



## Abdominal Pain in the Elderly

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High risk for and subtle presentations of serious pathologic conditions in the elderly patient who has abdominal pain require careful, timely evaluations and aggressive management. The elderly patient who has abdominal pain consumes more time and resources than any other emergency department (ED) patient presentation [1]. Their length of stay is 20% longer than younger patients who have the same complaint, they require admission nearly half the time, and they require surgical intervention one third of the time [2]. In contrast to many other patient presentations, the elderly patient who has abdominal pain requires the ED physician to do more than determine “sick or not sick” and make a disposition of admission versus discharge. Failure to identify an acute surgical condition in the emergency department can lead to increased mortality even if the patient is admitted for observation [2]. Of those elderly patients who have abdominal pain and are discharged home, nearly one third returns to the ED with continued symptoms.

The population of the United States is continuing to age. Twelve percent of the population is older than the age of 65 years, and this number is expected to increase to 20% by the year 2030. The fastest growing subset is the group of people over the age of 85 years. There is likely to be an increase in the number of elderly patients who present to the emergency department with abdominal pain.

### Challenges to diagnosis

Several variables create complexities in securing a diagnosis in this age group. These include the physiologic changes that accompany aging, difficulties with taking an adequate history, medications that cause or confound

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pathology, lack of expected vital sign changes and physical findings, significant comorbidities, and seemingly normal laboratory values in the face of surgical disease.

### *Physiologic changes*

Although the actual number of T cells does not decline with age, their function does [3]. This renders the elderly person less able to fight infection. Moreover, they have alteration in their physical barriers to infection, such as skin and mucous membrane strength and integrity. Altered pain perception is well documented in elderly patients. A 1960 study demonstrated a prolongation in time necessary to sense a painful stimulus and to perceive it as painful [4]. Painless cardiac ischemia and infarction have long been recognized in elderly patients [5]. More recent studies now extend this decreased pain perception to intra-abdominal conditions [6,7]. This decreased sensitivity may be one factor why elderly patients present to EDs later in their disease course with resultant poorer prognosis.

### *History taking*

Several factors contribute to the difficulty that may be encountered in taking an adequate history from an elderly patient. Decreased hearing or memory may exacerbate the problem. Stoicism commonly is encountered, coupled with the fear of losing independence should a serious condition be found. Acute or chronic alteration in mental status is encountered frequently.

### *Medications*

Medication use may mask or create pathology. More elderly patients are taking nonsteroidal anti-inflammatory drugs (NSAIDs) than ever before, which may increase their risk for peptic ulcer disease. Steroid medications are useful for various conditions found in elderly patients, such as rheumatoid arthritis and temporal arteritis, but they also may increase the risk for ulcer formation. In addition, they may block the expected inflammatory response to peritonitis, leading to less abdominal tenderness. Anticholinergic medications may induce abdominal pain through urinary retention or ileus. Several other common medications, including digoxin, colchicine, and metformin, can produce abdominal pain. Beta blockers may blunt the expected tachycardia often seen with serious intra-abdominal pathology. Acetaminophen and NSAIDs may reduce the likelihood of fever, whereas corticosteroids may alter the serum leukocyte count and blunt the inflammatory response. Chronic narcotic use may blunt the pain that normally accompanies an abdominal catastrophe. Antibiotic use may cause abdominal pain, vomiting, and diarrhea. This is important to keep in mind when evaluating the elderly patient who has a long list of medications.

### *Physical examination*

Evaluation of vital signs is the first step of a physical examination. This too may be fraught with uncertainty in the elderly patient. Despite serious intra-abdominal pathology, elderly patients are often normothermic or even hypothermic [8]. As noted earlier, the expected tachycardia may be blunted by medications or intrinsic conduction system abnormalities. Normal appearing blood pressure may reflect significant hypotension for a patient who has chronic hypertension. Tachypnea should be noted, and although it may reflect the expected response to pain, it also may be a compensatory mechanism for progressive acidosis caused by sepsis or ischemic bowel.

Physical examination should not be limited to the abdomen. General appearance is important, as is overall volume status. Conjunctivae should be examined for pallor. The cardiopulmonary examination is crucial. It may suggest a diagnosis by showing signs of pneumonia, congestive heart failure, pericarditis, or pulmonary emboli. The presence of atrial fibrillation is of particular significance, because it increases the risk for mesenteric ischemia. Examination of the extremities may reveal the presence of peripheral emboli or stigmata of vascular disease. Neurologic findings of previous cerebrovascular accident also may be a clue to underlying vascular disease.

The abdomen should be assessed fully, taking special note of surgical scarring, distention, organomegaly, ecchymosis, masses, or bruits. Abdominal musculature is often thin in elderly patients, leading to less guarding and rigidity even in the presence of frank peritonitis. A detailed search for hernias should be conducted, because they may be the cause of bowel obstruction and strangulation. Although the rectal examination does not assist in limiting the differential diagnosis, it may reveal the presence of gross or occult blood and may be the only way to discover prostatitis as a source of pain.

### *Comorbidities*

Diabetes may blunt the normal response to serious abdominal pathology, including acute cholecystitis and acute appendicitis, making these surgical conditions more difficult to identify. Patients who have known gastrointestinal malignancies may have their abdominal pain written off as cancer pain, when in fact they may have a perforated viscus or other surgical process. The higher prevalence of vascular disease in elderly patients means that vascular catastrophes, such as leaking abdominal aortic aneurysm, mesenteric ischemia, and mesenteric venous thrombosis, all of which are difficult to diagnose in a timely fashion, are more likely to be the cause of abdominal pain in an older patient.

### *Laboratory values*

It is prudent for the clinician to have a low threshold for obtaining laboratory studies in elderly patients who have abdominal pain. The clinician

should not be swayed by normal laboratory values, however, nor be confused by abnormalities that do not fit the clinical picture. Laboratory values are often normal despite the presence of surgical disease. Over-reliance on the leukocyte count is another common pitfall. Up to one quarter of patients who have appendicitis may not develop leukocytosis [9]. The same is often found in other surgical conditions. Hyperamylasemia is nonspecific, and although elevations may indicate pancreatitis, they also may be seen in more life-threatening entities, such as mesenteric ischemia. The presence of blood in the urine may be seen in patients who have nephrolithiasis or urinary tract infection, but it also may be found in cases of appendicitis, diverticulitis, or even ruptured abdominal aortic aneurysm (AAA). An electrocardiogram should be obtained early in the work-up of elderly patients who have abdominal pain.

### **Imaging studies**

A discussion of plain radiographs and other imaging modalities deserves special consideration, because their role has changed with advances in technology, availability, and operator skills.

#### *Plain radiographs*

The general usefulness of plain radiographs is limited mainly to evaluation for free intra-peritoneal air, signs of obstruction, or the rare case of foreign body ingestion or insertion. Although neither cost effective nor diagnostically helpful as a general screening tool in the elderly patient who has abdominal pain, there are several clues to serious disease that may be found on plain radiographs [10]. Suggestion of cecal or sigmoid volvulus may be noted. Signs of biliary tract disease such as emphysematous cholecystitis may be seen. A calcified aneurysmal aorta may be noted. Despite these more subtle abnormalities, the presence of free intra-peritoneal air or bowel obstruction remain the most useful radiographic findings.

#### *Ultrasound*

As more and more emergency physicians (EPs) gain familiarity and skill with bedside ultrasound, more uses are found for it. Long used to evaluate the abdomen in trauma, EPs are now becoming more comfortable with other applications. In the geriatric patient who has abdominal pain, it is useful for diagnosing AAA. Although ultrasound cannot determine whether the AAA is leaking or not, in an unstable patient who has abdominal pain and who is found to have an AAA, emergent surgical exploration is mandated. Ultrasound is also the imaging modality of choice for biliary and pelvic disease. Ultrasound may be limited by body habitus, bowel gas, and operator dependence.

### *Computerized tomography*

Advances in computerized tomography (CT) technology have been widespread in recent years. The advent of multidetector row CT scanners has led to improved image quality in shorter acquisition times with less motion artifact. In addition, reformatting the images allows for CT angiography to be performed with image quality near that of conventional angiography [11].

A 2004 study examined the ability of CT to alter decision making in elderly patients who have abdominal pain [12]. Results of CT scans altered the diagnosis in 45% of cases. It also changed the admission decision in one quarter of patients, the need for antibiotics in one fifth, and the need for surgery in 12% of cases. In addition, CT scanning doubled the diagnostic certainty of the attending EP from 36% before CT to 77% after CT.

CT is highly sensitive for diagnosing perforation, AAA, appendicitis, and other common entities. Although not the gold standard for diagnosing mesenteric ischemia, it is more useful than angiography in cases of suspected mesenteric venous thrombosis.

### *Angiography*

Angiography is most helpful in cases in which the suspicion for acute mesenteric ischemia is high. Though invasive, potentially nephrotoxic, and not always easy to obtain, it should be sought on an emergent basis in such cases. Even in cases in which mesenteric ischemia is identified by CT, preoperative angiography should be pursued for diagnostic and therapeutic reasons.

## **Specific conditions**

### *Bowel obstruction*

Elderly patients may present with small bowel obstruction (SBO) or large bowel obstruction (LBO). The etiology is different depending on the site. Hernias and adhesions from prior surgeries are the most common causes of SBO. Large bowel obstructions are usually caused by cancer, diverticulitis, or volvulus. In addition, although gallstone disease accounts for only 2% of cases of bowel obstruction in the general population, it may lead to almost one quarter of cases of intestinal obstruction in elderly patients, usually women [13]. It predominantly causes SBO but may in rare cases lead to colonic obstruction.

### *Small bowel obstruction*

The symptoms of SBO are similar in the elderly population to those in the general population. Abdominal pain, distention, and vomiting commonly are seen, accompanied by constipation. Early in the course, however, these

symptoms may be absent. Diarrhea may be present because of hyperperistalsis distal to the obstruction. This may account for the high rate of misdiagnosis of SBO: it remains the second most common condition (behind appendicitis) to be inappropriately discharged home [2]. The mortality rate for SBO in the geriatric population remains high at 14% to 35%. Although plain radiographs may suggest SBO (Fig. 1), abdominal CT is much more sensitive and may reveal the cause of the obstruction. When patients who have nonspecific SBO are admitted to medical services for conservative treatment, there is evidence that surgical therapy, if it becomes necessary, may be delayed [14]. This leads to increased morbidity and mortality.

### *Large bowel obstruction*

LBO is less common than SBO. Proportionally more cases of LBO are seen in elderly patients, because the two most common causes (diverticulitis and cancer) increase with age. The classic description is that of a patient who has abdominal pain, severe constipation or obstipation, and intractable vomiting. Nearly one fifth of elderly patients have diarrhea, however, and only half report constipation or vomiting [15]. A difficult diagnosis, LBO often is discovered late in its course. This contributes to the mortality rate of nearly 40%. All patients who have LBO should be questioned carefully about symptoms of weight loss, change in bowel habits or stool caliber, and fatigue, because these may be signs of colorectal cancer (Figs. 2 and 3).

Volvulus causes only 15% of cases of LBO but is more likely to require emergent surgical intervention [10]. Symptomatology depends on the site of the volvulus. Sigmoid volvulus accounts for nearly 80% of cases and tends



Fig. 1. Plain radiograph shows multiple air–fluid levels consistent with partial small bowel obstruction. Incidental finding is nephrostomy tube in right kidney.

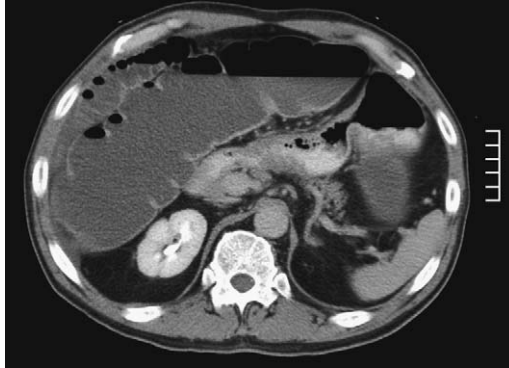


Fig. 2. Axial, contrast-enhanced CT scan shows markedly dilated, fluid-filled large bowel consistent with obstruction.

to present with more gradual onset of pain. Vomiting is seen in only one third of patients and constipation in half to three quarters. Cecal volvulus typically presents with acute onset of pain, nausea, and vomiting. On plain films, cecal volvulus usually shows a dilated loop of bowel with a kidney bean appearance in the left upper quadrant [16]. Virtually all cases of cecal volvulus require operative repair, whereas selected cases of sigmoid volvulus can be nonoperatively managed by decompressing the bowel with a rectal tube placed by way of a sigmoidoscope.

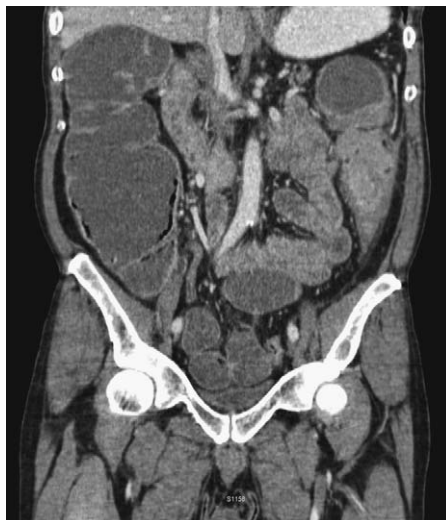


Fig. 3. Coronal reformatting of CT scan in Fig. 2 reveals the cause of obstruction to be a mass in the descending colon.

### *Biliary tract disease*

Biliary disease remains the leading reason for acute abdominal surgery in the elderly population [17]. When cholecystectomy is performed emergently, the mortality rate is nearly fourfold that of the same procedure performed electively [18]. Cholelithiasis increases with age, and the severity of gallstone disease is much higher in the elderly population. The prevalence of gallbladder perforation, gangrene, emphysematous cholecystitis, ascending cholangitis, gallstone ileus, choledocholithiasis, and gallstone-induced pancreatitis are all higher [19].

Elderly patients who have cholecystitis tend to have right upper quadrant or epigastric pain with tenderness over the gallbladder. Other signs may be absent. Unlike younger patients, more than half of elderly patients who have acute cholecystitis have no nausea or vomiting and half also lack fever. Even with gallbladder empyema, gangrene, or frank perforation, one third still may be afebrile [20]. Laboratory studies also may be unreliable. Leukocytosis is absent in 30% to 40%, and a significant percentage have normal liver function tests. A recent study found no decrease in the accuracy of ultrasound or the sonographic Murphy's sign in elderly patients, even when they were premedicated with opioid analgesia [21]. Elderly patients have an increased likelihood of acalculous cholecystitis, however, which is not appreciated as readily on ultrasound [22]. A negative ultrasound combined with a high clinical suspicion for cholecystitis should prompt a radio-nuclide (HIDA) scan.

The incidence of complications caused by biliary disease is increased markedly in elderly patients. When the diagnosis of biliary disease is made, broad spectrum antibiotics, specifically covering gram-negative and anaerobic organisms, therefore should be started and prompt surgical evaluation initiated. Delayed surgical treatment in this population is associated with increased morbidity and mortality [23].

Choledocholithiasis is also more common, and with it, ascending cholangitis. Acute suppurative cholangitis rarely is seen before the seventh decade of life and mandates prompt decompression. Disseminated intravascular coagulation is common in both of these entities, and coagulation profiles should be monitored closely.

### *Pancreatitis*

Pancreatitis remains the most common nonsurgical abdominal condition in the elderly population [24]. The incidence of pancreatitis increases 200-fold after the age of 65 years. Similar to most other abdominal conditions, the mortality rate in elderly patients is much higher, approaching 40% after the age of 70 years [25]. The presentation in elderly patients is varied. It may present classically with a boring pain radiating to the back, associated with nausea, vomiting, and dehydration. It also may be a hypermetabolic state resembling systemic inflammatory response syndrome. Unfortunately as



many as 10% of cases of pancreatitis in elderly patients may present initially with hypotension and altered mental status [26]. This mandates maintaining a high index of suspicion for this condition. The astute clinician is not too quick to assume that mild elevations of amylase are pancreatitis without considering more lethal entities such as mesenteric ischemia. Elderly patients, especially those older than 80 years, are at higher risk for necrotizing pancreatitis, which places them in jeopardy of rapid deterioration [27]. The threshold for performing a CT scan in cases of pancreatitis in the elderly population should be low, especially if there are signs of impending sepsis.

### *Peptic ulcer disease*

In a frequently quoted study from the 1960s, 35% of endoscopically proven peptic ulcer disease (PUD) was painless in patients older than age 60 years, compared with 8% of those younger than 60 years [28]. An acute abdomen is the first presentation of PUD in 50% of elderly patients, commonly because of perforation [26]. Other complications of PUD include hemorrhage, gastric outlet obstruction, and penetration into an adjacent viscus.

Perforation may present atypically in the elderly patient. Less than half of patients have the classic acute onset of abdominal pain. Rigidity is absent in nearly 80% [29]. Free intraperitoneal air on plain radiographs is absent in 40% of patients who have perforation [30]. When it is present (Figs. 4 and 5), it is often best visualized on a lateral film, which frequently is not obtained. The mortality of perforation in the general population is approximately 10%, whereas in the geriatric population it is 30% and increases



Fig. 4. Erect radiograph of patient ultimately determined to have perforated peptic ulcer shows free intraperitoneal air silhouetting the right side of the diaphragm (marked with small “x”s).



Fig. 5. Lateral radiograph of patient from Fig. 4 better demonstrates the presence of free intraperitoneal air.

eightfold if the diagnosis is delayed by 24 hours [31]. In a well-publicized randomized, controlled trial showing identical mortality rates for conservative treatment of perforated peptic ulcer versus surgical treatment, the group of patients older than age 70 years was less likely to respond to conservative treatment [32].

Hemorrhagic complications of PUD are also more common in elderly patients. Nearly one fifth of cases of hemorrhage in elderly patients have shown no prior symptoms of peptic ulcer. When elderly patients do bleed from PUD, they are more likely than younger patients to require blood transfusions, to need surgery to control bleeding, and to re-bleed [33]. Early signs of bleeding such as tachycardia are often absent for reasons mentioned previously.

### *Diverticular disease*

Diverticular disease increases in prevalence with age. The incidence is approximately 50% in patients older than age 70 years and 80% after age 85 years [34]. Diverticular disease typically manifests as lower gastrointestinal bleeding or diverticulitis. Diverticulitis in turn may result in abscess formation, bowel obstruction, free perforation, or fistula, and may be a cause of overwhelming sepsis. Free perforation is seen more commonly in elderly or immunocompromised populations. It carries a significant mortality rate, 25% in some studies [35].

Diverticulosis is the most common etiology of lower gastrointestinal bleeding in the geriatric population and may be massive. Nearly 15% of all people who have diverticular disease experience at least one episode of significant bleeding. Though it typically resolves spontaneously, 25% of patients re-bleed and some progress to hemorrhagic shock [36].

More people who have diverticular disease develop clinical diverticulitis than hemorrhage. Unfortunately it is misdiagnosed 50% of the time [37]. The classic findings of nausea, distention, fever, palpable left lower quadrant mass, and leukocytosis are frequently absent. As with many other conditions in this population, leukocytosis may be lacking in a large number of cases. Irritation of the bladder or ureter by the inflamed diverticulum may induce pyuria or hematuria and result in the erroneous diagnosis of nephrolithiasis or urinary tract infection. A palpable mass in women often leads to suspicion of gynecologic malignancy and provokes unnecessary worry of cancer. Right-sided diverticulitis may provoke unnecessary operations for presumed appendicitis. Liberal use of abdominal and pelvic CT scan usually can distinguish between these entities. Early diverticulitis and early appendicitis may be missed by CT scan.

### *Appendicitis*

Appendicitis used to be thought of as a disease of the young. Although it certainly is more common in younger patients, it is the third most common indication for abdominal surgery in the elderly population [38]. In addition, the mortality rate in the general population is less than 1%, whereas in the geriatric population it ranges from 4% to 8% [39]. Despite the lower incidence of appendicitis in this population, elderly patients account for half of all deaths from appendicitis [40]. The incidence of perforation is much higher in elderly patients, nearly 70% in some studies [41].

A recent study was performed comparing appendicitis in elderly patients over 10 years at one institution to the previous 10 years [42]. Despite improved technology, knowledge of the disease, and awareness, the admitting diagnosis was still incorrect in 54% of cases. Half of all cases had perforated by the time of surgery, and delays to surgery of more than 24 hours occurred in one quarter of those initially misdiagnosed. This delay was associated with a perforation rate of nearly 75%.

Some of the challenges to diagnosing appendicitis include delayed presentation to care by the patient and atypical symptoms. Up to one fifth of elderly patients who have appendicitis present after 3 days of symptoms and another 5% to 10% after 1 week of symptoms [43]. In the study cited previously, it was noted that CT scans were obtained in less than half of cases in which symptoms had been present for greater than 48 hours.

Atypical symptoms are another confounding issue. Less than one third of elderly patients have fever, anorexia, right lower quadrant pain, and leukocytosis. Again, nearly half of patients are afebrile, half demonstrate no rebound or involuntary guarding, and nearly one quarter have no right lower quadrant tenderness at all [30,42]. It must be emphasized again that although appendicitis is not uncommon in this population, the typical presentation is. Liberal use of CT scanning is encouraged for any patient in this age group who still possesses an appendix. Early surgical consultation should be

obtained in suspicious or equivocal cases, because delays in diagnosis lead to increased risk for perforation, with resultant increases in morbidity and mortality. Many studies have demonstrated decreased morbidity and mortality with rapid diagnostic laparotomy rather than watchful waiting [44–46].

### *Vascular catastrophes*

#### *Ruptured abdominal aortic aneurysm*

Ruptured AAA remains the thirteenth leading cause of death in the United States [47]. The mortality is extremely high. One study demonstrated a mortality rate of 70%, even with an average ED time of only 12 minutes before surgery [48]. Although the diagnosis is fairly straightforward in the elderly patient who has abdominal pain, hypovolemic shock, and a pulsatile abdominal mass, this is the exception rather than the rule. Hypotension is absent in nearly 65% of cases, presumably because of tamponade in the left retroperitoneal space [49]. This affords the EP an opportunity to diagnose the condition before catastrophic rupture. Unfortunately atypical presentations are common, and the misdiagnosis rate is as high as 30% to 50% [50,51].

The most common misdiagnosis is that of renal colic [50,51]. Patients who have ruptured AAA often have back pain radiating toward the groin associated with microscopic hematuria caused by irritation of the ureter by the AAA. As a general rule, any elderly patient presenting with symptoms of new onset nephrolithiasis should have an evaluation of their aorta to detect AAA. This can be accomplished by ultrasound or noncontrast CT scan, which is often used to diagnose renal colic. Similarly, when diagnosing musculoskeletal back pain in elderly patients, the clinician should have a low threshold for imaging the aorta. Other conditions that are mimicked by ruptured AAA include diverticulitis (palpable left lower quadrant mass), lower gastrointestinal (GI) bleed (from aortoenteric fistula), and acute coronary syndrome (if the patient presents with syncope). Any patient who has previous aneurysm repair and who presents with GI bleeding must be considered to have an aortoenteric fistula until proven otherwise. The already high mortality rate of this condition increases further with any delay in diagnosis. The diagnosis of AAA should be considered in any patient who has syncope or hypotension in combination with abdominal or back pain.

Treatment decisions should be based on the stability of the patient. Early consultation with a vascular surgeon in suspected cases of AAA is essential. An unstable patient in whom AAA is diagnosed by history (known AAA), physical (pulsatile abdominal mass), or testing (bedside ultrasound) should be transported emergently to the operating room without delay [48]. Bedside ultrasound has been remarkably effective in making the diagnosis, even in the hands of inexperienced operators [52,53]. In stable patients, CT with contrast remains the test of choice because of its high sensitivity for detection of aneurysm and presence of rupture (Fig. 6). If renal function or



Fig. 6. Axial, contrast-enhanced CT scan demonstrates 7×7-cm non-ruptured AAA with thrombus lining its wall.

allergy precludes the use of intravenous contrast, unenhanced CT still can visualize acute hemorrhage [54,55].

Volume resuscitation in patients who are perfusing peripheral tissues adequately and who exhibit normal mentation should be deferred. Increasing blood pressure may lead to loss of the retroperitoneal tamponade with subsequent exsanguination [56]. At least 10 units of blood should be available for the operating room, because transfusion needs are usually substantial [48]. Advanced age is not a contraindication for repair. Mortality rates do not differ significantly with age, and AAA rupture is uniformly fatal without surgical treatment [57].

### *Mesenteric ischemia*

Acute mesenteric ischemia (AMI) is one of the most difficult diagnoses to make. It requires a high index of suspicion, coupled with the willingness to image suspected cases aggressively.

Mesenteric ischemia encompasses four distinct entities: superior mesenteric artery (SMA) embolus, SMA thrombosis, mesenteric venous thrombosis (MVT), and nonocclusive mesenteric ischemia (NOMI). Embolus of the SMA accounts for most cases [58]. It presents as severe abdominal pain out of proportion to physical examination and may be associated with vomiting and diarrhea. Typically the patient has risk factors for embolic disease, such as atrial fibrillation, valvular disease, ventricular aneurysm, or postinfarction ventricular thrombi. Although atrial fibrillation is the most common cause, it is present in less than 50% of cases [59]. Patients who have SMA thrombosis typically have a long history of pain after meals (intestinal angina) and may report “food fear” and subsequent weight loss [60]. They often have known atherosclerotic disease, and their acute event occurs when an atherosclerotic plaque ruptures in the SMA. The acute presentation is then similar to that of SMA embolus. MVT conversely tends to be less

acute, and presentation may be delayed days to weeks [61]. It is highly associated with an underlying hypercoagulable state. Half of patients have a personal or family history of deep venous thrombosis or pulmonary embolus [62]. Hypoperfusion secondary to sepsis, severe dehydration, or congestive heart failure predispose to NOMI. Although less common than embolic disease, the mortality of NOMI is exceedingly high [63].

The diagnosis of AMI is exceedingly difficult. Symptoms are often nonspecific, and the classic triad of abdominal pain, gut emptying, and underlying cardiac disease is found in the minority of cases. When present, vomiting and diarrhea may lead to the erroneous diagnosis of gastroenteritis. The physical examination is usually unhelpful. Abdominal tenderness, peritoneal signs, and bloody stools are absent early in the course until transmural necrosis develops. No specific laboratory studies have been found to date. A leukocytosis is generally present, as is some degree of metabolic acidosis and elevated lactate [64,65]. As noted previously, hyperamylasemia frequently is seen and should not sway the clinician to the diagnosis of pancreatitis.

Plain films are generally unhelpful. Mortality is actually much lower if plain radiographs are normal, presumably because the abnormalities that are visible on plain films are typically late findings [66]. As CT technology continues to improve, it will probably assume a larger role in the diagnosis of AMI, especially with the increasing quality of CT angiography. CT is the test of choice for MVT, because it often shows the thrombus itself [67]. For now, angiography remains the gold standard. The early, aggressive use of angiography is the only factor that has been shown to reduce overall mortality from mesenteric ischemia [68–70]. It should be considered in any at-risk patient who presents with acute abdominal pain and a paucity of physical findings. Despite the risks associated with angiography, it should not be delayed in these patients while obtaining other, less valuable tests or while waiting for peritoneal signs to develop.

Treatment of AMI is primarily surgical, although there have been studies investigating intra-arterial thrombolytics, vasodilators, or angioplasty [71–73]. Even in those cases in which AMI is diagnosed by another modality, angiography generally should be pursued, because it is needed in conjunction with surgical embolectomy to address the associated vasospasm [74].

### *Extra-abdominal causes*

Elderly patients who have abdominal pain often have causes for their pain located outside of the abdominal cavity. The most important is acute myocardial infarction (MI). Elderly patients who have acute MI frequently lack chest pain. Nearly one third of women older than age 65 years have abdominal pain as their presenting symptom of acute MI [75]. Abdominal pain also may accompany other cardiac causes, such as decompensated heart failure, pericarditis, and endocarditis.

Pulmonary etiologies, including lower lobe pneumonias or pulmonary emboli, also may cause abdominal pain. Pleural effusions, empyemas, or pneumothoraces can mimic intra-abdominal conditions. Endocrine conditions, such as diabetic ketoacidosis, hypercalcemia, or adrenal crisis, may lead to nonspecific abdominal pain. Herpes zoster, porphyria, medication effects, and gynecologic or genitourinary conditions are additional etiologies to consider.

### **Disposition**

Given the likelihood of atypical presentations, unreliability of physical examination findings, and lack of sensitivity of laboratory testing, the elderly patient who has abdominal pain should be approached systematically, keeping the differential diagnosis broad and searching for potentially life-threatening etiologies. The EP should not be swayed by aspects of the history that do not follow classic teachings, normal vital signs, laboratory values that are seemingly normal, or laboratory abnormalities that do not explain the patient's presentation. Liberal use of imaging and early surgical consultation is encouraged. The importance of serial examinations and even serial laboratory studies cannot be overemphasized.

Even after a thorough work-up has been pursued in the ED, the clinician should realize that certain entities may not become obvious until the disease course has progressed further. The EP should have a low threshold for admission to the hospital or to an ED observation unit for further monitoring.

Those patients who are selected for discharge home should have a repeat abdominal examination documented, have improvement in their clinical course noted, in most cases have a normal imaging study, and be able to tolerate oral nutrition. They also should have a reliable caretaker and a timely follow-up evaluation. Finally, the clinician should avoid labeling undifferentiated abdominal pain with a more benign diagnosis, such as gastroenteritis. Patients should be informed that the cause of their symptoms is unclear, and they should be given specific instructions regarding signs and symptoms to monitor themselves for or to seek further medical attention.

### **Summary**

The population of the United States continues to age. As such, all physicians will be seeing more geriatric patients. Abdominal pain remains one of the most common and potentially serious complaints that EPs encounter. Vascular catastrophes should be considered early in the course of all elderly patients who have abdominal pain, because the window for successful intervention is small. A thorough work-up is essential and a broad differential should be kept in mind. The astute clinician should always be mindful that elderly patients may have delayed presentations of serious illnesses, and their signs and symptoms of disease may be atypical. Early imaging,

surgical consultation, and hospital admission in equivocal cases should always be considered.

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