

15.4.1 The acute abdomen

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ESSENTIALS The term 'acute abdomen' describes abdominal pain of rapid onset requiring urgent surgical assessment. No firm pathological diagnosis is made in many patients initially presenting in this way, but those that do, require rapid diagnosis and treatment to avoid potentially life-threatening complications. Patients may present directly to medical specialties with an acute abdomen, or abdominal pain may occur in patients already residing on medical wards. These patients are often old and their acute abdomen is likely to present on a background of other comorbidities. Understanding the interaction between risk factors and underlying pathological diagnosis is key to preventing misdiagnosis in such cases. Although not eliminating the need for a sound focused history and examination, spiral CT scanning allows rapid diagnosis of most causes. However, management of the diagnosed acute abdomen in medical patients can be extremely difficult, and there is no substitute for an experienced physician working together with a thoughtful surgeon supported by anaesthetists and intensivists. The key question is often 'Does this patient need an operation?', a decision which depends on many factors. It may be necessary to proceed straight to surgery without any supportive imaging in very sick patients who may be bleeding or who are profoundly septic.

Introduction The acute abdomen can be defined as a rapid history of abdominal pain caused by a pathology usually requiring an invasive intervention. The vast majority of patients suffering with an acute abdomen are not seen by physicians as they are generally referred directly to surgeons. Nevertheless, patients under the care of physicians can suffer an acute abdomen or the acute abdominal pathology may be the underlying primary diagnosis in the first place. Diagnosing an acute abdomen requires an open-minded approach to a patient suffering with abdominal pain and should include a readiness to reappraise a patient's signs and symptoms. Given that many of the underlying pathologies can be life-threatening, it is important to assess patients with acute abdominal pain expeditiously and request timely investigations with concurrent advice from an experienced surgeon. Delay in initiation of treatment and surgical intervention should be avoided at all costs, as this is directly

related to overall outcome. Aetiology While many of the causes of the acute abdomen are bowel related, there are many others that are nonintestinal related (Table 15.4.1.1). The frequencies of the underlying pathology also vary according to a patient's age and sex. Similar to many medical conditions, patients at the extremes of ages may not present with 'textbook' signs and symptoms of an acute abdomen, requiring even greater vigilance. Clearly, this has significant implications for the general physician whose patients will fall into these higher age groups. Clinical features The diagnosis of an acute abdomen is based on a sound, focused history together with a thorough examination supplemented by appropriate investigations. History The history compatible with an acute abdomen is typically short in onset (generally <48 h) with abdominal pain that may be general or

15.4 Common acute abdominal presentations

SECTION 15 Gastroenterological disorders 2766 localized. Particular attention should be drawn to patients with a short history of severe back pain which can suggest an underlying acute aortic pathology. Although the pain may be colicky or constant in nature, the pain associated with the acute abdomen does not commonly improve over time. Colicky pain suggests visceral contractions and stretch, mediated by general visceral afferents, with an associated blockage which may be biliary, ureteric, or intestinal in cause. Constant abdominal pain, also mediated by these visceral nerves and/or the somatic sensory system, may be central or lateralized. Central upper abdominal pain is typically associated with foregut-derived viscera such as stomach and hepatobiliary structures. Central periumbilical pain is generated from the embryological midgut (D2 to two-thirds along the transverse colon). Central lower abdominal pain will arise from the hindgut or pelvis. Migratory pain implies an evolving pathology with a change in nociceptive neuronal mediation from visceral referred to somatic in origin, the classic example being in appendicitis. Other associated symptoms may include anorexia and/or nausea and vomiting. Feculent vomiting is a particularly ominous sign suggesting high-grade small-bowel obstruction. The patient may complain of abdominal bloating and/or a change in bowel habit. Constipation, which may be absolute, and the inability to pass flatus suggests large-bowel obstruction. Bloody diarrhoea is compatible with colonic ischaemia or an acute colitis. Urinary symptoms, although most commonly associated with urinary disorders, may also be caused by juxtaurinary tract pathologies such as a large inflammatory sigmoid phlegmon (most often due to sigmoid diverticulitis) or classically the rapidly enlarging abdominal aortic aneurysm causing ureteric colic-like symptoms. Examination On examination, the patient may appear shocked and/or septic. Jaundice may be present and the combination of jaundice with sepsis should raise immediate concern of underlying cholangitis. The patient who is unwilling to move around on the couch, because this exacerbates their abdominal pain, is likely to have peritonism. On the other hand, the patient rolling around in agony with an inability to get comfortable is more likely to be suffering with ureteric colic. Peritonism is defined as irritation of the parietal peritoneum of the abdominal wall by an intra-abdominal pathology. It is diagnosed by eliciting the cardinal signs of guarding or rebound tenderness. Guarding is the involuntary contraction of the abdominal musculature after gentle palpation whereas rebound tenderness is the generation of pain after rapid removal of the hand following deep palpation or percussion. Similar pain may be experienced on coughing or gentle percussion over the pathology in this clinical condition. Peritonism is pathognomonic of many aetiologies of the acute abdomen and therefore the discovery of these signs should warrant urgent surgical referral. As well as examining the anterior abdomen, it is important to additionally assess the other areas of the lower torso. The loins should be palpated for renal tenderness which can be caused by pyelonephritis or an obstructed urinary system. The hernial orifices should be palpated for the

presence of inguinal or femoral herniae. Should these be found then attention should be paid as to whether they are (1) reducible and if not reducible (2) tender. The presence of an irreducible and tender hernia is diagnostic of acute strangulation which requires an immediate operation. Even in the absence of genital symptoms such as scrotal pain, it is essential that these structures should be examined. Acute testicular torsion can, albeit uncommonly, present with abdominal pain, and failure to diagnose this pathology is disastrous. Finally, a digital rectal examination should be performed to look for the presence or absence of stool, a collapsed or expanded rectal cavity, rectal mucosal pathologies and tenderness that could be associated with an extrarectal pelvic abscess, or an acutely inflamed appendix lying within the pelvis.

Investigation Timely investigations are often key to diagnosing an acute abdomen as signs and symptoms may be equivocal. A high level of clinical suspicion should therefore be maintained, and management should be progressed to investigation rapidly to prevent any delay in diagnosis. For most causes of the acute abdomen, patients' outcomes are closely related to how far advanced the pathology is and the timeliness of treatment.

Anatomical location	Cause	Approximate incidence (%)
Gastrointestinal	Appendicitis	40
Small-bowel obstruction	(adhesions)	
Large-bowel obstruction	Perforated peptic ulcer	
Intestinal ischaemia	Diverticulitis	
Strangulated hernia	Sigmoid volvulus	
Hepatopancreaticobiliary	Pancreatitis	12
Acute cholecystitis	Biliary colic	
Obstructive jaundice ± cholangitis	Urological	
Ureteric colic	8	
Pyelonephritis	Testicular torsion	
Urinary retention	Gynaecological	
Ruptured ectopic pregnancy	1	
Ovarian torsion	Ovarian cyst 'accident'	
Salpingitis	Vascular	
Ruptured abdominal aortic aneurysm	1	
Aortic dissection	Miscellaneous	
Nonspecific abdominal pain	38	

'Medical' (see 'Medical causes of an acute abdomen')

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Laboratory tests Investigations begin with bedside urine analysis, including a β -human chorionic gonadotropin pregnancy test in women. Laboratory tests will include a full blood count to look for anaemia or a leucocytosis, urea and electrolytes, liver function tests, a C-reactive protein level, and an amylase level to exclude a diagnosis of acute pancreatitis. Arterial blood gas analysis, looking for a metabolic acidosis, is often useful in aiding the diagnosis of acute mesenteric ischaemia where clinical signs can be very subtle; however, typically the pain remains significant. If the physician has particular concern that the patient may imminently need surgery, then a coagulation screen with a group and save can help prevent a delay in moving the patient to the operating theatre.

Imaging Plain radiographs have a limited role in diagnosing acute surgical pathologies. The erect chest radiograph, however, remains a useful, easily acquired modality to diagnose free intra-abdominal air, although it has less sensitivity than CT scanning (Fig. 15.4.1.1). The plain abdominal radiograph is only of use in monitoring patients with acute colitis for the development of toxic megacolon and has no role in the modern approach to the acute abdomen (Fig. 15.4.1.2).

(a) (b) Fig. 15.4.1.1 Pneumoperitoneum on supine abdominal and upright chest radiographs. There is central lucency beneath the hemidiaphragm (arrow in (a)). The upright chest radiograph shows free intraperitoneal air beneath the hemidiaphragms (arrows in (b)). From Levy AD, Morteale KJ, Yeh BM (eds) (2015). Gastrointestinal imaging. By permission of Oxford University Press.

(a) (b) Fig. 15.4.1.2 Plain abdominal X-ray of a 68-year-old man with inflammatory bowel disease who presented with fever, abdominal pain, and bloody diarrhoea. The descending colon is grossly dilated (a), with a close up view (b) demonstrating a diameter of 10 cm, with loss of the normal mucosal pattern with irregular nodular contour (arrows). From Abujudeh HH (ed) (2014). Emergency radiology cases. By permission of Oxford University Press.

SECTION 15 Gastroenterological disorders 2768 Rapid access to 24/7 radiology, in particular spiral CT scanning, has revolutionized the management of patients suspected of having an acute abdomen. Historically, many patients were managed by repeated clinical examination to assess for developing pathology— ‘masterful inactivity coupled with cat-like observation’. Nowadays, with appropriate clinical concern, a CT scan can be performed in many centres within a few minutes if required. The contrast-enhanced CT scan is capable of diagnosing most causes of the acute abdomen and a normal scan, although not eliminating all pathologies, is very reassuring. Some patients with severe sepsis and an acute abdomen may still require emergency surgery without a prior CT scan, and this decision is generally best made by a senior surgeon. Of note, there are a few pathologies where other radiological modalities are of greater utility than standard contrast-enhanced CT scanning:

- Cholelithiasis (gallstones) and biliary obstruction—transabdominal ultrasound scan has greater sensitivity than CT (Fig. 15.4.1.3)
- Gynaecological pathology—transvaginal ultrasound scan
- Mesenteric ischaemia—CT angiogram
- Renal colic—unenanced CT (Fig. 15.4.1.4)

Treatment Management of the individual pathologies is obviously specific to each, but there are some underlying principles behind the management of all patients with an acute abdomen. Many patients with these acute pathologies are volume depleted from gastrointestinal losses and sepsis. Rapid resuscitation is of great importance and should be guided by clinical examination and urine output. A urinary catheter is essential in most cases, and a nasogastric tube should be passed if the patient is vomiting. The role of antibiotics is variable according to individual pathologies, but once an appropriate diagnosis has been made, or if the patient is clearly overwhelmingly septic, then antibiotics should immediately be commenced. Often, however, the most important aspect of these patients’ management is assessment by an experienced surgeon to decide on whether or not they require an operation (Table 15.4.1.2).

The acute abdomen on the medical ward There are some causes of the acute abdomen that are seen more frequently on the medical wards. Pseudo-obstruction Colonic pseudo-obstruction (also known as Ogilvie’s syndrome) is not an uncommon pathology in the elderly or infirm. Predisposing factors include pneumonia, stroke, myocardial infarction, hypothyroidism, electrolyte disturbance, or recent orthopaedic surgical intervention. It manifests with signs and symptoms compatible with an acute large-bowel obstruction, but there is in fact no obstructive process. Rather, there is a failure of correct autonomic supply to the colon leading to a failure of function and consequent acute dilatation. The patient will be suffering with absolute constipation and will have a grossly distended and tympanic abdomen, although will commonly have minimal abdominal pain or tenderness. Importantly, rectal examination reveals a cavernous rectum. It is important to differentiate this condition from true mechanical large-bowel obstruction, and a CT scan is the investigation of choice. Management is nonoperative, with correction of electrolyte disturbances in the first instance. The parasympathomimetic neostigmine has been used successfully, although it carries a significant cardiac risk profile and should only be given in a monitored environment. Flexible sigmoidoscopic decompression can be used if there is concern over an enlarging colonic diameter (>10 cm). Immunosuppression Many medical patients are on immunosuppressive treatments such as corticosteroids, or suffer with inherent immunosuppression consequent to an ongoing disease process such as a haematological malignancy. The immunosuppressed patient who is suffering with an acute abdominal pathology can present atypically, with occult symptoms and signs. Further, these patients will present later and with more advanced disease. They tend to have a much poorer outcome from the abdominal pathology as in addition to the delayed presentation they are less able to fight any septic insult.

Fig. 15.4.1.3 Ultrasound image of the gallbladder with posterior acoustic shadowing (arrow) due to gallstones. From Abujudeh HH (ed)

(2014). Emergency radiology cases. By permission of Oxford University Press. Fig. 15.4.1.4 A large right renal calculus seen on an unenhanced CT scan. From Hamdy FC, Eardley I (eds) (2017). Oxford textbook of urological surgery. By permission of Oxford University Press.

15.4.1 The acute abdomen 2769 Elderly patients Elderly patients present atypically. Not only are the signs and symptoms more difficult to elucidate from patients who are commonly confused and distressed, but the sequelae of the disease process can be far more severe. A heightened sense of urgency should accompany the management of elderly patients suspected of having an acute abdomen. Liver disease Spontaneous bacterial peritonitis can occur in patients with chronic liver disease and associated ascites. Bacteria, either translocated from the gut or seeded from elsewhere, can infect the normally sterile ascites. The patient will present in a septic manner with associated abdominal pain, although some may have minimal signs. Diagnosis is made by an ascitic tap demonstrating the presence of greater than 250 polymorphonuclear cells/mm³. Treatment is nonsurgical with intravenous antibiotics. Inflammatory bowel diseases Patients with inflammatory bowel disease can develop an acute abdomen as a result of disease progression. Those with acute colitis can deteriorate, developing toxic megacolon or even more worryingly a perforation. Given these patients are likely to be on high doses of immunosuppression (see 'Immunosuppression') they may also present atypically. Patients suffering with Crohn's disease can develop acute bowel obstruction or on occasion an intestinal perforation. Cardiac disease A patient who has suffered an acute cardiac event, be it a myocardial infarction or a cardiac arrhythmia, can develop acute mesenteric ischaemia as a result of either hypoperfusion or a thromboembolic event. These patients are at particular risk as they can seldom be managed conservatively, and the risk of having to undergo a laparotomy following any recent cardiac pathology is often not insignificant. Iatrogenic problems Medical patients undergoing interventions as part of their management can develop complications, some of which will present with an acute abdomen. Ascitic taps, liver biopsies, and even intercostal chest drains can cause abdominal visceral injuries resulting in acute bleeds, or intestinal perforations requiring surgical intervention. ERCP results in postprocedural acute pancreatitis in approximately 10% of patients, the management of which is conservative. Other forms of endoscopy such as colonoscopy can result in intestinal perforations, most commonly following the use of diathermy for polypectomy. These are sometimes managed conservatively, but others will inevitably have to undergo laparotomy. Medical causes of an acute abdomen Diabetic ketoacidosis Abdominal pain is present in almost 50% of patients suffering diabetic ketoacidosis. In about one-third of these patients, the cause of the pain is the precipitating factor inducing the diabetic crisis. In the remaining two-thirds, the abdominal pain occurs secondary to the diabetic ketoacidosis, and here the abdominal pain rapidly resolves following correction of the underlying metabolic derangements. Radiological imaging is useful in differentiating those requiring surgical intervention from those who do not. Table 15.4.1.2 Surgical management of common causes of acute abdomen

Pathology	Management
Acute appendicitis	Urgent surgery to be considered, normally via a laparoscopic approach
Conservative management (antibiotics) in selected cases (comorbidity, appendix mass, patient choice)	
Strangulated hernia	Immediate surgery ± bowel resection if nonviable
Small-bowel obstruction	Normally conservative approach (nasogastric tube and intravenous infusion) for up to 48 h in the absence of pain or a raised white cell count. If conservative approach fails, the patient will require laparotomy
Large-bowel obstruction	Generally surgical resection with either primary anastomosis or stoma.
Immediate	in the presence of right iliac fossa tenderness as this suggests a closed-loop obstruction

with imminent caecal perforation Colonic stenting in selective cases determined by aetiology and comorbidity Intestinal ischaemia Immediate surgery with resection of nonviable bowel. On occasion, revascularization if bowel has not infarcted Perforated peptic ulcer Urgent surgery (laparoscopic or laparotomy) with repair Conservative approach in the elderly with minimal abdominal signs Acute diverticulitis Antibiotics for uncomplicated diverticulitis Radiological drainage of abscesses Laparoscopy and washout may be considered for selected cases Laparotomy and surgical resection for free perforation with faecal contamination Sigmoid volvulus Flexible sigmoidoscopy and decompression with possible flatus tube insertion Acute pancreatitis Conservative and organ-supportive management in the first instance Acute cholecystitis Either urgent 'hot' laparoscopic cholecystectomy or alternatively antibiotics and delayed surgery Biliary colic Analgesia and nonurgent laparoscopic cholecystectomy Obstructive jaundice $\pm$ cholangitis Urgent endoscopic retrograde cholangiopancreatography (ERCP) Ruptured abdominal aortic aneurysm Immediate endovascular aneurysm repair or open aneurysm repair if patient is medically fit

SECTION 15 Gastroenterological disorders 2770 Herpes zoster Shingles can generate an extremely painful, unilateral dermatomal eruption. Commonly the pain precedes the appearance of the rash by 2 to 3 days, when diagnostic confusion can arise. Acute urinary retention An acutely painful lower abdomen and inability to pass urine should raise suspicion of urinary retention, which can be confirmed by clinical examination and a bladder scan. However, on occasion urinary retention can occur secondary to an intra-abdominal pathology, hence if the pain persists following catheterization then an alternative explanation for the patient's symptoms should be sought. Rectus sheath haematoma This relatively rare condition is characterized by the accumulation of a haematoma within the rectus sheath and is associated with anticoagulation, abdominal trauma, and coughing. More common in women, it presents with acute abdominal pain and a palpable abdominal mass. Ultrasonography or CT scanning can differentiate the haematoma from an intra-abdominal source when there is diagnostic doubt. It is a self-limiting condition that does not require surgical/radiological intervention, although correction of overanticoagulation may be needed. Pneumonia It is not uncommon for lower lobe pneumonia to present with upper abdominal pain. A chest radiograph can diagnose this, but it should be borne in mind that on occasion pneumonia can occur as a result of an upper intra-abdominal pathology causing basal atelectasis and thus secondary infection. Gastroenteritis In addition to diarrhoea and/or vomiting, patients may also suffer with abdominal pain. Laboratory tests and stool cultures can confirm the diagnosis, and a CT scan can be a useful adjunct if there is diagnostic doubt. Constipation Constipation is common in the elderly, even more so in combination with neurological disease such as Parkinson's disease. In addition to abdominal distension and failure to pass stool, the patient may complain of abdominal pain. The ongoing passage of flatus can be reassuring, but imaging may be required to exclude a mechanical blockage. Addisonian crisis Abdominal pain as a presenting sign in an acute adrenal crisis is a well-recognized phenomenon. Diagnosis can be confirmed on laboratory blood tests. If in doubt, intravenous hydrocortisone should be given immediately. Spontaneous splenic rupture This rare but life-threatening condition can occur secondary to various aetiologies. It is most commonly associated with haematological malignancies and systemic infections such as infectious mononucleosis. There are rarer associations with local inflammatory processes such as pancreatitis, pregnancy, and drug use (e.g. granulocyte colony-stimulating factor). Most cases require immediate laparotomy and splenectomy. The overall mortality rate is approximately 10%, although is significantly higher in those with an underlying neoplastic process. Cocaine abuse There are an estimated 1 million cocaine users in the United Kingdom. While there are many well-

recognized cardiovascular and respiratory conditions associated with its use, there are uncommonly some severe, life-threatening, intra-abdominal conditions which are also related. Gastrointestinal perforations have been reported both near the gastric pylorus and mesenteric ischaemia in locations throughout the gut causing perforations secondary to acute vasoconstriction and subsequent infarction. Crack cocaine abuse more commonly causes upper gastrointestinal perforations and has also been associated with ischaemic colitis. Surgical management is generally laparotomy and resection and mortality rates are high (approximately 20%). Acute porphyria The autosomally dominant inherited metabolic disorder porphyria has an approximate incidence of 1 in 10 000. Abdominal pain is a common presenting symptom, but abdominal tenderness is seldom present. Diagnosis is made on biochemical analysis. Surgery should be avoided in the absence of convincing evidence of a surgically remediable cause. See Chapter 12.5 for further discussion. FURTHER READING ASGE Standards of Practice Committee (2011). Complications of colonoscopy. *Gastrointest Endosc*, 74, 745–52. Hansson J, et al. (2009). Randomized clinical trial of antibiotic therapy versus appendicectomy as primary treatment of acute appendicitis in unselected patients. *Br J Surg*, 96, 473–81. Paterson-Brown S (ed) (2013). Core topics in general and emergency surgery, 5th edition. Saunders/Elsevier, Edinburgh. Renzulli P, et al. (2009). Systematic review of atraumatic splenic rupture. *Br J Surg*, 96, 1114–21. Siegel JD, et al. (2005). Medical treatment of constipation. *Clin Colon Rectal Surg*, 18, 76–80. Tiwari A, et al. (2006). Life threatening abdominal complications following cocaine abuse. *J R Soc Med*, 99, 51–2. UK Working Party on Acute Pancreatitis (2005). UK guidelines for the management of acute pancreatitis. *Gut*, 54, Suppl 3, iii1–9. Umpierrez G, et al. (2002). Abdominal pain in patients with hyperglycaemic crises. *J Crit Care*, 17, 63–7. Vennix S, et al. (2015). Laparoscopic peritoneal lavage or sigmoidectomy for perforated diverticulitis with purulent peritonitis: a multicentre, parallel-group, randomised, open-label trial (LADIES Trial). *Lancet*, 386, 1269–77.

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