Recognizing the signs and symptoms of common abdominal complaints is vital in the triage of patients in pain practice and emergency departments. By Eric Schnitzer, DO, MS, Leonard Goldstein, DDS, PhD and Bennett Futterman, MD

The diagnosis and treatment of acute abdominal pain is a collaborative effort, often starting in the emergency department (ED). Over 50% of complaints presenting to the ED are related to acute pain, with abdominal pain accounting for 7% of all ED visits.¹ ²

Pain is now recognized as the fifth vital sign, along with blood pressure, pulse, respiratory rate, and temperature. As a vital sign, it allows physicians to monitor changes in a patient’s condition and better evaluate the clinical picture.³ However, the best way to manage acute pain in the ED remains controversial. One school of thought calls for minimal pain management until a diagnosis has been made and surgery ruled out.⁴ ⁵ According to the other school of thought, undertreatment of pain can hamper recovery and decrease patient satisfaction.⁶ ⁷ Recent studies of patients receiving tramadol preoperatively, however, have shown that its use does not affect decision-making.⁸ In addition, early administration of potent analgesics, such as morphine, have also been shown to reduce pain but not to hamper diagnosis.⁹ ¹⁰

The problem of the undertreatment of pain is more pronounced in the pediatric and elderly populations. In one study, pediatric patients were shown to be less likely to receive analgesics than adults.¹¹ One reason that children are undertreated is the myth that children, especially infants, do not feel pain the same way that adults do.¹² Another reason is physicians’ fear of opioid side effects, such as oversedation, respiratory depression, hypotension, and addiction. Lastly, many physicians are not comfortable with the pharmacokinetics and dosing of opioid medications in the pediatric population, especially in the ED.¹³ ¹⁴ Not only is dosing during the ED stay problematic, children often are discharged with inadequate doses of analgesic medication.¹³ Older adults face similar problems—receiving inadequate analgesia and waiting significantly longer than younger adults before their pain is addressed.¹⁵

This article will discuss the most common acute abdominal conditions treated in the ED.

Differential Diagnosis

When a patient presents to the ED with abdominal pain, one of the primary considerations is the differentiation of the most dangerous diagnoses from non-
emergency causes (Table 1).\textsuperscript{16} Taking a thorough medical history is critical because trauma to a certain area and/or a certain progression of symptoms makes some diagnoses more likely than others. Conditions such as acute mesenteric ischemia lead to significant morbidity and mortality and requires early diagnosis and intervention.\textsuperscript{17}

<table>
<thead>
<tr>
<th>Table 1. Differential Diagnosis of Abdominal Pain</th>
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<tbody>
<tr>
<td>Conditions that must be ruled out:</td>
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<tr>
<td>• Ruptured abdominal aortic aneurysm</td>
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<tr>
<td>• Aortic dissection</td>
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<tr>
<td>• Perforated bowel</td>
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<tr>
<td>• Volvulus</td>
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<tr>
<td>• Mesenteric ischemia</td>
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<td>• Torsion of structures</td>
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**Location, Location, Location**

The location of the pain corresponds to different anatomical structures. For example, back pain usually indicates a retroperitoneal source of abdominal pain. The bladder, distal colon, and pelvic organs refer pain to the suprapubic region. The small bowel, appendix, and midgut structures often convey a periumbilical pain.\textsuperscript{18} Pain from the stomach, pancreas, liver, and gallbladder often will convey an epigastric pain.\textsuperscript{19} The location and timing of the pain, whether the pain is relieved by eating, and other information gleaned from a patient history are just some of the clues that ED physicians use to diagnose and treat abdominal pain.

**Abdominal Pain Conditions**

Some of the most common causes of abdominal pain are appendicitis, gastroesophageal reflux disease (GERD), pancreatitis, gallbladder disease, diverticulitis, and small bowel obstruction.

**Appendicitis**

Appendicitis is the most common abdominal-related emergency seen in the ER, as well as the most common reason to have urgent surgery. There are 250,000 appendectomies performed in the United States every year.\textsuperscript{20,21} The diagnosis of appendicitis needs to be made quickly because the risk for rupture or perforation increases significantly after 36 hours from the onset of symptoms.\textsuperscript{22}

The typical presentation of appendicitis includes a patient complaining of periumbilical, colicky pain that worsens during the first 24 hours. The pain then localizes to the right lower quadrant of the abdomen and sharpens in intensity. This migration of pain is the most consistent finding for appendicitis.\textsuperscript{23,24}

Yet the misdiagnosis of appendicitis remains a problem.\textsuperscript{25} Laboratory values indicating an inflammatory response may help with the diagnosis. Loss of appetite is
present in more than two-thirds of patients. However, in the elderly, loss of appetite is much less common, present in only one-third of older patients.26

In addition to a physical examination and laboratory results, imaging techniques are helpful with the differential diagnosis. Computed tomography (CT) scanning has been shown to have a greater sensitivity than ultrasound in detecting appendicitis, but the positive predictive values of the 2 are similar, and ultrasound is a good first-line technique.27,28 Although appendicitis is the most common reason to undergo surgery due to right lower quadrant pain, there are many other ailments that can mimic or confuse the picture, including diverticulitis, mesenteric inflammation, Crohn’s disease, infectious enterocolitis, endometriosis, ectopic pregnancy, and intussusception, to name a few.29

When the patient arrives in the ED, morphine is a great choice to reduce the pain without hindering the diagnosis of appendicitis; it has a long history of use with good outcomes.30

GERD

GERD is a common complaint affecting 7% of the US population daily and up to 40% monthly.31,32 In addition to the typical symptoms of GERD (heartburn and regurgitation), other presenting symptoms may include sour taste in the throat, cough, asthma, and stenosis (trouble swallowing).33 Data suggests that GERD may account for between 25% and 55% of the cases of non-cardiac chest pain presenting to physicians.34 This, however, should not lead physicians to dismiss chest pain as GERD. Patients with cardiac disease and angina may have symptoms similar to those of GERD, and they may even feel relief after treatment with proton pump inhibitors (PPIs) or histamine-2 (H2-receptor blockers).35 Therefore, the ER physician needs to rule out cardiac and more serious causes of chest pain in patients presenting with GERD, especially in elderly patients.36

As for many other medical conditions, the treatment for GERD begins with lifestyle modifications including not eating for 2 to 3 hours before bedtime, elevating the head of the bed, quitting smoking, losing weight, and eating a low-fat diet. Avoiding foods such as chocolate, mint, and onions, as well as beverages such as alcohol, tea, and soda, also is helpful.

If these lifestyle modifications do not work, then PPIs and H2 blockers can be used as first-line drug therapy. PPIs are beneficial in patients with peptic ulcer disease and GERD.37,38,39 The class of drugs is very safe, with a very low risk of serious side effects.39 H2 blockers have more drug-drug interactions because they effect the cytochrome P-450 3A4 system and can potentially affect the metabolism of medications such as warfarin, anticonvulsants, and benzodiazepines.40 PPIs have better inhibitory effects on gastric acid secretion, but they take 2 to 3 days to take effect whereas H2 blockers work much faster, making them more suitable for ED use.41 Physicians have to be cognizant that relapse of symptoms is common in patients with GERD after they cease therapy. In these cases, long-term therapy may be warranted.42
Acute pancreatitis has increased to become the leading cause of hospitalization for gastrointestinal problems in the US. The vast majority of cases of pancreatitis (80%) are related to gallbladder disease and alcohol abuse. Less commonly, pancreatitis is associated with a history of hypertriglyceridemia or hypercalcemia, a family history of pancreatic disease, prescription and nonprescription drug history, a history of trauma, and concomitant autoimmune diseases.

Although the management of acute pancreatitis has evolved over the past 2 decades, there is still no consensus regarding the proper management of patients with acute pancreatitis. According to the American Gastroenterological Association (AGA), most patients with acute pancreatitis will recover with only general supportive care. However, 1 in 5 patients will develop severe acute pancreatitis, and 20% of these patients may die.

In an effort to form consensus, the AGA has developed guidelines for the management of patients with both mild and severe acute pancreatitis. According to the AGA, the diagnosis of acute pancreatitis should be made within 48 hours of admission to the hospital. A physical examination and laboratory tests are used to confirm the diagnosis. The diagnosis is based upon having 2 of the following: upper abdominal pain radiating to the back, serum amylase level 3 times the upper limit of normal, and serum lipase level 3 times the upper limit of normal, with elevated lipase levels being somewhat more specific.

To confirm the diagnosis of acute pancreatitis (but not to predict severity), some experts recommend a CT scan using contrast dye. Clinicians should be aware that an early CT scan (within 72 hours of illness onset) might underestimate the amount of pancreatic necrosis. The prediction of severe disease is best achieved by careful ongoing clinical assessment coupled with the use of imaging studies and a multiple factor scoring system, preferably the Acute Physiology and Chronic Health Evaluation (APACHE) II system using a cutoff of ≥8. Patients with predicted or actual severe disease, and those with other severe comorbid medical conditions should be strongly considered for triage to an intensive care unit or intermediate medical care unit. A follow-up CT scan can be performed 5 to 7 days later in patients with predicted severe disease (APACHE II score ≥8) and in those with evidence of organ failure during the initial 72 hours to detect any local complications related to the pancreatitis, such as pseudocyst, necrosis, or abscess. It is very important for ED physicians to act quickly in treating pancreatitis because the greatest risk of organ dysfunction occurs in the first 12 to 24 hours of presentation.

The initial medical management of pancreatitis begins with general supportive care, consisting of vigorous fluid resuscitation, supplemental oxygen as required, correction of electrolyte and metabolic abnormalities, and pain control. Table 2 provides AGA guidelines for appropriate therapy.
First-line pain management for acute pancreatitis includes morphine, hydromorphone, and oxycodone. Morphine may increase the Sphincter of Oddi tone, but this has not been shown to intensify the disease process. Buprenorphine, a partial opioid agonist, has been shown to be as effective as meperidine (which is no longer recommended for patients with pancreatitis because of side effects) but does not causing contracting of the Sphincter of Oddi.

Outpatient management of a patient with pancreatitis is crucial because chronic pancreatitis is a painful condition that requires careful monitoring. Primary care physicians must reinforce lifestyle changes because alcohol consumption, smoking, and biliary disease are the major risk factors for recurrence. Risk prevention must be stressed to the patient because up to 25% of patients will have repeat episodes within a few years of their attack. Those with alcoholic pancreatitis should be referred to counseling services and smoking cessation services, if applicable. Patients with gallstone pancreatitis should undergo prompt cholecystectomy and/or endoscopic sphincterotomy, depending on their overall medical condition.

The patient with chronic pancreatitis must be very careful about his or her diet. Dietary modifications should include a low-fat diet, pancreatic enzyme replacement if there is exocrine insufficiency, and additional calories to prevent tissue wasting. In addition to the exocrine gland dysfunction, up to 30% of patients with pancreatic-induced diabetes will require insulin and dietary management. Alcohol abstinence (and smoking cessation) is vital because it reduces pain and slows disease progression, while lowering the chance of developing complications such as carcinoma.

Gallbladder Disease

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Gallstone disease is a common medical problem, affecting 10% to 15% of the US population. Nearly 1 million new cases of gallstone disease are diagnosed every year in this country. Gallstones are classified as cholesterol, pigment, and mixed, however, cholesterol gallstones are much more common in the United States and other westernized countries, accounting for about 75% of gallstones. Cholesterol gallstones are associated with risk factors such as obesity, type 2 diabetes, dyslipidemia, and hyperinsulemia.

The patient with biliary pain usually presents with severe right upper quadrant abdominal pain. It also is common for gallbladder pain to present as right scapular pain, or Kehr’s sign, which is diaphragm irritation causing shoulder pain. Although called a colicky pain, gallbladder pain usually lasts an average of 5 to 16 hours. The patient should fast to avoid the release of cholecystokinin (CCK), which produces gallbladder contractions.

Studies have shown that non-steroidal anti-inflammatory drugs (NSAIDs) are as effective as opioids for biliary colic and have fewer side effects. NSAIDs also are useful in that they may reduce the inflammation and the risk of progression to acute cholecystitis. If the biliary pain is complicated with leukocytosis, nausea, jaundice, vomiting, and fever, then cholecystitis should be suspected. The patient should be admitted to the hospital and have a surgical consult.

Laparoscopic cholecystectomy is the most widely used therapy. This less-invasive technique is associated with less postoperative pain, quicker healing, and better cosmetic results than open cholecystectomy. The patient usually can go home from the hospital within a day and resume normal activities within a few days.

Although laparoscopic procedures comprise more than 90% of cholecystectomies, laparoscopy cannot be used in all cases. For instance, in cases of severely inflamed gallbladders and stones in the bile duct, open cholecystectomy is still preferred. Gallbladder surgery may be complicated by injury to the bile duct, leading either to leakage of bile or scarring and blockage of the duct. Mild cases frequently can be treated without surgery, but severe injury generally requires bile duct surgery. Bile duct injury is the most common complication of laparoscopic cholecystectomy.

It is important for physicians to diagnose and treat acute cholecystitis early because laparoscopic surgery within 72 hours of symptoms has been associated with fewer complications and less need for open surgeries.

Diverticulitis

The prevalence of diverticulosis increases with age, affecting approximately 70% of individuals aged 80 years or older in the United States. Patients with diverticulosis may experience acute complications, including diverticulitis, peritonitis, obstruction, fistulization, or abscess formation, and chronic complications including a clinical picture resembling irritable bowel syndrome. The incidence of diverticular complications is increasing, and the number of patients affected by diverticular disease will continue to increase as the population ages.
The rise in diverticular disease is linked to a decline in fiber intake amongst children with a rise in childhood obesity.\textsuperscript{78,79} Other risk factors include increased body mass index and waist circumference which significantly increases the risk for diverticulitis.\textsuperscript{80} It was taught for years that there was a correlation between nuts, seeds, and popcorn with diverticulitis. However, this was not the case when tested in a large cohort of patients.\textsuperscript{81} Despite the lack of evidence, 47\% of colorectal surgeons have told their patients with diverticular disease to stay away from these foods.\textsuperscript{82} Physicians should be encouraging their patients to eat more fiber and to increase physical activity, both of which have proven to be associated with fewer episodes of diverticulitis.\textsuperscript{83-85}

Patients with sigmoid diverticulitis usually present with the classic triad of left lower quadrant tenderness, fever, and leukocytosis.\textsuperscript{86} The diagnosis is confirmed by CT scan. Although much more common on the left side in Caucasians, right-sided diverticulitis represents more than half of the diverticulitis seen in Asians.\textsuperscript{87} In the past, right-sided diverticulitis was misdiagnosed as appendicitis; however, the increased use of CT scans has helped with the diagnostic accuracy.\textsuperscript{88}

Management of diverticulitis starts with wide-spectrum antibiotics, ceftriaxone and metronidazole, piperacillin/tazobactum, and meropenem all being acceptable intravenous regimens in the hospital.\textsuperscript{82,89} Outside of the hospital, oral regimens might include ciprofloxacin and metronidazole or amoxicillin/clavulonate.\textsuperscript{82} In addition to antibiotics, bowel rest or a clear fluid diet, and analgesia is indicated as part of the care.\textsuperscript{90} In the first few days of treatment, opioids are effective for analgesia; antispasmodics have no confirmed advantage in the treatment.\textsuperscript{91}

If symptoms or radiological evidence of complicated diverticulitis is present, then a surgical consult is warranted. The American Society of Colon and Rectal Surgeons recommended that the standard of care for emergency diverticulitis surgery be the Hartmann’s procedure.\textsuperscript{92} The Hartmann’s procedure involves resection of the affected segment of bowel, creating an end colostomy, and sewing a distal stump. This procedure often is followed by a reversal, during which the colostomy and distal stump are eventually re-anastomosed.\textsuperscript{93}

For years, physicians have been taught that elective sigmoidectomy was the standard of care after 2 attacks of uncomplicated diverticulitis. This was based on assumptions that after 2 attacks, there was a high likelihood of recurrent attacks and complications including perforation.\textsuperscript{89} These traditional teachings are being called into question and it is now recommended that treatment be based more on an individual basis.\textsuperscript{92} Patients with diverticular disease should be advised not to consistently use acetaminophen or NSAIDs because they are associated with complications, especially bleeding.\textsuperscript{94}

Small Bowel Obstructions

Adhesions from prior abdominal surgeries account for approximately 60\% of small bowel obstructions (SBO).\textsuperscript{95} However, strangulated hernias and malignancy still account for a high proportion of mortalities.\textsuperscript{96} Acute SBO is a common cause of emergency surgery. It occurs when there is an encroachment of luminal flow through the small bowel either extrinsically on the bowel or intrinsically. It accounts for 12\%
to 16% of surgical admissions. SBOs are associated with life-threatening complications such as bowel infarction and perforation. With increased use of CT scan and laboratory tests, the mortality rate from SBO has dropped from 25% 60 years ago to 5% today. However, SBO remains a challenge for physicians as they decide whether to treat conservatively or send patients for surgery.

The traditional cardinal symptoms of SBO are abdominal pain, vomiting, abdominal distention, and absolute constipation. Many patients do not present with all the symptoms, however, and some patients will still pass gas or stool. Therefore, patients suspected of SBO should be x-rayed when they arrive in the ED; this will reveal dilation of bowel and air fluid levels if an obstruction is present. If the x-ray does not show signs of obstruction, but there is still sufficient suspicion, then a CT scan with oral contrast should be performed.

Initial therapy is to correct any fluid or electrolyte abnormalities. The patient should be placed on bowel rest (NPO) and have a nasogastric tube placed. If CT is performed, the water-soluble contrast medium used for CT scan has been shown to reduce the rate of operations and hospital length of stay. A partial bowel obstruction may be managed by supportive measures and serial examinations to see if the situation resolves. If there are signs of a complete obstruction, strangulation, perforation, or the situation does not resolve, then surgery is indicated. After a surgery is performed, opioid analgesics typically are given for pain management, but NSAIDs are preferred when the patient can tolerate them because intestinal motility returns more quickly with NSAIDs than with opioids.

Summary

Diagnosing and treating acute abdominal pain requires a coordinated effort, often starting in the ED. Recognizing the signs and symptoms of common abdominal complaints is vital in the triage of pain patients in pain practice and emergency departments. Early management often avoids later complications and sequelae, reducing the risk that these conditions will become chronic diseases.