsing's sign (rebound tenderness in the right lower quadrant on palpation of the left lower quadrant) and psoas sign (increased abdominal pain with resisted hip flexion, which suggests inflammation of the psoas muscle).

Unfortunately, diagnosing the etiology of abdominal pain can be frustrating due to nonspecific signs and symptoms, especially in the elderly. Sometimes observation of disease progression, repeat physical examination, advanced imaging studies, and/or surgical exploration are needed to determine the exact etiology of abdominal pain. Nonetheless, emergency physicians are regularly called upon to identify those patients with acute abdominal pain requiring surgical intervention. The remainder of this article will review specific causes of abdominal pain that require surgical intervention.

TABLE 1. Selected Causes of Acute Surgical Abdomen

Etiology	Location/Quality of Pain	Primary Symptoms	Laboratory Tests	Imaging	Treatment
Mesenteric Ischemia	General, out of proportion to exam findings	Postprandial abdominal pain	Lactate, CBC	CT angiography	Antibiotics
Appendicitis	Periumbilical migrating to McBurney's point	Anorexia, nausea, vomiting	CBC	CT	Antibiotics
Cholecystitis	RUQ	Pain, jaundice, fever	Bilirubin, lipase measurement, liver function tests	RUQ ultrasonography	Antibiotics
Diverticulitis	LLQ	Pain	CBC	CT	Antibiotics
Small Bowel Obstruction	Generalized	Nausea, vomiting, distention	Basic metabolic profile	Acute abdominal series, CT with oral contrast	Nasogastric tube, IV fluids
Abdominal Aortic Aneurysm	Severe abdominal/back pain	Pain	CBC, coagulation studies	CT angiography	β -Blocker/CCB*

CBC = complete blood count; CT = computed tomography; RUQ = right upper quadrant; LLQ = left lower quadrant; IV = intravenous; CCB = calcium channel blocker.

* For systolic blood pressure of 120 to 130 mm Hg.

CAUSES OF ACUTE SURGICAL ABDOMEN

Perforated Viscus

Perforated viscus is a surgical emergency that can lead to serious morbidity and, commonly, mortality. To provide the best possible outcome, the emergency physician must maintain a high level of clinical suspicion for perforation in the patient with acute abdominal pain. Concurrent resuscitation and diagnosis of the patient, along with mobilization of the appropriate resources (surgical consultation, operating room team) are first-line goals. The abdominal exam is often telling in these patients, but imaging must often be used to augment the clinical exam and provide important information to the surgeon, who must plan the procedure. An upright chest radiograph by itself or an acute abdominal series

(AAS: upright chest radiograph, upright abdominal radiograph, and a flat abdominal radiograph) often shows free air and is diagnostic of perforated viscus. Diseases that can progress to organ perforation include mesenteric ischemia, diverticulitis, appendicitis, bowel obstruction, cholecystitis, incarcerated/strangulated hernia, and peptic ulcer disease. Table 1 highlights characteristic and important features of some of these disease processes.

Appendicitis

Appendicitis occurs following obstruction of the lumen of the appendix, typically secondary to a fecalith. The obstruction leads to trapping of mucosal and bacterial fluids and a subsequent increase in appendiceal volume. Increased intraluminal pressure causes distention, resulting in visceral pain that is typically

diffuse or periumbilical. Subsequent inflammation that develops around the appendix leads to peritoneal irritation, which causes the pain to localize, typically near McBurney's point. Over time, continued pressure leads to appendiceal wall ischemia and the possibility of rupture.

Patients often present with anorexia and abdominal pain followed by vomiting. Unfortunately, atypical presentations are common as well. The most sensitive signs for appendicitis are right lower quadrant pain (classically described as *periumbilical pain migrating to the right lower quadrant*), abdominal wall rigidity, pain before vomiting, and a positive psoas sign. Anatomical variations of the appendix play a role in atypical presentations and location of pain. One study showed that 32% of pediatric patients do not have the classically described right lower quadrant pain, making the diagnosis difficult and possibly delaying definitive treatment.³ Therefore, the high clinical suspicion for appendicitis is warranted in the patient with acute abdomen. A recent study by Frei et al demonstrated that delayed diagnosis of appendicitis declined following widespread use of CT scanning, decreasing from 7.8% in 1998 to 3.0% in 2004.⁴

Imaging, such as CT or ultrasonography, is commonly employed to facilitate diagnosis. On ultrasound, a noncompressible appendix greater than 6 mm is considered diagnostic of appendicitis, and thickened appendiceal wall and periappendiceal fluid are highly suggestive.⁵ Ultrasound can be particularly useful in pregnant patients, but CT is often preferred in the ED because it is accessible and it can be used to evaluate other etiologies. Prudent CT scanning minimizes unnecessary exposure to ionizing radiation. On CT, an appendix dilated more than 6 mm, a thickened appendiceal wall, a fecalith, and/or phlegmon, all suggest acute appendicitis in the proper clinical setting.⁵ When it is not readily apparent whether CT should be ordered, the Alvarado scale can be used as an aid in decision making.⁶ The Alvarado scale assigns points for certain signs, symptoms, and laboratory values, as noted in Table 2.⁶

McKay and Shepherd concluded that to confirm a diagnosis of appendicitis, ED patients with Alvarado scores of 3 or lower probably do not need CT (score sensitivity, 96.2%; specificity, 67%), while those with scores of 4 to 6 should undergo CT (score sensitivity, 35.6%; specificity, 94%), and those with scores of 7 or

TABLE 2. Alvarado Scale

Exam Finding	Point(s)
History	
Migration of pain	1
Anorexia	1
Nausea/vomiting	1
Physical Exam	
RLQ tenderness	2
Rebound	1
Increased temperature	1
Laboratory Results	
Leukocytosis	2
Left shift	1

RLQ = right lower quadrant
Adapted from Alvarado.⁶

higher should receive a surgical consultation without imaging (score sensitivity, 77%; specificity, 100%).⁷

Treatment for appendicitis is appendectomy, because the risks of rupture are well-known. It is important to start antibiotics in the ED. Other disorders can mimic appendicitis, so it is important to have a broad differential diagnosis and to consider other possibilities. In some hospitals, it is not uncommon for an appendix to be found normal during surgery for presumed appendicitis; thus, surgeons may request CT or another imaging modality to confirm the diagnosis. This request depends on the surgeon's experiences and habits, patient age and history, and other findings obtained during evaluation.

Mesenteric Ischemia

Mesenteric ischemia can have one of four causes: arterial emboli, arterial thrombus, vasospasm, and venous thrombus. Mesenteric ischemia is classically described as causing abdominal pain out of proportion to exam findings in affected patients. Patients often report severe generalized or periumbilical pain. They may also have bloody bowel movements, nausea, vomiting, food aversion, weight loss, abdominal distention, and peritoneal symptoms. Postprandial abdominal pain is the most prevalent preceding

symptom⁸ and is sometimes described as “intestinal angina.”

Mesenteric ischemia can be either acute or chronic, with the acute type presenting emergently. The natural history of mesenteric ischemia produces a spectrum of clinical findings and abnormalities on workup, with individual presentation depending on the extent of disease progression. The exam may yield significant findings or may reveal very little. The latter situation, unfortunately, can be falsely reassuring. Thus, when mesenteric ischemia is suspected but the exam or initial workup provide little support for the diagnosis, observation and serial examination and testing (usually in concert with a surgical consult) may be of benefit. Mesenteric ischemia should be part of the differential diagnosis in any patient with abdominal pain and a history of atrial fibrillation, hypercoagulable state, heart valve disease, recent cocaine use, or vascular disease, even if the exam and workup are relatively unremarkable.

Diagnostic workup of patients with mesenteric ischemia can be frustrating. Some patients have leukocytosis and elevated amylase levels. Acidosis, if present, generally indicates that the disease has progressed to a late stage and the patient already has full-thickness bowel injury. Imaging is often used to aid

in diagnosis. Although angiography is the gold standard exam, it is not available in many EDs. CT angiography can be a useful tool in the diagnosis of mesenteric ischemia, with recent studies showing a sensitivity of 96% and specificity of 94%.⁹ Common findings indicative of mesenteric ischemia include pneumatosis intestinalis, venous gas, superior mesenteric artery (SMA) occlusion, celiac and inferior mesenteric arterial occlusion with distal

SMA disease, and/or arterial embolism. Alternatively, bowel wall thickening combined with a finding of a focal lack of bowel wall enhancement, solid organ infarction, or venous thrombosis also suggests the diagnosis.⁹ CT angiography is useful for evaluating arterial and venous occlusions and the secondary ef-

fects of these processes (eg, bowel wall thickening, inflammation, perforation), as well as for evaluating other causes of abdominal pain.

In a patient with peritoneal signs in whom mesenteric ischemia is suspected, early surgical consultation is crucial, and the consult is often initiated before the diagnosis is established definitively. These patients often require an emergent laparotomy for resection of infarcted bowel in order to survive. For patients without peritoneal signs, thrombolysis or vascular bypass may be considered by the consultant surgeon. Anticoagulation therapy is indicated for acute mesenteric venous thrombosis, which may not be diagnosed until the patient is in the operating room. Early, empiric antibiotic treatment is also generally recommended.¹⁰

Biliary Tract Disease

Biliary tract disease is frequently diagnosed in the ED, with cholecystitis being much more common than cholangitis. Right upper quadrant pain and vomiting, especially in the presence of fever, suggests the potential for surgical consultation for biliary tract disease. On physical exam, the presence of Murphy's sign suggests cholecystitis. Workup for biliary tract disease includes electrolytes, renal function, a complete blood count, and measurements of serum bilirubin, alkaline phosphatase, and lipase levels. In addition, imaging should be ordered, especially in elderly patients. Ultrasonography of the right upper quadrant is the test of choice and is commonly utilized in the ED.

Gallstones are common in American adults, and the prevalence increases with age. Gallstones can lodge anywhere in the biliary tract, from the gallbladder neck to the common bile duct. Prolonged obstruction leads to inflammation and promotes subsequent bacterial invasion. In many cases, patients presenting with an acute surgical abdomen caused by biliary tract disease have had a delay in diagnosis. This occurs more often in elderly patients, as the early presentation of disease in this age-group can be subtle, and thus, the diagnosis is easily missed. If biliary tract disease is diagnosed as the cause of a patient's acute abdomen, early antibiotics with fluid resuscitation and surgical consultation are critical for a favorable outcome. Patients who do not respond to initial therapy may require emergent biliary decompression.

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It is particularly important to recognize ascending cholangitis, as this form of biliary tract disease can become fulminant if it is not treated appropriately. Charcot's triad of right upper quadrant pain, fever, and jaundice is classically described in cholangitis and can progress to Reynolds' pentad with the addition of mental status changes and shock, which represents the extreme of the spectrum. Ascending cholangitis typically results from obstruction of the common bile duct with subsequent migration of bacteria into the lymphatics and hepatic veins. Thus, it is important to maintain a high level of suspicion for this disease.

Diverticulitis

Diverticulitis occurs when bacteria proliferate within a diverticulum, a process that can lead to perforation and acute surgical abdomen. Diverticulitis is more common in the elderly and often causes pain in the left lower quadrant but can occur throughout the colon. As the infection progresses, the wall tension of the diverticulum can increase, leading to spontaneous rupture. The rupture can be relatively contained, forming an abscess, or it can be a large perforation leading to acute peritonitis. Interestingly, Issa et al found that recurrent bouts of diverticulitis do not correlate with a more complicated clinical course.¹¹ They found that patients without a previous episode of diverticulitis had a higher rate of perforation, while patients with a history of diverticulitis had a higher rate of phlegmon or abscess formation. CT of the abdomen and pelvis with IV contrast is useful for assessing the extent of diverticulitis and evaluating for abscess and/or perforation. Serial abdominal exams will ensure early recognition of disease progression and the need for surgical intervention, if applicable. Antibiotics are essential in the treatment of diverticulitis, as well.

Small Bowel Obstruction

Small bowel obstruction (SBO) is a common surgical disorder of the small intestine.¹² Adhesions from previous surgeries account for the majority of SBO cases, while other etiologies, including hernias and Crohn's disease, are less frequently seen.¹² With SBO, swallowed food, liquid, and air, as well as secretions from the GI tract, progressively accumulate proximal to the obstruction. Areas with high intraluminal pressures can impair blood flow, causing intestinal

ischemia and necrosis. This occurs most commonly in a closed loop obstruction.

Patients tend to present with the classic triad of abdominal pain, vomiting, and obstipation. However, because there is a continuum from partial to complete obstruction, the severity of signs and symptoms may vary. For example, early in the course of an SBO, patients may still have some bowel movements and gas in the rectum. Laboratory testing in SBO has limited diagnostic value in the ED setting, but it can be useful in identifying dehydration and electrolyte abnormalities that should be addressed prior to surgery. Imaging is needed to assess whether the obstruction is partial or complete. An AAS is cost-effective and provides useful diagnostic clues. If an obstruction is present, the AAS will show dilated loops of small bowel, air-fluid levels, and a paucity of air in the colon and rectum. Abdominal radiographs were found to have a sensitivity of 82% and specificity of 83% in diagnosing SBO, but accuracy was dependent on the radiologist's level of experience.¹³ CT is often employed, since it can localize a transition point and identify other intra-abdominal processes. Additionally, CT can help differentiate between SBO, closed loop obstruction, ileus, or colonic obstruction.

Therapy in the ED generally includes fluid resuscitation, placement of a nasogastric tube for decompression, analgesia, antiemetics, and a surgical consult. With a complete SBO, the risk of ischemia and perforation is significant. Thus, emergent surgical decompression is required. Patients with partial SBO are often admitted and observed for progression versus resolution of signs and symptoms over the next 48 hours. Any evidence of developing peritonitis should prompt urgent surgical intervention.

Abdominal Aortic Aneurysm

Patients with a ruptured abdominal aortic aneurysm (AAA) often die prior to arrival in the ED, or after arrival but before reaching the OR.¹⁴ Often, patients with an AAA are unaware of it prior to the onset of symptoms; thus, a high index of suspicion on the part of the emergency physician is paramount. Patients

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Therapy for small bowel obstruction in the ED generally includes fluid resuscitation, placement of a nasogastric tube for decompression, analgesia, antiemetics, and a surgical consult.

with AAA frequently complain of sudden severe abdominal and/or back pain and may also note a syncopal episode with the onset of pain, which likely represents the initial rupture. The patient presenting to the ED with a symptomatic AAA likely has a contained rupture and may initially be hemodynamically stable. Often, delays in diagnosis occur while other causes of the abdominal pain are considered, particularly if the patient does not have a history of AAA.

Patients in whom a ruptured AAA is suspected need an emergent vascular surgery consultation. Quick, targeted bedside ultrasonography can be useful in these patients if it is available and the patient's body habitus is favorable; however, imaging

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should not delay consultation. Due to the instability of these patients, CT generally should be reserved for cases in which the probability of rupture is low. In addition to surgical consultation, preoperative lab work (especially blood typing and crossmatching) and mobilization of the operating room team are

required. Tight regulation of blood pressure is crucial to limit the wall tension of the aneurysm and decrease the risk for further damage. Decompensation should be anticipated: ensure adequate IV access, the availability of blood, and adequate patient monitoring.

CONCLUSION

Emergency physicians are called upon every day to diagnose patients who have an acute surgical abdomen. The ability to recognize the condition and to gather

pertinent information quickly in order to stabilize and refer the patient is crucial. As always, proper management from the outset of the patient's contact with the hospital provides the best possible outcome. □

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