BMJ Best Practice

Assessment of acute abdomen

Straight to the point of care

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Table of Contents

Summary

Acute abdomen refers to the rapid onset of severe symptoms of abdominal pathology. It may indicate a potentially life-threatening condition that requires urgent surgical intervention. Acute abdominal pain is a common reason for emergency department attendance.[1]

Clinical features

Immediate assessment should focus on distinguishing patients with true acute abdomen that requires urgent surgical intervention from patients who can initially be managed conservatively.[2] Data from the UK suggest that access to an experienced surgeon reduces unnecessary admissions.[3]

A patient with acute surgical pathology may deteriorate rapidly; patients with severe, unremitting symptoms warrant thorough investigation and close monitoring.

Pain may:

- Be located in any quadrant of the abdomen
- Be intermittent, sharp or dull, achy, or piercing
- Radiate from a focal site
- Be accompanied by nausea and vomiting

Acute abdomen can occur without pain in older people, children, patients who are immunocompromised, and women in the last trimester of pregnancy.

Diagnostic work-up

An acute abdomen is diagnosed by a combination of history, physical examination, laboratory results and imaging.

Diagnostic laparoscopy can be considered in selected patients.[4] [5] [6]

Analgesia

Give patients adequate analgesia.[3] One meta-analysis of randomised controlled trials that included adult patients with acute abdominal pain found that opioid analgesia does not increase the risk of diagnosis error or treatment decision error, and improves patient comfort.[7]

Special groups

Abdominal pain in older people, patients who are immunocompromised, and pregnant women often presents atypically, which can lead to delayed diagnosis of life-threatening abdominal pathology.[8]

Older people

- Comorbid conditions or medications used to treat them may affect an older patient's ability to mount a characteristic physiological response.
- Older patients are at higher risk for more severe disease due to decreased immune function.[9]
- Central and peripheral nervous systems are affected by ageing. Conditions such as dementia can restrict an older person's ability to communicate problems, and decreased peripheral nervous system function can alter perception of pain and temperature, making diagnosis and management more difficult.

- One study of patients with perforated ulcers found that only 21% of older patients presented with peritonitis.[9]

Pregnant women

- The physical and physiological changes associated with pregnancy may present a challenge to diagnosis and treatment.
- The enlargement of the uterus, which displaces and compresses intra-abdominal organs, and the laxity of the abdominal wall make it difficult to localise pain and can blunt peritoneal signs.[10]
- Pregnant women may have mild physiological leukocytosis, so this finding is non-specific in pregnant women presenting with an acute abdomen.
- If there is a high index of suspicion for intra-abdominal pathology, further studies are warranted and may include additional laboratory testing, radiographic testing, or in some cases serial physical examinations.
- See also Assessment of abdominal pain in pregnancy (urgent considerations) .

Immunocompromised patients

- Immunocompromised patients mount an altered inflammatory response, and may display atypical symptoms and signs of acute abdominal pathology. Abdominal pain is usually non-specific, and physical examination is often inconclusive.[11]
- Immunocompromised patients are susceptible to opportunistic infections, e.g., cytomegalovirus colitis in patients with AIDS.
- An acute abdomen may occur as a result of immunosuppressive therapy. Typhlitis (neutropenic enterocolitis) is a complication of chemotherapy that typically presents with fever, neutropenia, and right iliac fossa pain 10 to 14 days after initiation of chemotherapy.[12]
- A lower threshold for admission to hospital and cross-sectional imaging is required in immunocompromised patients.[11]

Aetiology

Acute abdomen refers to the rapid onset of severe symptoms of abdominal pathology. Acute abdomen may indicate a potentially life-threatening condition that requires urgent surgical intervention.

The commonest causes of acute abdomen are:[13]

- nonspecific abdominal pain
- renal colic
- biliary colic
- cholecystitis
- appendicitis
- diverticulitis.

Likely aetiology varies according to age. Renal colic and appendicitis are more common in patients <60 years, while gallbladder disease and diverticulitis are more common in older patients.[13] [14]

Gastrointestinal causes

- Acute abdomen may result from inflammation causing peritonitis (e.g., appendicitis, diverticulitis, Meckel's diverticulitis), bowel obstruction, perforated viscus, or infection.
- Bowel obstruction occurs when there is a mechanical interruption to the flow of intestinal contents. The commonest causes of small bowel obstruction are intra-abdominal adhesions from previous surgery and incarcerated hernia.[15] Large bowel obstruction is usually caused by a colorectal tumour.[16] Large bowel volvulus or stricture are other possible causes.
- A gastric or duodenal ulcer may erode the wall of the stomach or duodenum leading to perforation. Oesophageal perforation (Boerhaave's syndrome) and Mallory-Weiss tear result in oesophageal laceration and gastrointestinal haemorrhage. Perforation can also occur as a consequence of untreated inflammation or obstruction.
- Ulcerative colitis and Crohn's disease may present with abdominal pain secondary to the inflammatory process or due to the complication of obstruction.
- Infective processes include gastroenteritis, infectious colitis, and typhlitis (neutropenic enterocolitis).

Genitourinary causes

- Renal and ureteric stones, and pyelonephritis, are urological causes of abdominal pain.
- Obstructed renal and ureteric stones can cause renal colic: severe, acute flank pain that may radiate to the ipsilateral groin, commonly associated with nausea and vomiting. Rarely, this is accompanied by macroscopic haematuria. As stones pass and get lodged in the distal ureter or intramural tunnel, this can lead to bladder irritation manifested as urinary frequency or urgency. Ipsilateral testicular and groin pain may occur rarely in men with obstructive stones.
- Common signs and symptoms of pyelonephritis include acute-onset fever, chills, severe back or flank pain, nausea and vomiting, and costovertebral angle tenderness.
- In men, testicular torsion should be considered.
- Gynaecological causes of acute abdomen include ectopic pregnancy, ruptured ovarian cyst, ovarian torsion, pelvic inflammatory disease, and endometriosis.

Hepatobiliary and pancreatic causes

- Biliary colic is characterised by steady, severe pain in the right upper quadrant (RUQ). Symptoms last between 15 minutes and 5 hours.
- Cholecystitis is biliary pain lasting more than 5 hours and is accompanied by features of inflammation, e.g., fever, marked RUQ tenderness, and leukocytosis.
- Pancreatitis typically presents with sudden onset epigastric or left upper quadrant (LUQ) pain, which may radiate to the back. The majority of patients also have nausea and vomiting. The most common causes are gallstones and excessive alcohol consumption.
- Infectious causes include hepatitis and hepatic abscess. Fitz-Hugh Curtis syndrome, a complication of pelvic inflammatory disease, comprises RUQ abdominal pain associated with perihepatitis.

Vascular causes

- Vascular pathologies may result in intra-abdominal haemorrhage, including abdominal aortic dissection, ruptured aortic aneurysm, and ruptured splenic artery aneurysm.
- Ischaemic causes include acute mesenteric ischaemia and infarction, ischaemic colitis, and splenic infarct.
- Vaso-occlusive episodes in sickle cell crises can present with abdominal pain.
- Budd-Chiari syndrome involves hepatic venous outflow obstruction and the abdominal pain may present with hepatomegaly and ascites.
- Splenic infarct can cause LUQ pain.

Metabolic and toxic causes

- Metabolic causes of acute abdomen include uraemia, diabetic ketoacidosis, Addisonian crisis, and hypercalcaemia.
- Inherited metabolic disorders include acute intermittent porphyria and hereditary Mediterranean fever.
- Heavy metal poisoning may be caused by medical/environmental/occupational exposure (e.g., mercury, lead, arsenic).
- Withdrawal from opioids may result in abdominal cramping pain.

Musculoskeletal causes

- Psoas abscess is most commonly due to a tuberculous abscess, which has extended from the lumbar vertebra into the psoas muscle.
- Abdominal wall haematoma may occur spontaneously or secondary to trauma, exercise, coughing, or a procedure.

Other

- Radiation enteritis and spider bites are other less common causes of an acute abdomen.

Non-specific abdominal pain (NSAP)

- Describes abdominal pain of <7 days' duration, when history, examination, and investigation have not revealed a cause of abdominal pain. It is a diagnosis of exclusion.
- A large retrospective study conducted in Finland found that NSAP was the most common diagnosis in patients who attended the emergency department with acute abdominal pain.[17] NSAP remained the most diagnosed condition throughout the 26 years of the study, despite presumed improvement in radiographical techniques over the course of data collection.
- NSAP seems more common in children than adults. One prospective study of children admitted under surgery with NSAP found that 2.3% were readmitted with abdominal pain during the subsequent 30

days, 0.5% had an operation or invasive procedure within 3 months of their original admission, and 0.2% had missed appendicitis.[18]

- A cohort study conducted in Sweden reported that 2.2% of patients who were discharged from the emergency department with a diagnosis of NSAP were diagnosed with cancer within 12 months.[19] The majority of patients who were diagnosed with cancer were ≥60 years.
- A retrospective study conducted in Denmark reported that 16% of patients discharged with NSAP were readmitted with abdominal pain within 3 months; 39% received a confirmed diagnosis of a somatic condition at the return visit.[20] 40% of those readmitted with a specific diagnosis were for biliary tract pathology. Comorbidity, nausea, vomiting, and leukocytosis at the primary admission were significantly associated with a missed significant diagnosis.[20]

Urgent considerations

(See **Differentials** for more details)
Assess the patient using a systematic approach, evaluating airway, breathing, circulation, disability, and exposure (ABCDE).[21] Monitor vital signs and obtain large bore intravenous access.

Hypovolaemia should be corrected with fluids and/or blood products as clinically indicated. O-negative blood can be given until cross-matched blood is available.

Patients with ruptured abdominal aortic aneurysm (AAA) or aortic dissection require especially careful fluid management. Aggressive fluid resuscitation before surgery in patients with ruptured AAAs is associated with an increased risk of perioperative death, independent of systolic blood pressure.[22] Lowest systolic blood pressure <70 mmHg is associated with higher 30-day mortality, compared with lowest systolic blood pressure ≥70 mmHg, in patients undergoing open or endovascular ruptured AAA repair (51% vs. 34%, respectively).[23] Typically, systolic blood pressure is maintained between 80 and 90 mmHg.[24]

Women of childbearing age should have a pregnancy test to exclude the possibility of ectopic pregnancy.[25] If ectopic pregnancy is suspected, send blood for blood typing and cross-matching and obtain an urgent gynaecological consultation. Urgent gynaecology consultation is important for ovarian torsion as the longer an ovary is torsed, the less likely that it can be salvaged.

Urgent urological consultation should be obtained if testicular torsion is suspected.

Full blood count, serum electrolytes, creatinine, and urea are recommended in all patients; additional tests should be guided by the history.

Obtain a surgical consultation before further diagnostic testing, if possible. This can help avoid unnecessary work-up and determine whether operative management is needed.

In patients exhibiting evidence of hypovolaemic shock with a known or suspected haemoperitoneum, it is imperative to proceed to surgery with a limited preoperative evaluation.

Consider giving an antifibrinolytic, such as tranexamic acid, to patients with suspected ongoing haemorrhage.[26]

Prophylactic antibiotics are recommended for patients with a perforated viscus, diverticulitis, appendicitis, mesenteric ischaemia, or ruptured AAA. These patients can rapidly develop sepsis. If possible, blood cultures and other microbiological samples should be taken before starting antibiotics.

Consider myocardial infarction in patients with epigastric pain, particularly if accompanied by sweating.[27] Obtain an ECG and serum troponin measurement; consult a cardiologist immediately if either is abnormal.

Approach

A comprehensive history and thorough physical examination are essential. Laboratory tests and imaging are used to support clinical assessment.

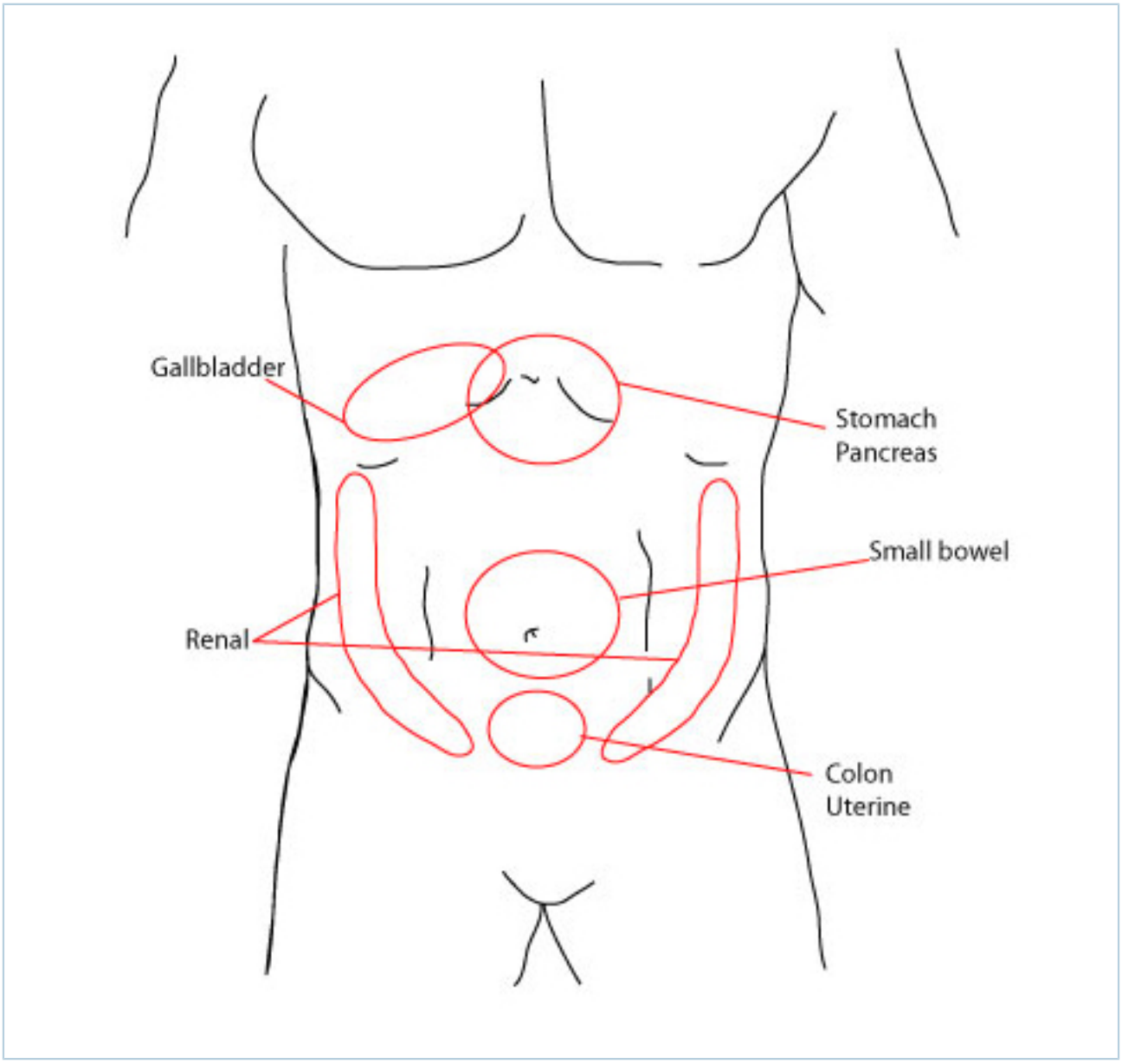
History and clinical evaluation

Key components of the history include:

- a detailed evaluation of the pain (site, onset, character, radiation, referral, associated symptoms and signs, time course, exacerbating and relieving factors, and severity)
- type and time of last meal or other oral intake (information required if surgery is indicated)
- past medical and surgical history, medication use, and family history.

Site of pain

Location of pain can identify the organ involved.[28]



Common locations of visceral pain

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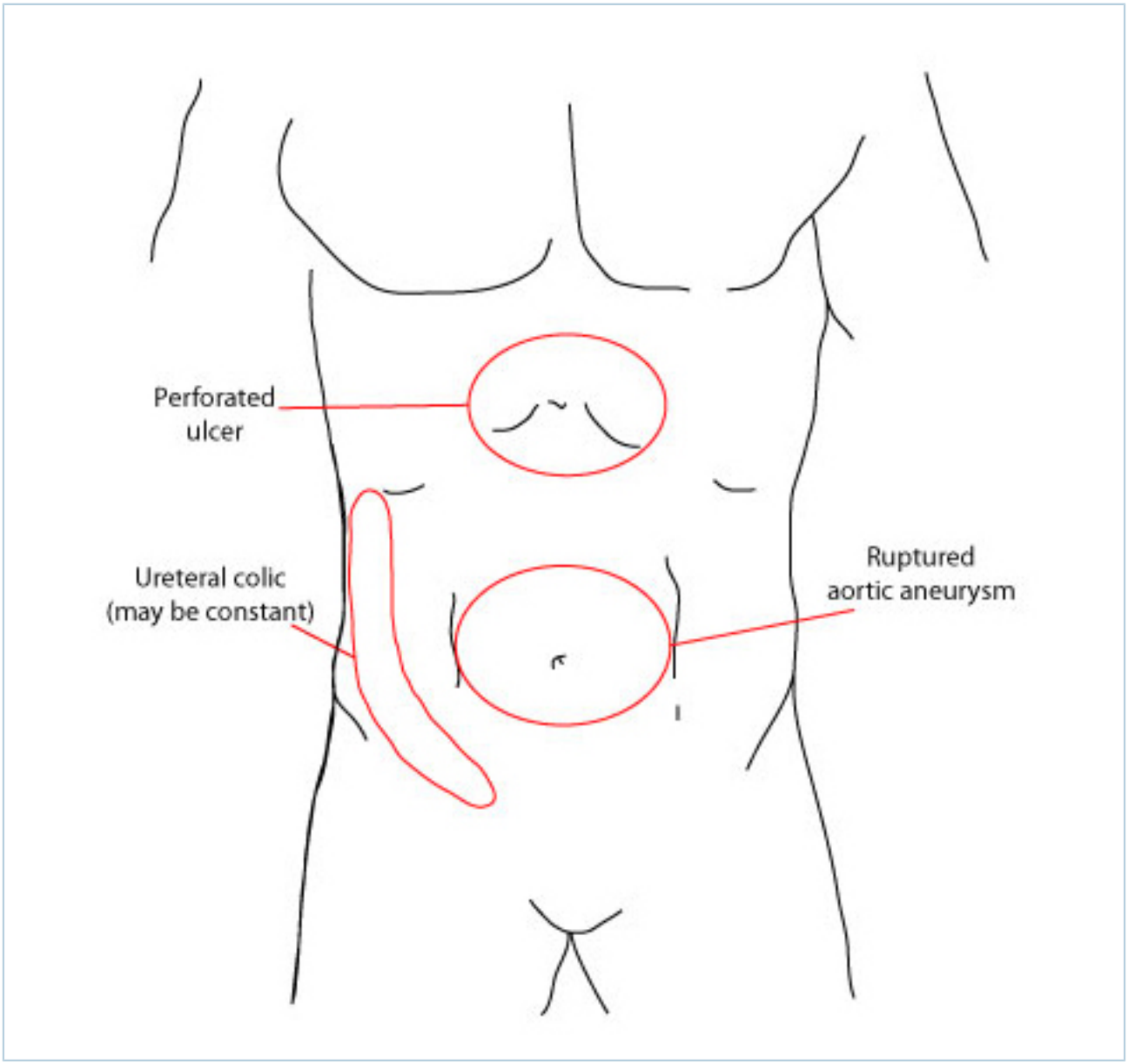

Areas of pain that present suddenly and severe in onset

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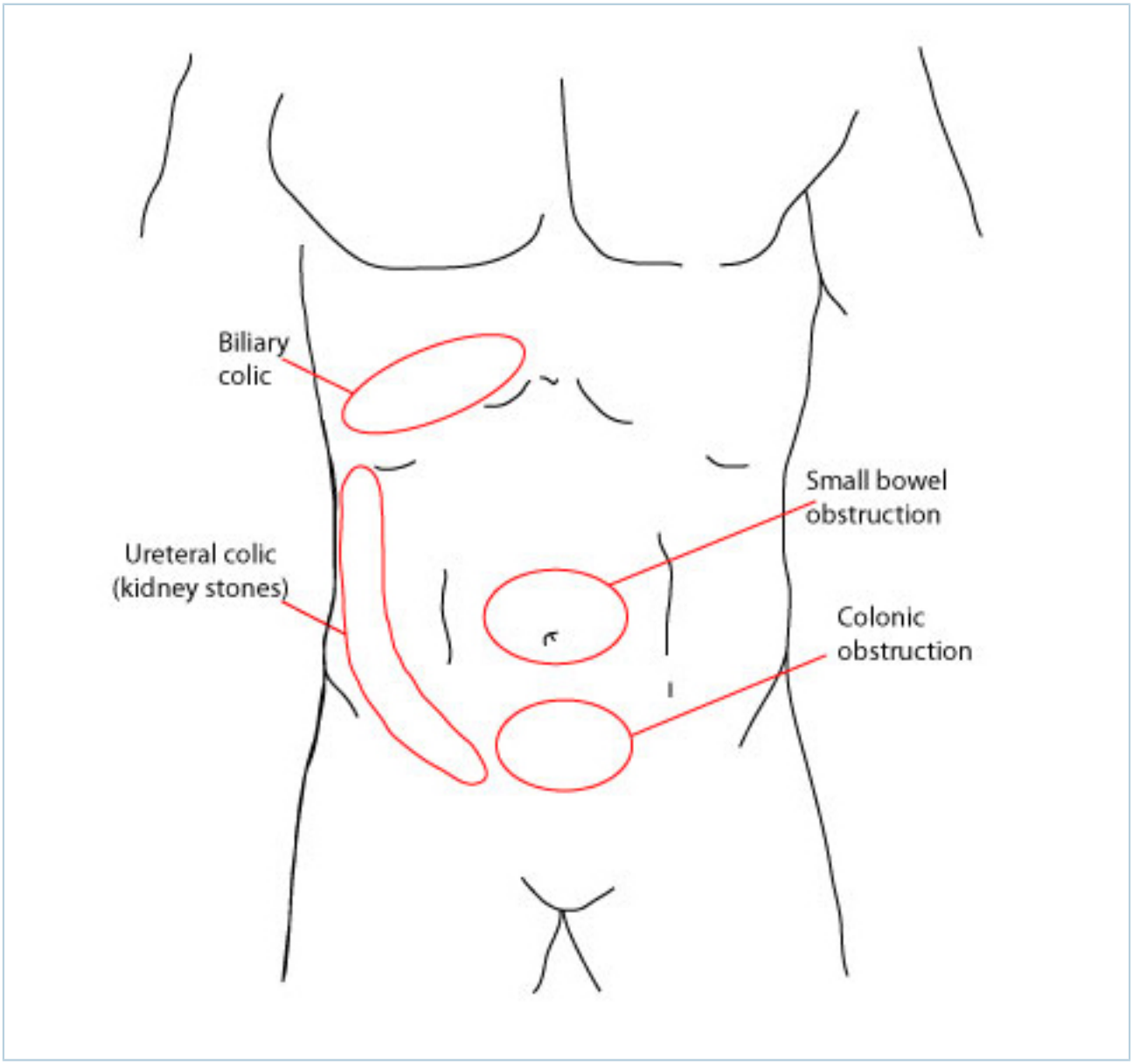

Areas of pain that present more colicky, crampy, and intermittent in nature

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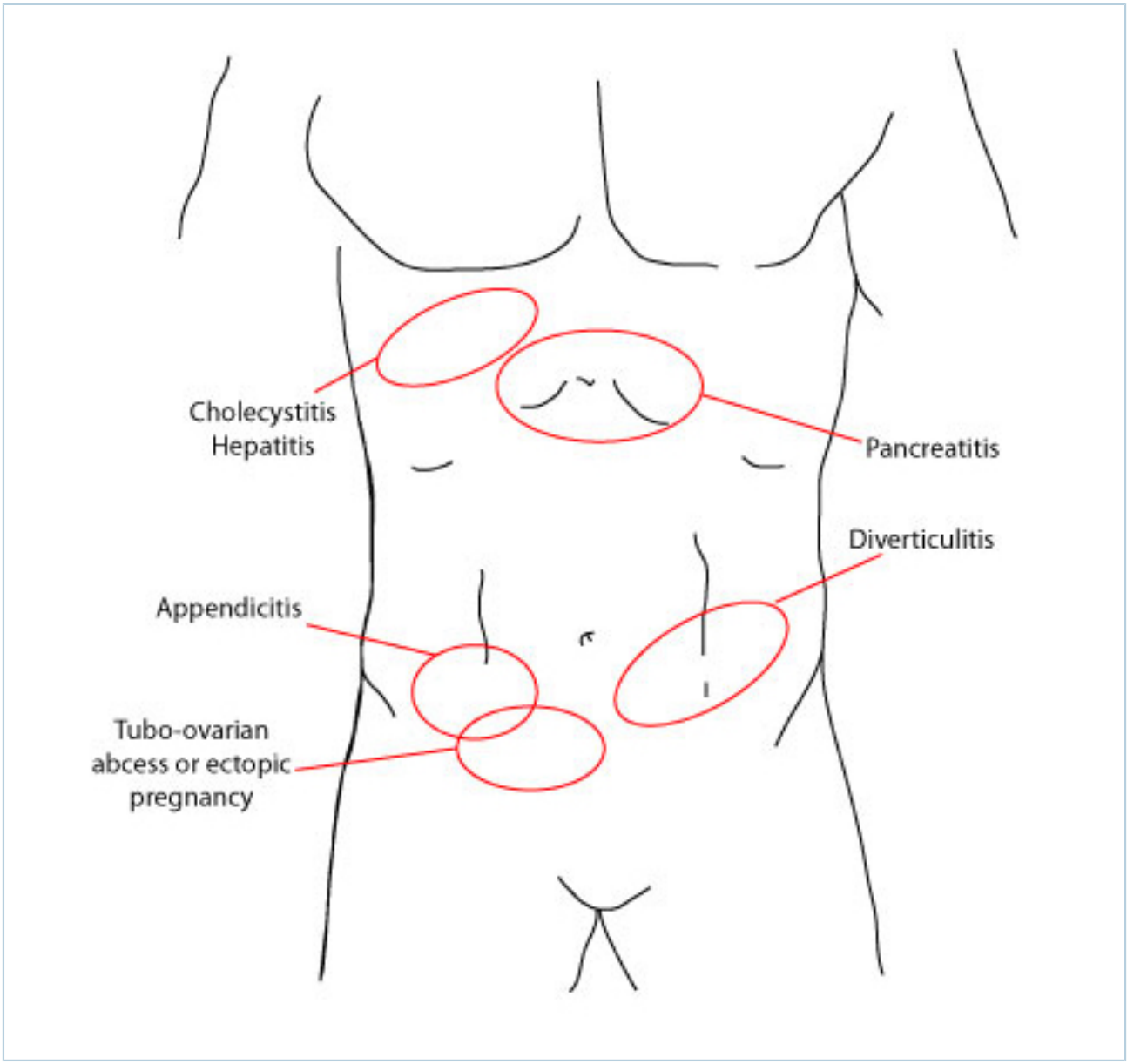

Areas of pain that present gradually or more progressively

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- Epigastric pain may relate to gastric ulcer/perforation, pancreatitis, perforated oesophagus, or Mallory-Weiss tear. Cholelithiasis and myocardial infarction should also be considered.
- Left upper quadrant pain may indicate splenic infarct or ruptured splenic artery aneurysm, pyelonephritis, kidney stones, or perforation or malignancy of the colon.
- Right upper quadrant pain can indicate cholelithiasis, cholecystitis, hepatitis, hepatic abscess, Fitz-Hugh Curtis syndrome, perforation or malignancy of the colon, pyelonephritis, or kidney stones. It may also occur with acute appendicitis in a pregnant woman due to displacement by the enlarging uterus.
- Left lower quadrant pain can indicate sigmoid volvulus (typically older patients), diverticulitis, Crohn's disease, ulcerative colitis, kidney stones, gastrointestinal malignancy, psoas abscess, an incarcerated/strangulated hernia, or gynaecological concerns, including ovarian torsion or cyst rupture, ectopic pregnancy, or pelvic inflammatory disease (PID). Although uncommon, situs inversus and midgut malrotation should be considered for patients with left-sided abdominal pain.[29]

- Right lower quadrant pain can indicate appendicitis, kidney stones, gastrointestinal malignancy, psoas abscess, an incarcerated/strangulated hernia, or gynaecological concerns, including ovarian torsion or cyst rupture, ectopic pregnancy, or PID.
- Periumbilical pain can indicate appendicitis (may radiate to the right lower quadrant) or acute mesenteric ischaemia. Other causes of central abdominal pain include leaking or ruptured abdominal aortic aneurysm and small bowel obstruction.
- Persistent lateralised pain is more likely to indicate a condition associated with ascending or descending colon, kidney, gallbladder or ovary.
- Perforated viscus may cause generalised pain.

Onset and time course of pain

Elicit the time of onset, whether the pain was sudden or gradual, and how it is changing over time. Sudden onset pain is typical of perforated ulcer, oesophageal tear or rupture, nephrolithiasis, biliary colic, acute cholecystitis, pancreatitis, and appendicitis. Bowel obstruction is often preceded by intermittent pain. Diverticulitis usually causes persistent pain. Previous instances of similar pain suggest a recurrent condition, such as cholecystitis, pancreatitis, or diverticulitis, with increasing frequency and severity indicating disease progression.

Character of pain

Elicit whether pain is intermittent, sharp, dull, achy, or piercing. Sharp, localised pain usually indicates that the parietal peritoneum is irritated. Dull, poorly localised pain felt in the midline is characteristic of visceral pain.

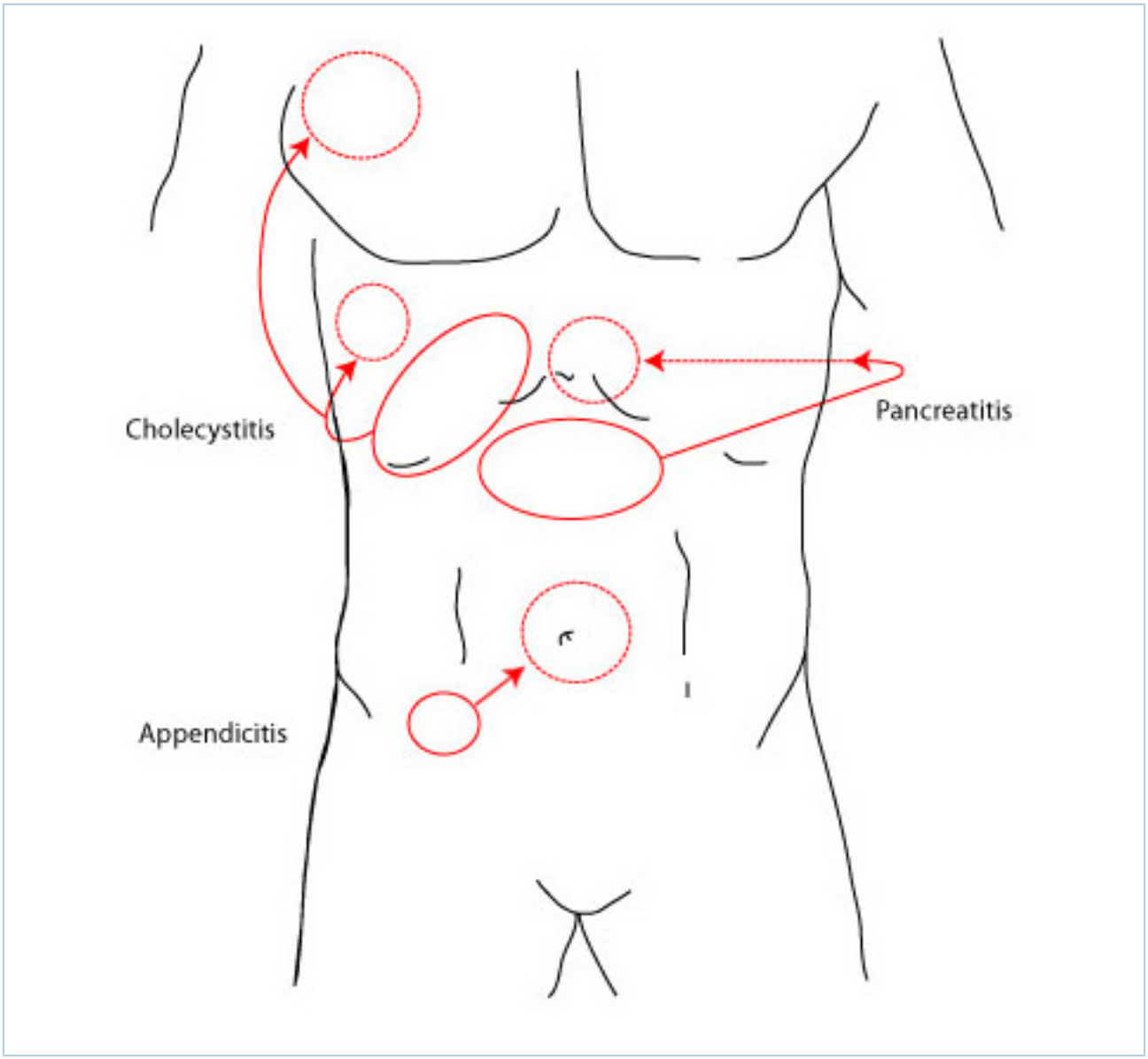
The pain of kidney/ureteric stones as they pass down the ureter is characteristically severe, with the patient unable to find a comfortable position. The pain from adhesions and incarcerated/strangulated hernias can be described as intermittent and colicky. With abdominal aortic dissection the pain can be described as severe, sharp, or tearing in the thorax or abdomen.

Radiation and referral of pain

The presence and pattern of radiation can suggest potential aetiology.[28] For example, the pain of renal colic frequently radiates from the flanks downwards into the groin.

Pain with radiation to the back can indicate pancreatitis, abdominal aortic dissection, or ruptured abdominal aortic aneurysm.

Classic locations for referred pain and its cause are as follows:



Solid circles represent the primary sites of pain and dotted circles represent the areas of referred pain

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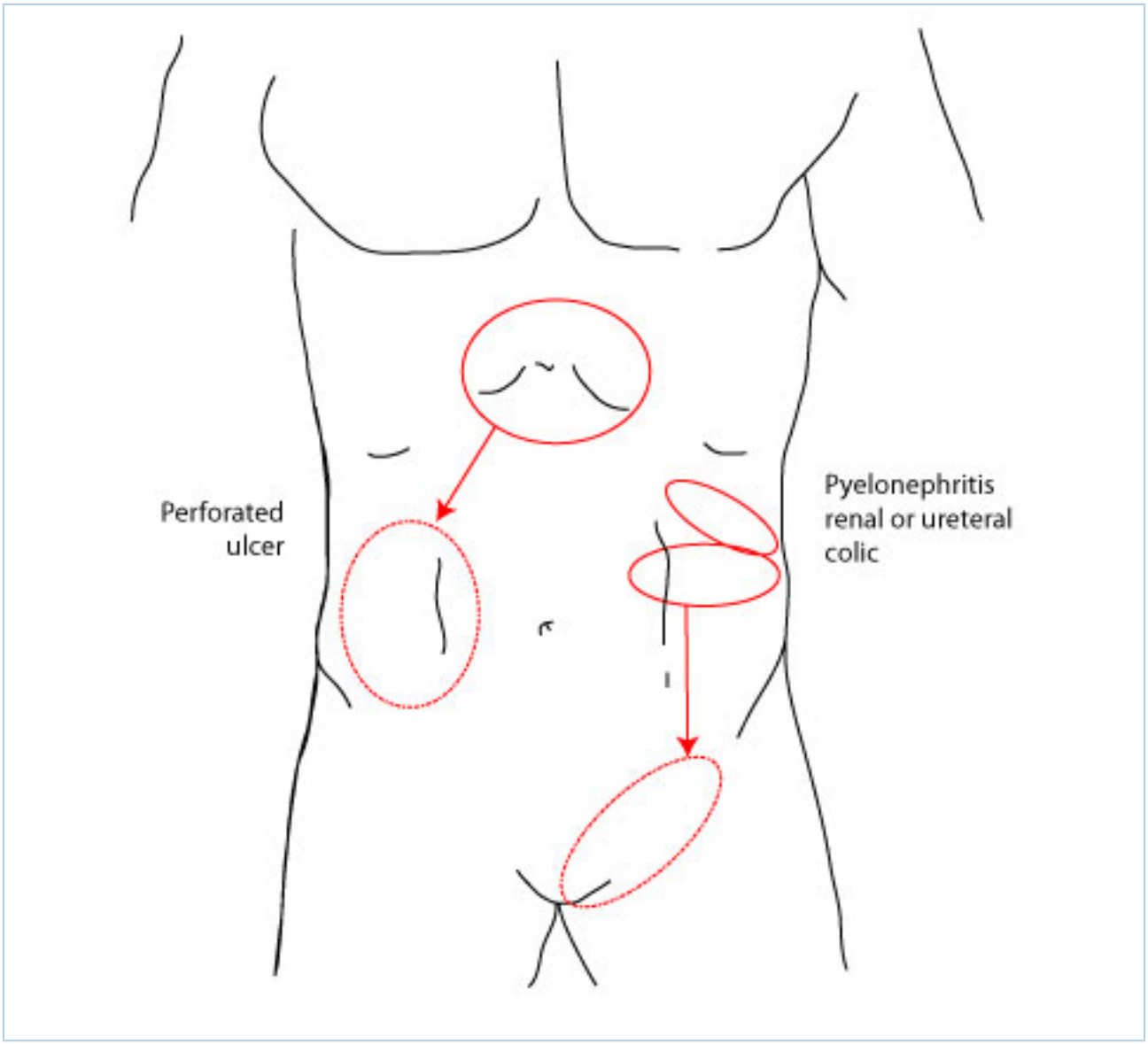

Solid circles represent the primary sites of pain and the dotted circles represent the areas of referred pain

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- Right scapula pain: gallbladder disease, liver disease, or irritation of right hemidiaphragm (e.g., right lower lobe pneumonia)
- Left scapula pain: cardiac disease, gastric disease, pancreatic disease, splenic disease, or irritation of left hemidiaphragm
- Scrotal or testicular pain (usually pain is radiating from either costophrenic angle to the groin): kidney stones or ureteral disease.

Associated gastrointestinal or systemic symptoms

- Anorexia is associated with appendicitis but may also be associated with other causes of acute abdomen, including obstructive processes, diverticulitis, hepatic abscess, radiation enteritis, and infectious colitis.
- Fever, chills, nausea, and vomiting are associated more commonly with cholecystitis, a ruptured duodenal ulcer, gastric ulcer, appendicitis, acute mesenteric ischaemia, PID, acute diverticulitis, hepatic abscess, hepatitis, abdominal wall haematoma, or spider bites.

- Patients with an obstructive process may not have had a recent bowel movement or be able to pass flatus, although bowel motility may continue distal to the obstructed site. Enquire as to the nature of recent stool: diarrhoea, hard stool, acholic (pale) stool, or presence and appearance of blood and/or mucus.

Presence and nature of exacerbating or relieving factors

- Check whether the patient has taken any medications or made any other attempts to alleviate symptoms.
- The pain associated with cholecystitis and cholelithiasis can be exacerbated by eating, especially eating fatty food.
- Pain caused by appendicitis can be exacerbated by movement.
- Pain made worse by food suggests a gastric ulcer.
- Pain relieved by eating that worsens after a few hours suggests duodenal ulcer.

Medical and surgical history

- Prior surgery increases the likelihood of an obstruction secondary to adhesions.
- Consider whether the patient may be immunocompromised.
- History of inflammatory bowel disease: this may help to differentiate the likely cause of pain; for example, colitis due to inflammatory bowel disease.
- Explore whether there has been any history of trauma in recent days or weeks. This may include obvious instances, such as from a motor vehicle accident or assault, to more innocuous falls.
- For women, the date of their last menstrual period, contraception used, and current pregnancy status should be determined:
    - patients with a known or suspected early pregnancy are at risk for an ectopic pregnancy, particularly if they have not had an ultrasound confirming the location of the pregnancy.
- Cardiovascular disease can predispose to aortic aneurysm.
- Atrial fibrillation can predispose to mesenteric ischaemia.

Medication history

- Any analgesia or other non-prescription medication taken for symptoms, and its effect.
- Any immunosuppressive medication, radiation exposure, or chemotherapy.
- Any regular opioid use or dependence (withdrawal can cause acute abdominal pain).
- Non-steroidal anti-inflammatory drugs increase the risk of gastric ulceration.
- Drugs that can trigger pancreatitis, e.g., corticosteroids, oestrogen, sulfonamides, tetracycline.

Social history

- Excessive alcohol consumption is a risk factor for pancreatitis.
- Travel history: ask about visits to areas endemic for amoebiasis (hepatic abscess), or areas that have insanitary conditions (gastroenteritis and infectious colitis).
- Environmental or occupational history consistent with heavy metal exposure.

Family history

- In patients with suspected gastroenteritis, check whether other family members have similar symptoms.

- A positive family history may raise suspicion for nephrolithiasis, inflammatory bowel disease, hereditary Mediterranean fever, or acute intermittent porphyria.

Physical examination

Measure vital signs: blood pressure, temperature, and pulse rate.

The physical examination should be performed in the order:

- Inspection
- Auscultation
- Percussion
- Palpation
- Other important examinations: rectal, pelvic, scrotal.

Inspection

Make a general assessment of how ill the patient appears.

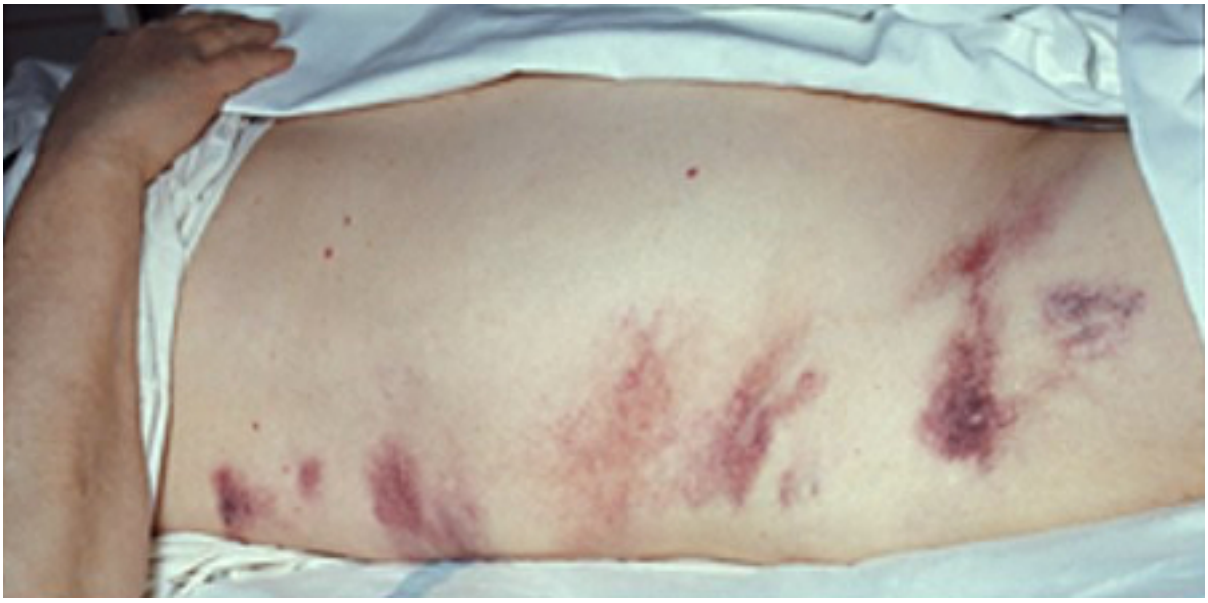
A patient in pain and moving around unable to find a comfortable position is characteristic of renal colic; a patient who is still and reluctant to move is more typical of peritonitis; the presence of abdominal scars may give clues to previous and current pathology and the likelihood of adhesions.

The contour of the abdomen may indicate generalised distension or local bulges that may accompany bowel obstruction, hernia, or mass.

Skin changes, particularly over hernia sites, can signify strangulation with blanching erythema, discoloration, or even ulceration in late stages. Periumbilical discoloration (Cullen's sign) or bruising of the flanks (Grey-Turner's sign) indicates haemorrhagic pancreatitis.

Cullen sign (periumbilical discoloration) in a 36-year-old man who presented with a 4-day history of severe epigastric pain following an alcoholic binge

Courtesy of Herbert L. Fred MD and Hendrik A van Dijk



Grey-Turner sign (bruising of the flanks) in a 40-year-old woman with worsening epigastric pain of 5 days' duration

Courtesy of Herbert L. Fred MD and Hendrik A. van Dijk

Auscultation of chest and abdomen

- Small or large bowel obstruction: if examined early in the course of obstruction, there may be hyperactive 'tinkling' bowel sounds; if the patient presents later in the course of obstruction there may be reduced or absent bowel sounds, often in combination with a markedly distended abdomen.
- Bowel sounds may be absent in a patient with a perforated viscus, haemoperitoneum, or other conditions with peritoneal inflammation.
- Chest auscultation may reveal increased vocal resonance and reduced breath sounds consistent with pneumonia, or reduced heart sounds and/or a pericardial rub associated with pericarditis, that may be giving rise to the symptoms of an acute abdomen.

Palpation

- A rigid abdomen is a hallmark sign for an acute abdomen and implies severe peritoneal irritation with reflex involuntary guarding. It is generally only encountered with perforated peptic ulcer (with generalised release of gastric acid).
- Rebound tenderness (or more generally examination evidence of peritoneal irritation) is present not only with appendicitis and diverticulitis but also with any condition where there is irritation of the parietal peritoneum. It can also be seen in advanced obstruction and volvulus.
- Occasionally, patients report abdominal pain to try to obtain opioid analgesia. If this is suspected, subtle distraction of the patient during examination can be useful in helping to determine the validity and severity of abdominal signs.
- Murphy's sign (right upper quadrant tenderness with arrest of inhalation during palpation) may be present with cholecystitis.
- A palpable and irreducible hernia may be detected in patients with incarcerated hernia. The groin should be examined in all patients with symptoms or signs of bowel obstruction.[30] Palpable masses may also be detected in patients with cholecystitis, appendix mass, intussusception, or aortic aneurysm (pulsatile).
- Psoas sign, Rovsing's sign, pain on coughing, or pain on hopping are highly specific, but not sensitive, for paediatric appendicitis.[31]

Percussion

- If percussion induces pain, peritoneal inflammation may be present. Also used to detect the presence of shifting dullness.

Rectal examination

- Blood may be present in a range of conditions responsible for acute abdomen: acute diverticulitis; volvulus; intussusception (often mixed with mucus, often described as 'currant jelly'). It may also be detected in other conditions that may not present as an acute abdomen such as haemorrhoids, upper gastrointestinal bleeding, or lower gastrointestinal tumours.
- May also reveal faecal impaction, tumour, prostate, or pelvic abscess.

Pelvic examination

- Indicated for most women if the pain is in the lower abdomen.
- May assist in the diagnosis of ovarian torsion, an ectopic pregnancy, or PID, or may exclude these conditions.
- In PID, cervical motion tenderness and adnexal tenderness will be present, and bimanual examination may reveal a tubo-ovarian abscess.

- With ectopic pregnancy, there is often a palpable adnexal mass with or without tenderness, and vaginal bleeding on speculum examination.
- Ovarian torsion can cause severe, unilateral adnexal tenderness and an adnexal mass that is often palpable.

Scrotal/testicular examination

- Inspect and palpate the scrotum and testicles. Tenderness can signify epididymitis or testicular torsion. Early urology consult is important as the longer the testicle is torsed the less likely that it can be salvaged.
- Inguinal hernia examination is important, as some inguinal hernias can track down into the scrotum through a patent processus vaginalis. Both inguinal canals should be examined even though a hernia may present on only one side.

Diagnostic accuracy may be improved by using algorithms or decision tools, although further prospective studies are required to fully evaluate their clinical use. The Appendicitis Inflammatory Response (AIR) score and the Pediatric Appendicitis Risk Calculator (pARC) have been shown to help stratify risk of appendicitis in patients presenting with acute abdominal pain.[32] [33]

Laboratory tests

Laboratory tests are often non-specific and are used to support clinical findings and medical expertise.

Initial tests to order for all patients:

- Full blood count: leukocytosis is often (but not invariably) present in conditions such as appendicitis, cholecystitis, PID, duodenal and gastric ulcer, acute mesenteric ischaemia, intussusception, hepatic abscess, pyelonephritis, strangulated hernia, pancreatitis, diverticulitis, and infectious colitis.
- Serum electrolytes panel that includes sodium, potassium, chloride, bicarbonate, urea, creatinine, and glucose: hypochloraemia and hypokalaemia may occur in the latter stages of intestinal obstruction; glucose may be elevated in pancreatitis if insulin secretion is compromised; serum urea may be elevated in patients with abdominal aortic dissection or aneurysm if the renal arteries are compromised.
- Urinalysis: useful to identify possible urinary infection (pyelonephritis) and rule out renal or urinary source of pain (e.g., kidney stone). Also likely to have abnormal results in uraemia.
- Pregnancy test for all women of reproductive age. Important in ruling out ectopic pregnancy and if considering treatments.[25]

If diagnosis is not definitive from the physical examination and/or laboratory analysis, the following tests may be helpful:

- Comprehensive metabolic panel: with liver function tests (aminotransferases, bilirubin, and alkaline phosphatase).
- C-reactive protein: non-specific marker of inflammation.
- Coagulation studies: carried out in patients with suspected vascular causes of abdominal pain (including aortic dissection, ruptured aortic aneurysm, or acute mesenteric ischaemia), and in unstable patients, especially if surgery is indicated.
- Serum lipase and amylase levels: significantly elevated levels are the hallmark of acute pancreatitis (threshold is more than 3 times normal); use serum lipase testing in preference to serum amylase.[34] [35] Serum lipase levels remain elevated for longer (up to 14 days after symptom onset vs. 5 days for amylase).[36] About one quarter of people with acute pancreatitis fail to be diagnosed as having

acute pancreatitis with serum amylase and serum lipase tests. It is, therefore, important to have a low threshold for admitting and treating patients whose symptoms are suggestive of acute pancreatitis, even if these tests are normal.[36] [37] About 1 in 10 patients without acute pancreatitis may be wrongly diagnosed as having acute pancreatitis with these tests.[36] It is important to consider other conditions that may require urgent surgery even if these tests are abnormal.[36] Serum amylase levels may also be modestly elevated in other conditions such as ectopic pregnancy, intestinal obstruction, and perforated duodenal ulcer, although amylase levels are not used to diagnose or monitor these conditions.

- Serum lactic acid levels: elevated in acute mesenteric ischaemia. The exact level depends on the severity of ischaemia, and the laboratory used. Serial measurement may help as a guide for resuscitation.
- Assessment for colorectal cancer: the US and UK guidelines report risk thresholds for testing symptomatic patients.[38] [39] [40] The US guidelines recommend adults aged <50 years with colorectal bleeding symptoms undergo colonoscopy or evaluation sufficient to determine a bleeding cause.[38] The UK guidelines recommend certain quantitative faecal immunochemical tests (FITs) to guide referral for suspected colorectal cancer in adults:[39] [40]

    - aged 40 years and over with unexplained weight loss and abdominal pain
    - aged under 50 years with rectal bleeding and unexplained abdominal pain
    - aged 50 years and over with unexplained abdominal pain.

    Refer to guidelines for an exhaustive list of signs and/or symptoms that may prompt assessment for colorectal cancer.[38] [39][40]

Imaging

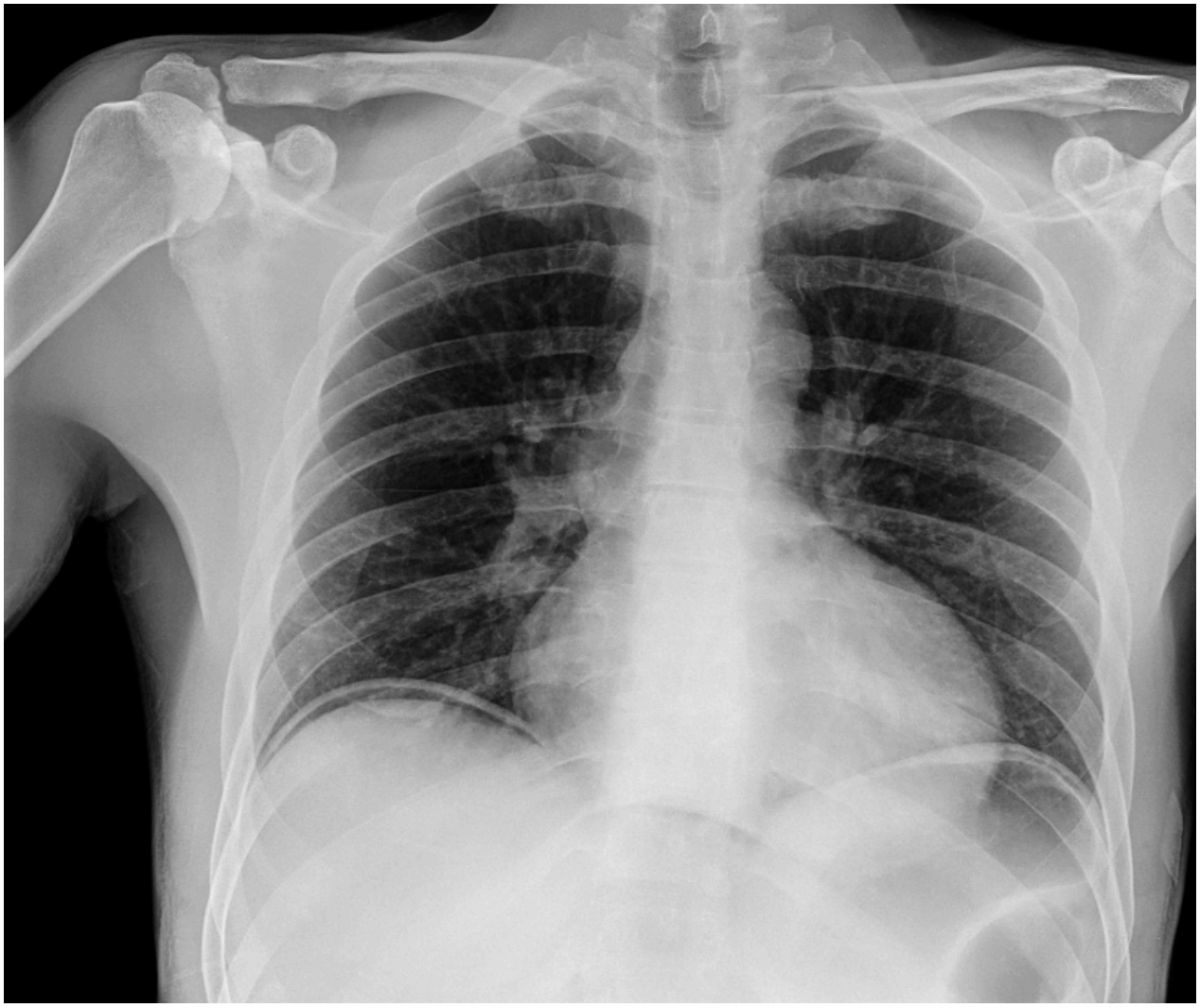
Imaging tests are guided by findings from the history and physical examination. Radiographic examination can include:

Plain abdominal x-ray:

- Often performed but rarely changes management. May be the initial imaging test in suspected bowel obstruction or constipation; a positive result may make subsequent imaging unnecessary.[41]
- May reveal radiopaque gallstones, renal stones, or pancreatic stones.
- Abdominal wall calcification may indicate the presence of an abdominal aortic aneurysm. Loss of the psoas shadow may be noted in the presence of aortic aneurysm rupture.

Erect chest x-ray if perforation is suspected:

- Primarily performed to rule out the presence of free air under the diaphragm secondary to a ruptured viscus.
- If free air is visible, this may preclude the need for additional studies - urgent surgical consultation is recommended.
- May also be a useful preoperative test for anaesthetists and is often performed in conjunction with plain abdominal x-rays.



Abdominal free gas pockets, x-ray

Science Photo Library; used with permission

Computed tomography (CT) of abdomen:

- Useful for the evaluation of almost all causes of abdominal pain, including obstruction, diverticulitis, pancreatitis, acute appendicitis, intestinal ischaemia, and abdominal aortic aneurysm.[41] [42] [43][44] [45] [46] [47] [48] [49] [50]
- Intravenous contrast is usually given, because it increases the range of detectable pathologies.[41] The patient's renal function and risk of contrast-induced acute kidney injury should be considered before intravenous contrast is administered.[51]
- CT angiography is recommended for suspected cases of mesenteric ischaemia.[41]
- Non-contrast CT is performed if renal stones are suspected. One retrospective study found that non-contrast CT is accurate for the clinical triage of patients older than 75 years who attend the emergency department with acute abdominal pain.[52]
- May have a role in pregnancy if ultrasound findings are non-diagnostic/equivocal and magnetic resonance imaging is unavailable.[41]

Ultrasound:

- Useful for helping diagnose a number of acute abdomen pathologies.[44] [49] [50][53] [54][55]

- Usually the first-line imaging test in pregnant women because it does not involve ionising radiation and is not associated with any fetal adverse effects.[56]
- Ultrasound of the right upper quadrant in patients with suspected cholecystitis can reveal features such as gallstones, a thickened gallbladder wall (>4 mm), and pericholecystic fluid.[50] However, the diagnosis of chronic cholecystitis is difficult on anatomical imaging. The gallbladder may appear contracted or distended, and pericholecystic fluid is usually absent.[57]
- Pelvic ultrasound in women with an ectopic pregnancy can reveal blood or a pseudogestational sac in utero, or complex mass in adnexa.[58]
- Doppler ultrasound may reveal reduced or absent blood flow into a torsed ovary.
- Ultrasound can also indicate presence and size of an abdominal aortic aneurysm and the presence of fluid or blood within the peritoneum; this bedside test can be helpful in assessing unstable patients where transfer for CT might be hazardous.
- The focused assessment with sonography for trauma (FAST) is a limited ultrasound examination directed solely at identifying the presence of free intraperitoneal or pericardial fluid and is used principally in trauma situations.[59]

Magnetic resonance imaging (MRI):

- Has a comparatively limited role in the evaluation of acute abdominal pain. It may be diagnostic for an aortic dissection and can be helpful in the assessment of pancreatitis, Crohn's disease, endometriosis, and psoas abscess.
- MRI is highly sensitive and specific for the diagnosis of appendicitis in children.[49] [60] Paediatric MRI may, however, require anaesthesia.
- Useful second-line imaging test in pregnant women, particularly those with suspected appendicitis. Gadolinium contrast crosses the placenta and should not be used in pregnancy.[56]

Fluoroscopy:

- Contrast enema using air or water is used as a diagnostic and therapeutic procedure for suspected intussusception. It can also diagnose volvulus.

Endoscopy:

- Oesophagogastroduodenoscopy, sigmoidoscopy, and colonoscopy permit direct visualisation of the gastrointestinal tract mucosa and acquisition of histological specimens.
- Colonoscopy (and/or FIT) is indicated for a patient with suspected colorectal cancer. Refer to guidelines for an exhaustive list of signs/symptoms suggestive of colorectal cancer.[38] [39] [40]
- Endoscopy is particularly useful in the investigation of suspected gastric and duodenal ulcers, inflammatory bowel disease, and malignancy.

Laparoscopy

May be considered in patients with the following characteristics:[4] [5] [6]

- Clinically stable
- No indication for therapeutic surgical intervention
- No apparent cause for their abdominal pain after non-invasive procedures
- No relative or absolute contraindication to surgery.

Laparoscopy may also be considered for premenopausal women or women of childbearing age with non-specific abdominal pain and suspected appendicitis. In these patients laparoscopy is associated with a

higher rate of specific diagnoses being made, a lower rate of removal of normal appendices compared with open appendicectomy only, and shorter hospital stays.[61]

Laparoscopy can be both diagnostic and therapeutic (e.g., acute cholecystitis, perforated duodenal or gastric ulcer, appendicitis, lysis of adhesions).

There are data to suggest that early laparoscopy is better than active observation in establishing a final diagnosis of non-specific abdominal pain after accident and emergency admission, but the lack of uniform information does not allow it to be recommended for use in routine clinical practice.[62]

Differentials overview

Common
Adhesions
Incarcerated/strangulated hernia
Cholecystitis
Perforated gastric ulcer
Appendicitis
Ectopic pregnancy
Pelvic inflammatory disease
Acute pancreatitis
Acute diverticulitis
Ulcerative colitis
Crohn's disease
Cholelithiasis
Gastrointestinal malignancy
Mallory-Weiss tear
Diabetic ketoacidosis
Opioid withdrawal
Gastroenteritis
Infectious colitis
Sickle cell crisis
Endometriosis
Testicular torsion

Common

Kidney stones

Pyelonephritis

Uncommon

Volvulus

Retroperitoneal haemorrhage

Viral Hepatitis

Intussusception

Perforated duodenal ulcer

Ruptured ovarian cyst

Ovarian torsion

Abdominal aortic dissection

Ruptured aortic aneurysm

Acute mesenteric ischaemia (AMI) and infarction

Myocardial infarction

Meckel's diverticulitis

Hepatic abscess

Psoas abscess

Tuberculosis

Oesophageal perforation (Boerhaave's syndrome)

Fitz-Hugh Curtis syndrome

Ischaemic colitis

Ruptured splenic artery aneurysm

Uncommon
Budd-Chiari syndrome
Splenic infarct
Abdominal wall haematoma
Uraemia
Addisonian crisis
Hypercalcaemia
Acute intermittent porphyria (AIP)
Familial Mediterranean fever
Typhlitis (neutropenic enterocolitis)
Radiation enteritis
Heavy metal poisoning
Spider bite

Differentials

Common

Adhesions

History	Exam	1st Test	Other tests
history of abdominal or pelvic surgery; intermittent, cramp-like abdominal pain; nausea and/or vomiting, feculent vomiting, constipation, absence of flatus, history of intra-abdominal malignancy, including ovarian or colon cancer	high-pitched (hyperactive) bowel sounds with rushes, or absent bowel sounds; distended abdomen, tenderness to abdominal palpation, involuntary guarding; pyrexia; tachycardia; tympany on percussion; presence of abdominal scars	»**CT of abdomen and pelvis with oral and intravenous contrast:** may see dilated loops of proximal bowel with collapsed loops posterior to site of obstruction »**plain abdominal x-rays:** may see dilated loops of bowel CT preferred if available, because it gives more information about the level and cause of the obstruction.[63] Images of both flat (supine) and upright (erect) position are taken. Presence of free air necessitates emergency laparotomy for perforated viscus. »**chest x-ray:** may see free air under the diaphragm Presence of free air necessitates urgent laparotomy for perforated viscus. »**ABG:** may be normal; metabolic acidosis; elevated lactate Metabolic acidosis occurs in advanced obstruction.[64]	»**water soluble contrast study:** may see dilated loops of proximal bowel with collapsed loops posterior to site of obstruction; absence of contrast in the colon Sensitivity 92% and specificity 93% for predicting resolution of obstruction without surgery.[65] Radiographs should be performed 8 hours after administration of oral contrast. »**pregnancy test:** negative Performed in women of childbearing age.

Common

Adhesions

History	Exam	1st Test	Other tests
		Elevated lactate indicates reduced tissue perfusion. »**FBC:** elevated WBC count; may be normal in early obstruction Non-specific for diagnosis. Elevated WBC count indicates inflammation. Marked leukocytosis suggests advanced small bowel obstruction.[64] Low haematocrit may indicate blood loss into the obstructed bowel. This is a potential sign of intestinal necrosis. May indicate degree of volume depletion that is secondary to the obstruction. »**serum electrolytes:** may not see any abnormalities with early obstruction; may confirm hypochloraemia and hypokalaemia; urea and creatinine may be elevated Non-specific for diagnosis. Hypochloraemia and hypokalaemia can be associated with persistent obstruction associated with nausea and vomiting.	

Common

Adhesions

History	Exam	1st Test	Other tests
		May indicate degree of volume depletion that is secondary to the obstruction. »**CRP:** may be elevated »**serum lipase or amylase:** normal Performed to exclude acute pancreatitis. Serum lipase levels remain elevated for longer (up to 14 days after symptom onset vs. 5 days for amylase), providing a higher likelihood of picking up a diagnosis of pancreatitis in patients with a delayed presentation.[36]	

Incarcerated/strangulated hernia

History	Exam	1st Test	Other tests
history of hernia, intermittent, cramp-like abdominal pain; painful bulge; nausea, vomiting, decreased or absent bowel function; absence of flatus; distended abdomen	high-pitched (hyperactive) bowel sounds with rushes, or absent bowel sounds; distended abdomen, tenderness to abdominal palpation; tender bulge in abdominal wall or inguinal/femoral region; involuntary guarding; or indirect hernia (more common on right than left)	»**ABG:** may be normal; metabolic acidosis; elevated lactate Metabolic acidosis occurs in advanced obstruction.[64] Elevated lactate indicates reduced tissue perfusion. »**FBC:** may be normal in early obstruction; elevated WBC count as bowel infarction develops	»**CT of abdomen and pelvis:** may see dilated loops of proximal bowel with collapsed loops posterior to site of obstruction Clinical examination is usually sufficient for the diagnosis of incarcerated/strangulated groin hernias. CT is used in selected cases to acquire additional diagnostic information.[30]

Common

Incarcerated/strangulated hernia

History	Exam	1st Test	Other tests
		Non-specific for diagnosis. May indicate degree of volume depletion that is secondary to the obstruction. »**serum electrolytes:** may be normal in early obstruction; may confirm hypochloraemia and hypokalaemia Non-specific for diagnosis. Hypochloraemia and hypokalaemia can be associated with persistent obstruction associated with nausea and vomiting. May indicate degree of volume depletion that is secondary to the obstruction. »**CRP:** may be elevated »**serum lipase or amylase:** normal Performed to exclude acute pancreatitis. Serum lipase levels remain elevated for longer (up to 14 days after symptom onset vs. 5 days for amylase), providing a higher likelihood of picking up a diagnosis of pancreatitis in	»**ultrasound of groin:** free fluid in hernia sac; bowel wall thickened; fluid within a herniated bowel loop; dilated intra-abdominal bowel loops Clinical examination is usually sufficient for the diagnosis of incarcerated/ strangulated groin hernias. Ultrasound may be useful to confirm the diagnosis in obese patients or visualise the contents of the hernia sac preoperatively.[30] »**pregnancy test:** negative Performed in women of childbearing age.

DIAGNOSIS

Common

Incarcerated/strangulated hernia

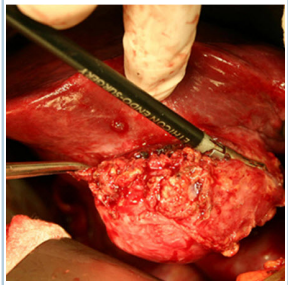
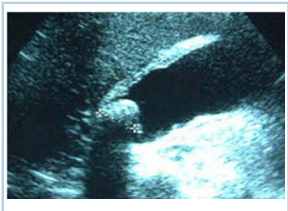
History	Exam	1st Test	Other tests
		patients with a delayed presentation.[36]	

Cholecystitis

History	Exam	1st Test	Other tests
history of cholelithiasis and biliary colic; intense right upper quadrant pain, lasting more than 30 minutes, exacerbated by eating (especially fatty foods); right shoulder pain (referred pain from the gallbladder may be felt in the right shoulder or interscapular region); fever, nausea, and/or vomiting; more common in women than men; risk factors include obesity, age over 50, pregnancy, use of oestrogen, history of liver disease, cirrhosis, and pancreatitis	fever, tachycardia, right upper quadrant tenderness, Murphy's sign (right upper quadrant tenderness with arrest of inhalation during palpation), palpable gallbladder, local guarding, and jaundice	»**FBC:** elevated WBC count Leukocytosis is not present in all patients. »**LFTs:** may see elevated alkaline phosphatase, bilirubin, and aminotransferase Non-specific as liver enzymes not elevated in all patients. »**CRP:** >30 mg/L (>3 mg/dL) Elevated CRP is a risk factor for gallbladder perforation.[74] »**right upper quadrant ultrasound:** gallstones; thickened gallbladder wall (>4 mm); pericholecystic fluid; may also see ultrasonographic Murphy's sign Positive predictive value of >90%.[57] [75]	»**cholescintigraphy (hepatobiliary iminodiacetic acid [HIDA] scan):** no contrast filling in gallbladder; may see patent cystic duct Patent cystic duct excludes diagnosis of cholecystitis. Positive predictive value of 92%.[76] »**pregnancy test:** negative Performed in women of childbearing age. »**CT or MRI of abdomen and pelvis:** may show irregular thickening of the gallbladder wall, poor contrast enhancement of the gallbladder wall (interrupted rim sign), increased density of fatty tissue around the gallbladder, gas in the gallbladder lumen or wall, membranous structures within the lumen (intraluminal flap or intraluminal membrane), peri-gallbladder abscess In non-pregnant adults with suspected acute

Common

Cholecystitis

History	Exam	1st Test	Other tests
		 *Cholecystitis: Operative photo showing acute cholecystitis* *From the collection of Dr Charles Bellows*  *Cholecystitis: Ultrasound of acute cholecystitis and presence of gallstones* *From the collection of Dr Charles Bellows*	cholecystitis, if initial ultrasound is equivocal/ non-diagnostic and clinical suspicion persists, an abdominal CT scan should be considered.[50] If both ultrasound and CT are equivocal/ non-diagnostic and clinical suspicion persists, either an abdominal MRI/MRCP or cholescintigraphy (hepatobiliary iminodiacetic acid [HIDA] scan) should be considered.[50]

Perforated gastric ulcer

History	Exam	1st Test	Other tests
background of recurrent upper abdominal pain (dyspepsia); with nausea, vomiting, loss of appetite, and pain made worse by food; weight loss; use of non-steroidal anti-inflammatory drugs; sudden-onset severe	often points to site of pain ('pointing sign'); develops into spreading upper abdominal pain; fever, peritoneal signs with guarding and rebound	»**ABG:** may be normal; metabolic acidosis; elevated lactate Metabolic acidosis associated with increased mortality risk.[77]	»**upper gastrointestinal series with water-soluble contrast:** extravasation of contrast from stomach »**oesophagogastroduodenoscopy with biopsy:** may show *Helicobacter*

Common

Perforated gastric ulcer

History	Exam	1st Test	Other tests
upper abdominal pain with fever, nausea, vomiting, and peritoneal signs; referred pain to shoulders secondary to diaphragmatic irritation		»**blood cultures:** may detect bacteraemia Ideally taken before administration of antibiotics, but should not delay antibiotic treatment.[77] »**FBC:** microcytic anaemia; elevated WBC count Nonspecific as leukocytosis is not present in all patients. »**serum electrolytes:** may show elevated creatinine and urea Acute kidney injury associated with increased mortality risk.[77] »**CRP:** usually elevated »**serum lipase or amylase:** normal Performed to exclude acute pancreatitis. Serum lipase levels remain elevated for longer (up to 14 days after symptom onset vs. 5 days for amylase), providing a higher likelihood of picking up a diagnosis of pancreatitis in patients with a delayed presentation.[36] »**CT of abdomen and pelvis:** pneumoperitoneum More sensitive than plain abdominal or	*pylori* on culture and/or malignancy on histology Important that gastric ulcers be biopsied to rule out malignancy. »**fasting serum gastrin level:** hypergastrinaemia in Zollinger-Ellison syndrome »**pregnancy test:** negative Performed in women of childbearing age.

Common

Perforated gastric ulcer

History	Exam	1st Test	Other tests
		chest radiographs and permits evaluation for other differential diagnoses.[77] »**plain abdominal x-rays:** abdominal free air on erect abdominal film Images of both flat (supine) and upright (erect) position are taken. Endoscopy is avoided when perforation is suspected because it could exacerbate perforation. »**chest x-ray:** may see free air under the diaphragm Presence of free air necessitates urgent laparotomy for perforated viscus. »**Helicobacter pylori testing:** positive result if *H pylori* present All patients with a perforated ulcer should be tested for *H pylori* .[78] Urea breath test is preferred. Stool antigen test also has high sensitivity and specificity. Serological tests should be locally validated, because they may perform differently depending on the	

Common

Perforated gastric ulcer

History	Exam	1st Test	Other tests
		antigenic composition of local strains.[79]	

Appendicitis

History	Exam	1st Test	Other tests
sudden-onset, constant, severe abdominal pain often periumbilical with migration to right lower quadrant, usually worse on movement; nausea, vomiting, anorexia, fever, diarrhoea, more common in children and young adults; pain may improve after appendix rupture	fever, tachycardia, patient may be lying in right lateral decubitus position with hips flexed; no or decreased bowel sounds; pain commonly originates near the umbilicus or the epigastrium; right lower quadrant (McBurney's point) tenderness with rigid abdomen; guarding and rebound tenderness; Rovsing's sign (palpation of left lower quadrant elicits pain in the right lower quadrant), psoas sign (right lower quadrant pain with right thigh extension), pain reproduced by coughing or hopping	»**FBC:** elevated WBC count WBC count >15.0 x 10^9/L (>15,000 cells/microL) suggests perforation or alternative aetiology. Increased polymorphonuclear leukocytes (>75%). High discriminatory power when combined with history.[80] May see leukocytosis with neutrophilia. Appendicitis is very unlikely if WBC count and CRP both normal.[81] »**CRP:** elevated Appendicitis is very unlikely if WBC count and CRP both normal. CRP increases with severity of appendicitis.[81] »**CT scan of abdomen and pelvis with intravenous contrast:** abnormal appendix (diameter >6 mm) identified or	»**pregnancy test:** negative Performed in women of childbearing age. »**right lower quadrant ultrasound:** non-compressible appendix of ≥7 mm in anteroposterior diameter appendicolith; interruption of the continuity of the echogenic submucosa; peri-appendiceal fluid or mass Sensitivity of 85%, specificity of 90%.[82] May be performed as the initial imaging test in pregnant women.[43] Obesity may preclude a definitive diagnosis. Rapid technique that avoids radiation exposure. »**MRI abdomen:** findings may include diffuse or segmental enlargement of the pancreas with irregular contour and obliteration of the peri-pancreatic fat, necrosis, or pseudocysts

Common

Appendicitis

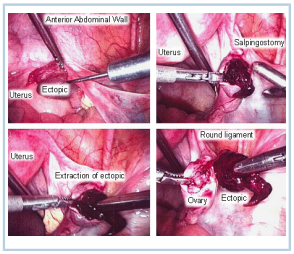
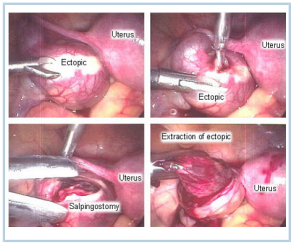
History	Exam	1st Test	Other tests
		calcified appendicolith seen in association with peri-appendiceal inflammation Sensitivity and specificity >90%.[46] [49]  *Appendicitis: CT abdomen showing thickened appendix* *Courtesy of Nasim Ahmed, MBBS, FACS* Use of enteral contrast may improve specificity.[43] Preoperative abdominal CT is associated with lower negative appendicectomy rates.[42]	May be performed as the initial imaging test in pregnant women.[43] May be performed in children or women of childbearing age. Paediatric MRI may require anaesthesia. Gadolinium contrast crosses the placenta and should not be used in pregnancy.

Ectopic pregnancy

History	Exam	1st Test	Other tests
vaginal bleeding with severe, usually unilateral pelvic pain; amenorrhoea or painless vaginal bleeding; history of recent early pregnancy or missed last menstrual period; risk factors include history of ectopic pregnancy,	may have palpable adnexal mass with or without tenderness; rigid abdomen, guarding, and rebound tenderness with ruptured ectopic leading to haemoperitoneum, tachycardia, and hypotension; vaginal	»**human chorionic gonadotrophin (hCG):** positive Although the threshold at which a viable intrauterine pregnancy may be seen on transvaginal ultrasound is variable, if the hCG is	»**diagnostic laparoscopy:** ectopic pregnancy or complex mass seen Presence of acute abdominal findings warrants either culdocentesis or diagnostic laparoscopy

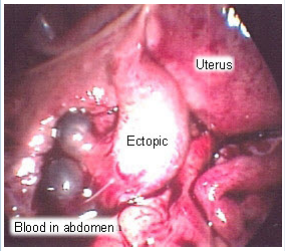
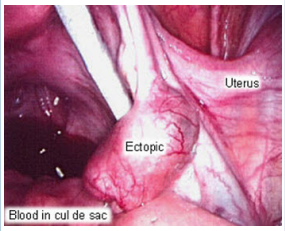
Common

Ectopic pregnancy

History	Exam	1st Test	Other tests
tubal surgery, pelvic inflammatory disease, infertility treatment and pregnancy with an intrauterine device in situ	bleeding on speculum examination	greater than 1500-2000 IU/L (1500-2000 mIU/mL), then generally, evidence of an intrauterine gestation may be observed. Threshold value varies with institution. If hCG stable and diagnosis is unclear, hCG is measured again within 48 hours in the absence of acute abdominal findings. Failure of hCG levels to increase by at least 50% in 48 hours generally indicates an abnormal pregnancy. However, this test does not indicate whether the abnormal pregnancy is extrauterine or intrauterine.[83] »**FBC:** possible anaemia »**transabdominal or transvaginal pelvic ultrasound:** no intrauterine pregnancy detected; ectopic pregnancy visualised Blood or pseudogestational sac in uterus can be differentiated from a true gestational sac by absence of the double decidual sign, yolk sac or fetal pole.[58]	to rule out ruptured ectopic pregnancy when diagnosis is unclear, regardless of hCG or ultrasound findings.  *Ectopic pregnancy: Surgical extraction of ectopic pregnancy From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission*  *Ectopic pregnancy: Surgical extraction of ectopic pregnancy From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission*

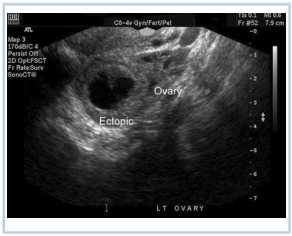
Common

Ectopic pregnancy

History	Exam	1st Test	Other tests
		 *Ectopic pregnancy: Ultrasound image of ectopic pregnancy showing the donut sign* *From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission*	 *Ectopic pregnancy: Blood in the abdomen* *From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission*
		 *Ectopic pregnancy: Ultrasound image of ectopic pregnancy* *From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission*	 *Ectopic pregnancy: Blood in cul de sac* *From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission*

Common

Ectopic pregnancy

History	Exam	1st Test	Other tests
		 *Ectopic pregnancy: Ultrasound image of ectopic pregnancy* *From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission* Absence of intrauterine pregnancy using transvaginal ultrasound when hCG is 1500-2000 IU/L (>1500-2000 mIU/mL) may indicate ectopic pregnancy.	

Pelvic inflammatory disease

History	Exam	1st Test	Other tests
sexually active, young age at onset of sexual activity, unprotected sexual intercourse with multiple sexual partners; prior infection with chlamydia or gonorrhoea; history of pelvic inflammatory disease; use of intrauterine device; lower abdominal or pelvic pain of recent onset or relatively	abdominal tenderness; abnormal vaginal discharge; cervical motion tenderness and adnexal tenderness will be present; bimanual examination may reveal a tubo-ovarian abscess	»**FBC:** elevated WBC count Result is not specific, but elevated WBC supports the diagnosis. »**erythrocyte sedimentation rate/ CRP:** elevated Result is not specific, but elevated inflammatory marker(s) supports the diagnosis.	»**ultrasound:** tubal wall thickness >5 mm, incomplete septae within the tube, fluid in the cul-de-sac, and a cog-wheel appearance on the cross-section of the tubal view; may see complex adnexal mass, which could be indicative of a tubo-ovarian abscess

Common

Pelvic inflammatory disease

History	Exam	1st Test	Other tests
short duration that may have begun after intercourse; abnormal vaginal discharge; fever (non-specific, but suggestive)		»**wet mount of vaginal secretions:** polymorphonuclear cells present Negative predictive value 94.5% and positive predictive value 17.1% for upper genital tract infection.[93] »**nucleic acid amplification test or culture of vaginal secretions:** may confirm infection with *Chlamydia trachomatis* or *Neisseria gonorrhoeae*	Definitive test to confirm presence of a tubo-ovarian abscess.[94] Sensitivity for tubo-ovarian abscess as high as 95%.[95]

Acute pancreatitis

History	Exam	1st Test	Other tests
acute-onset, constant, severe mid-abdominal/epigastric pain that often radiates to the back; nausea, vomiting; anorexia; history of biliary colic, alcohol misuse, use of specific medicines (e.g., sulphonamides, tetracycline, oestrogens, corticosteroids), trauma, or surgery	varying degrees of abdominal tenderness, usually worse in the epigastric region; guarding, abdominal distension, and reduced or absent bowel sounds; ecchymoses in the skin of one or both flanks (Grey-Turner's sign) and/or the periumbilical area (Cullen's sign)	»**serum lipase or amylase:** elevated (3 times the upper limit of normal) Use serum lipase testing in preference to serum amylase.[34] [35] Serum lipase levels remain elevated for longer (up to 14 days after symptom onset vs. 5 days for amylase), providing a higher likelihood of picking up the diagnosis in patients with a delayed presentation.[36] About one quarter of people with acute pancreatitis fail to be diagnosed as having	»**serum calcium:** may be elevated Hypercalcaemia is a rare cause of pancreatitis. »**serum triglycerides:** may be elevated Hypertriglyceridaemia is a rare cause of pancreatitis. »**abdominal ultrasound:** may see ascites, gallstones, dilated common bile duct, and enlarged pancreas Abdominal imaging is not needed for diagnosis in most patients. However, once

Common

Acute pancreatitis

History	Exam	1st Test	Other tests
		acute pancreatitis with serum amylase and serum lipase tests.[36] [37] The patient should be admitted and treated as having acute pancreatitis, even if these tests are normal, if there is a suspicion of acute pancreatitis.[36] About 1 in 10 patients without acute pancreatitis may be wrongly diagnosed as having acute pancreatitis with these tests.[36] It is important to consider other conditions that require urgent surgery, even if these tests are abnormal.[36] The diagnostic performance of these tests decreases with time, and additional investigations should be performed if there is a suspicion of acute pancreatitis.[36] »**FBC:** elevated WBC count »**LFTs:** normal or elevated alanine aminotransferase (ALT) ALT ≥3 times the upper limit of normal has a	a diagnosis of acute pancreatitis has been made, transabdominal ultrasound is required to rule out gallstones as the aetiology.[34] »**CT scan of abdomen with oral and intravenous contrast:** may show pancreatic inflammation, peri-pancreatic stranding, calcifications, or fluid collections; confirms or excludes gallstones Abdominal imaging is not needed for diagnosis in most patients. Necrosis generally takes around 5 days to develop, so an early CT scan cannot be used to assess disease severity. American College of Gastroenterology guidelines recommend CT or MRI after 48-72 hours in patients who do not improve or whose symptoms worsen.[34] Other guidelines recommend a delay of 72-96 hours after symptom onset before contrast-enhanced CT or MRI to assess for necrosis.[97] [98]

Common

Acute pancreatitis

History	Exam	1st Test	Other tests
		positive predictive value of 95% for gallstone pancreatitis.[96] In the absence of choledocholithiasis, LFTs are usually normal. A slight increase in alkaline phosphatase and bilirubin may be seen. »**urea and creatinine:** normal or elevated Increased risk of severe disease if elevated.[34] »**serum glucose:** normal or elevated Glucose may be elevated if insulin secretion is compromised.	»**magnetic resonance cholangiopancreatography (MRCP):** findings may include stones, diffuse or segmental enlargement of the pancreas with irregular contour and obliteration of the peri-pancreatic fat, necrosis, or pseudocysts American College of Gastroenterology guidelines recommend CT or MRI after 48-72 hours in patients who do not improve or whose symptoms worsen.[34] Other guidelines recommend a delay of 72-96 hours after symptom onset before contrast-enhanced CT or MRI to assess for necrosis.[97] [98] MRI employing MRCP has the advantage of not requiring intravenous contrast or radiation, although intravenous gadolinium enhances images compared with non-contrast MRI. In addition, MRCP allows better visualisation of common bile duct stones and the pancreatic duct

Common

Acute pancreatitis

History	Exam	1st Test	Other tests
			compared with CT. It can more readily distinguish solid from cystic in dealing with peri-pancreatic collections.[99] Used when contrast-enhanced CT is contraindicated. »**pregnancy test:** negative Performed in women of childbearing age.

Acute diverticulitis

History	Exam	1st Test	Other tests
persistent left lower quadrant pain; fever, anorexia, nausea, vomiting, and abdominal distension (with ileus), patient may have a known history of diverticulosis	fever; left lower quadrant tenderness; frank blood in stool; diffuse tenderness with peritoneal signs (guarding, rebound tenderness, rigid abdomen) with perforation or ruptured abscess	»**FBC:** elevated WBC count »**CT abdomen/pelvis with intravenous, oral, and rectal contrast:** may see diverticula, inflammation of pericolonic fat, thickening of the bowel wall, free abdominal air, and an abscess Sensitivity of 69% to 95% and specificity of 75% to 100%.[47] [100] The imaging modality of choice to confirm suspicion of acute diverticulitis or complicated diverticular disease.[44] [47] [48] [50]	»**water-soluble contrast enema:** may see diverticula along with extravasation of contrast material into an abscess cavity or into the peritoneum Use of barium enema should be avoided due to risk of barium peritonitis. Sensitivity of 82% to 92%.[101] [102] This test has largely been replaced by CT. »**abdominal ultrasound:** may see fluid collections around the colon or a thickened hypoechoic bowel wall Should be considered if CT scan cannot be obtained. Sensitivity

Common

Acute diverticulitis

History	Exam	1st Test	Other tests
			of 84% to 98% and specificity of 80% to 93%.[103] [104] »**endoscopy:** may see inflamed diverticulum, abscess and perforation Limited applicability in acute setting due to risk of perforation. Used when diagnosis of diverticular disease is unclear and cancer or bowel ischaemia is suspected. »**laparoscopy:** allows direct visualisation of bowel if diagnosis is unclear »**pregnancy test:** negative Performed in women of childbearing age.

◊ Ulcerative colitis

History	Exam	1st Test	Other tests
bloody mucous diarrhoea and/or frank blood; fever, abdominal pain, weight loss, and growth retardation; back and joint pain and stiffness	abdominal tenderness; fevers; skin rash; episcleritis; pallor; guaiac-positive stools or frank blood on rectal examination	»**FBC:** variable degree of anaemia, leukocytosis, or thrombocytosis »**comprehensive metabolic panel (including LFTs):** hypokalaemic metabolic acidosis; elevated sodium and urea; elevated alkaline phosphatase, bilirubin, aspartate aminotransferase, and alanine	»**double-contrast barium enema:** results range from a fine granular appearance of the bowel wall to diffuse ulceration, thumbprinting (due to mucosal oedema), and narrowing and shortening of the bowel, depending on the severity of the disease »**serological markers: perinuclear antineutrophil**

Common

◊ Ulcerative colitis

History	Exam	1st Test	Other tests
		aminotransferase; hypoalbuminaemia »**CRP and erythrocyte sedimentation rate:** elevated »**stool studies:** negative culture, *Clostridium difficile* toxins A and B negative; WBCs present; elevated faecal calprotectin »**plain abdominal radiograph:** dilated loops with air-fluid level secondary to ileus; free air is consistent with perforation; in toxic megacolon, the transverse colon is dilated to ≥6 cm in diameter »**colonoscopy/ sigmoidoscopy:** rectal involvement, continuous uniform involvement, loss of vascular marking, diffuse erythema, mucosal granularity, fistulas (rarely seen), normal terminal ileum (or mild 'backwash' ileitis in pancolitis) »**biopsies:** continuous distal disease, mucin depletion, basal plasmacytosis, diffuse mucosal atrophy, absence of granulomata, and anal sparing; only mucosal/submucosal involvement	**cytoplasmic antibody (pANCA):** may be positive Approximately 70% of patients with ulcerative colitis have positive pANCA.[105] »**CT abdomen/ pelvis with oral and intravenous contrast:** may show thickening, inflammation, abscess, fistulisation, obstruction of the bowel; biliary dilation suggests primary sclerosing cholangitis Ordered when complications or other diagnoses are being considered. »**radionuclide studies:** positive areas of inflammation »**pregnancy test:** negative Performed in women of childbearing age.

Common

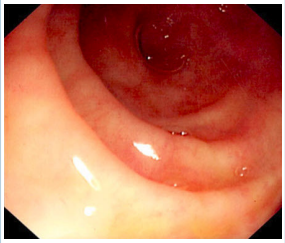
◊ Crohn's disease

History	Exam	1st Test	Other tests
family history of Crohn's disease; typical age range 15-40 or 60-80 years; fevers, abdominal pain, prolonged intermittent bloody or non-bloody diarrhoea; fatigue; anal discharge and abscess; weight loss; faltering growth in children	abdominal tenderness often periumbilical or right lower quadrant if terminal ileum inflamed, mimicking appendicitis; peri-anal disease with fissures, skin tags fistulae, sinuses, and abscesses; aphthous ulcers; blood on rectal examination	»**FBC:** anaemia; leukocytosis; may be thrombocytosis »**comprehensive metabolic panel:** hypoalbuminaemia, hypocholesterolaemia, hypocalcaemia »**CRP and erythrocyte sedimentation rate:** elevated »**iron studies:** normal, or may demonstrate changes consistent with iron deficiency Iron studies should include serum iron, serum ferritin, total iron binding capacity, and transferrin saturation. »**serum vitamin B12:** may be normal or low »**serum folate:** may be normal or low »**stool testing:** absence of infectious elements seen on microscopy or culture; faecal calprotectin may be elevated »**plain abdominal films:** small bowel or colonic dilation; calcification; sacroiliitis;	»**MRI abdomen/ pelvis:** skip lesions, bowel wall thickening, surrounding inflammation, abscess, fistulae Superior to CT scanning in demonstrating pelvic lesions. MRI has high diagnostic accuracy for small bowel disease.[106] »**abdominal and pelvic ultrasonography:** bowel wall thickening, surrounding inflammation, abscess; tubo-ovarian abscess »**colonoscopy:** aphthous ulcers, hyperaemia, oedema, cobblestoning, skip lesions Enables direct visualisation and biopsy.

DIAGNOSIS

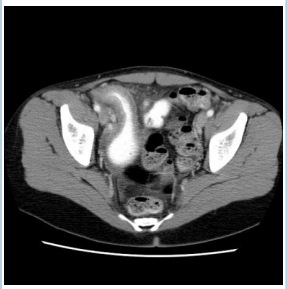
Common

◊ Crohn's disease

History	Exam	1st Test	Other tests
		intra-abdominal abscesses »**CT abdomen:** skip lesions, bowel wall thickening, surrounding inflammation, abscess, fistulae Helps in localisation of the disease and diagnosing fistulae, abscesses, and other extramural complications.  *Crohn's disease: CT scan demonstrating thickening of the terminal ileum in a patient with Crohn's disease exacerbation* *Provided by Drs Wissam Bleibel, Bishal Mainali, Chandrashekhar Thukral, and Mark A. Peppercorn*	 *Crohn's disease: Endoscopic view of Crohn's ileitis* *Provided by Drs Wissam Bleibel, Bishal Mainali, Chandrashekhar Thukral, and Mark A. Peppercorn*  *Crohn's disease: Endoscopic view of normal terminal ileum* *From the personal collection of Dr Charlotte Ford, North Middlesex Hospital Trust, London, UK* »**tissue biopsy:** mucosal bowel biopsies demonstrate transmural involvement with non-caseating granulomas »**technetium-99 labelled WBC scanning:** increased

Common

◊ Crohn's disease

History	Exam	1st Test	Other tests
		 *Crohn's disease: CT scan demonstrating thickening of the terminal ileum in a patient with Crohn's disease exacerbation* *Provided by Drs Wissam Bleibel, Bishal Mainali, Chandrashekhar Thukral, and Mark A. Peppercorn* »**Yersinia enterocolitica serology:** negative Important to exclude *Y enterocolitica* , a bowel pathogen that causes acute ileitis.	uptake in the inflamed segments Used in patients not able to undergo colonoscopy. »**oesophagogastroduodenoscopy:** aphthous ulcers; mucosal inflammation »**wireless capsule endoscopy:** aphthous ulcers; hyperaemia; oedema; cobblestoning; skip lesions Visualises the small bowel and may detect suggestive lesions not visible by other small bowel studies. A useful test in patients with suspected Crohn's disease when colonoscopy with terminal ileum biopsies is non-diagnostic. »**anti-glycan antibodies:** positive anti- *Saccharomyces cerevisiae* mannan antibodies (ASCA) and negative perinuclear neutrophil cytoplasmic antibodies Anti-glycan antibodies (e.g., anti-Saccharomyces cerevisiae [ASCA], anti-laminaribiose [ALCA], anti-chitobioside [ACCA], anti-laminarin [anti-L], anti-chitin [anti-C]) and antibodies to microbial antigens (anti-outer membrane

Common

◊ Crohn's disease

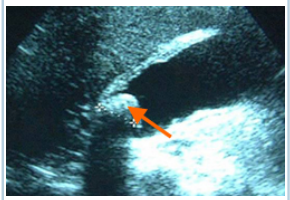
History	Exam	1st Test	Other tests
			porin C [anti-OmpC], anti-Cbir1 flagellin, anti-I2, and p-ANCA) are more prevalent in Crohn's disease than in ulcerative colitis, but have a low sensitivity.[107] Routine use of serological markers of inflammatory bowel disease to establish the diagnosis of CD is not recommended.[107] However, ASCA may be of prognostic value in children with CD.[108] [109] »**pregnancy test:** negative Performed in women of childbearing age.

◊ Cholelithiasis

History	Exam	1st Test	Other tests
right upper quadrant or epigastric pain (lasting more than 30 minutes) sometimes associated with food	right upper quadrant or epigastric tenderness; jaundice	»**LFTs:** may be normal or elevated alkaline phosphatase and elevated bilirubin »**abdominal ultrasound:** demonstrates stones in the gallbladder For biliary pain. This is the best single test (sensitivity 89.8% and specificity 88.0% for emergency physician use) for cholelithiasis and sludge in the	»**endoscopic retrograde cholangiopancreatography (ERCP):** ERCP demonstrates stones in the gallbladder or bile duct ERCP is recommended in patients with a high risk of choledocholithiasis (i.e., common bile duct stone seen on ultrasound/cross-sectional imaging; OR

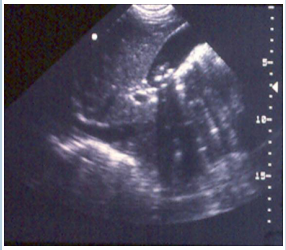
Common

◊ Cholelithiasis

History	Exam	1st Test	Other tests
		gallbladder, a key to diagnosis.[110] For bile duct dilation. Low sensitivity for choledocholithiasis. If stones are detected in the gallbladder with pericholecystic fluid and gallbladder wall thickening, consider acute cholecystitis.[110]  *Ultrasound of acute cholecystitis and presence of gallstones: the arrow points to a gallstone in the fundus of the gallbladder with its echogenic shadow below* *Courtesy of Charles Bellows and W. Scott Helton; used with permission*	total bilirubin >4 mg/dL and dilated common bile duct; OR ascending cholangitis).[111] »**magnetic resonance cholangiopancreatography (MRCP):** MRCP demonstrates stones in the gallbladder or bile duct MRCP is recommended in patients with an intermediate risk of choledocholithiasis (i.e., abnormal LFTs; OR age >55 years; OR dilated common bile duct on ultrasound/ cross-sectional imaging).[111] »**endoscopic ultrasound (EUS):** stones in gallbladder or bile duct EUS is recommended for patients with an intermediate risk of choledocholithiasis (i.e., abnormal LFTs; OR age >55 years; OR dilated common bile duct on ultrasound/ cross-sectional imaging).[111] »**pregnancy test:** negative

Common

◊ Cholelithiasis

History	Exam	1st Test	Other tests
		 *Gallbladder ultrasound demonstrating cholelithiasis with characteristic shadowing* *Courtesy of Kuojen Tsao; used with permission* Endoscopic ultrasound is more sensitive for microlithiasis (small gallstones <3 mm). »**serum lipase and amylase:** elevated (>3 times upper limit of normal) in acute pancreatitis For pain located primarily in the epigastric area, with or without radiation to the back. Serum lipase is the preferred test.	Performed in women of childbearing age.

Gastrointestinal malignancy

History	Exam	1st Test	Other tests
nausea, vomiting, abdominal pain and distension (especially with distal obstruction); little or no flatus or	may have palpable mass, pallor, or cachexia; if obstruction present, distended abdomen, high-pitched	»**FBC:** variable level of anaemia »**quantitative faecal immunochemical testing:** positive	»**upper gastrointestinal endoscopic ultrasound:** determines clinical

Common

Gastrointestinal malignancy

History	Exam	1st Test	Other tests
bowel function; weight loss; black stools	(hyperactive) bowel sounds with rushes, or absent bowel sounds; tenderness to abdominal palpation, involuntary guarding; tachycardia	Guaiac can react with food or medicine leading to a false-positive result, but quantitative faecal immunochemical tests (FITs) use antibodies specific to the globin part of human haemoglobin to detect small amounts of blood.[40] [112] As globin degrades while traversing the gastrointestinal tract, theoretically these tests are less likely to detect globin from upper gastrointestinal bleeding.[112] The US and UK guidelines report risk thresholds for testing symptomatic patients.[38] [39][40] The UK's National Institute for Health and Care Excellence (NICE) recommends certain FIT for the recognition and referral of patients at risk of colorectal cancer.[39] [40] Adults with a FIT result of at least 10 micrograms of haemoglobin per gram of faeces should be referred using a suspected cancer pathway referral for	tumour (T) and node (N) stage of upper gastrointestinal tumours »**transrectal endoscopic ultrasound:** determines clinical tumour (T) and node (N) stage of rectal tumours »**carcinoembryonic antigen:** elevated in colorectal cancer »**pregnancy test:** negative Performed in women of childbearing age.

DIAGNOSIS

Common

Gastrointestinal malignancy

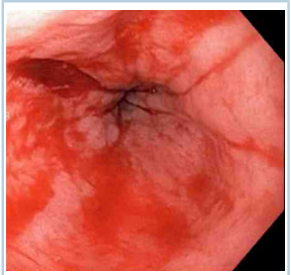
History	Exam	1st Test	Other tests
		colorectal cancer (for a diagnosis or ruling out of cancer within 28 days of being referred urgently).[39] [40] »**renal function:** normal, except if advanced pelvic disease is compressing ureters »**LFTs:** normal, except if liver metastases present »**chest x-ray:** normal or evidence of metastatic disease »**oesophagogastroduodenoscopy with biopsy:** may show upper gastrointestinal ulcer, mass, or mucosal changes and provide histological confirmation »**colonoscopy with biopsy:** ulcerating exophytic mucosal lesion that may narrow the bowel lumen; histological confirmation »**CT thorax/ abdomen/pelvis with oral and intravenous contrast:** hypodense lesions around tumour site or at distant metastatic sites (e.g. liver); colonic wall thickening, enlarged lymph nodes, liver metastases, ascites, lung secondaries; invasion of mesorectal fascia »**CT colonography:** appearances similar	

Common

Gastrointestinal malignancy

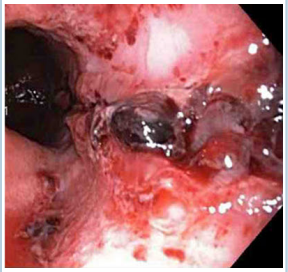
History	Exam	1st Test	Other tests
		to conventional colonoscopy, with an ulcerating exophytic mucosal lesion that may narrow the bowel lumen	

◊ Mallory-Weiss tear

History	Exam	1st Test	Other tests
vomiting or coughing with subsequent haematemesis; retrosternal, epigastric, or back pain; melena; presyncope/ syncope; dysphagia, odynophagia	postural/orthostatic hypotension; pallor, tachycardia	»**erect chest x-ray:** may show free air »**oesophagogastroduodenoscopy:** bleeding, adherent clot, or fibrous rind over an area of mucosal split at or near the gastro-oesophageal junction Enables direct visualisation and therapeutic intervention.  *Mallory-Weiss tear: Actively bleeding tear appears as a red longitudinal defect with normal surrounding mucosa* *From the collection of Juan Carlos Munoz, MD, University of Florida*	

Common

◊ Mallory-Weiss tear

History	Exam	1st Test	Other tests
		 *Mallory-Weiss tear: Non-bleeding adherent clot* *From the collection of Juan Carlos Munoz, University of Florida*	

Diabetic ketoacidosis

History	Exam	1st Test	Other tests
inadequate or inappropriate insulin therapy, infection (pneumonia and urinary tract infections are the most common), myocardial infarction; anorexia, nausea, vomiting, polyuria, thirst; abdominal pain; fever; dizziness, weakness, mental status change	acetone breath; deep, laboured, gasping breathing (Kussmaul's breathing); signs of hypovolaemia (tachycardia, hypotension, poor capillary refill, sunken eyes); abdominal tenderness; altered mental status	»**plasma glucose:** elevated »**serum electrolytes and urea:** usually sodium low, potassium elevated, chloride low, magnesium low, calcium low, phosphate normal or elevated, urea elevated, creatinine elevated »**arterial blood gases:** pH varies from 7.00 to 7.30 in diabetic ketoacidosis (DKA); arterial bicarbonate ranges from <10 mmol/L (<10 mEq/L) in severe DKA to >15 mmol/L (>15 mEq/L) in mild DKA »**urinalysis:** positive for glucose and ketones; positive for leukocytes and nitrites	

Common

Diabetic ketoacidosis

History	Exam	1st Test	Other tests
		in the presence of infection »**serum ketones:** elevated »**FBC:** elevated WBC count Leukocytosis is present in hyperglycaemic crises and correlates with blood ketone levels. However, leukocytosis >25.0 × 10^9/L (>25,000/microL) may indicate infection and requires further evaluations.	

◊ Opioid withdrawal

History	Exam	1st Test	Other tests
history of drug use/ misuse; fever, chills, nausea, vomiting; crampy abdominal pain; change of bowel habit; sweating, tremors, confusion, agitation, anxiety, muscular aches, increased salivation, dilated pupils	diffuse abdominal pain and tenderness; abdomen usually not distended; dilated pupils, confusion, sweating, copious salivation	»**urine drug screen:** positive A urine drug screen should be ordered initially if there is a clinical suspicion of drug misuse. »**gas chromatography-mass spectroscopy:** positive A positive urine screen should be followed by a confirmatory urine test, because certain medications (e.g., antibiotics) can interfere with the screen and produce false-positive results.[123] [124]	»**CT abdomen/pelvis:** may indicate intra-abdominal source »**pregnancy test:** negative Performed in women of childbearing age.

Common

◊ Gastroenteritis

History	Exam	1st Test	Other tests
nausea, vomiting, diarrhoea, crampy abdominal pain; history of sick contacts with similar symptoms; ingestion of questionable food or water; recent travel to places with insanitary conditions	dehydration; tachycardia; soft, non-distended abdomen; diffuse abdominal tenderness	»**FBC:** elevated WBC count »**serum electrolytes and urea:** variable, may show dehydration »**stool for culture, ova and parasites:** may identify infectious agent Ordered when a bacterial or parasitic aetiology suspected. Viral culture rarely necessary.	»**stool leukocytes:** positive »**CT abdomen/ pelvis with oral and intravenous contrast:** may show non-specific thickening of affected bowel Consider if diagnosis is unclear from history, examination, and initial investigations. »**pregnancy test:** negative Performed in women of childbearing age.

◊ Infectious colitis

History	Exam	1st Test	Other tests
fever, chills, nausea, vomiting, diarrhoea (may be bloody), abdominal pain; abdominal distention, malaise, and anorexia; may have been recent travel, community outbreak or close contact with people with similar symptoms, recent use of antibiotics or hospitalisation; immunocompromise	pyrexia, abdominal pain and tenderness; variable signs from mild dehydration to hypovolaemic shock/septic shock (hypotension, tachycardia); peritonitis; possible abdominal distention	»**FBC:** elevated WBC count and/or anaemia »**serum electrolytes and urea:** variable, may show dehydration »**stool culture:** may identify infectious agent	»**stool immunoassay for Clostridioides difficile toxins A and B:** may be positive Consider if patient institutionalised or recent antibiotic use. »**stool culture for ova/parasites:** may be positive Consider if there has been foreign travel, community outbreak, daycare exposure. »**cytomegalovirus antigen/shell assay:** may be positive Consider if patient is immunocompromised.

Common

◊ Infectious colitis

History	Exam	1st Test	Other tests
			»**abdominal x-ray:** may show distended colon »**CT abdomen/pelvis with contrast:** may show thickened and inflamed segments of colon or all of colon affected; may show pneumatosis or localised perforation or perforation with phlegmon/abscess in severe cases Image:  *Clostridium difficile-associated disease: CT scan of the abdomen showing gross thickening of the large bowel wall and obliteration of the lumen* *Yates B, Murphy CM, et al. Pseudomembranous colitis in four patients with cystic fibrosis following lung transplantation. BMJ Case Reports. 2009; doi: 10.1136/bcr.11.2008.1218* »**pregnancy test:** negative

Common

◊ Infectious colitis

History	Exam	1st Test	Other tests
			Performed in women of childbearing age.

◊ Sickle cell crisis

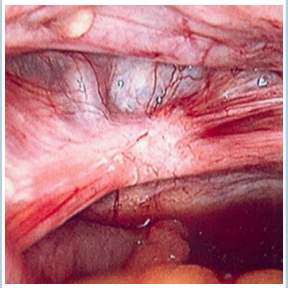
History	Exam	1st Test	Other tests
history of sickle cell anaemia; diffuse bodily pain which can include abdominal pain, bone pain, chest pain; may also have fatigue, fever, jaundice, tachycardia, delayed growth and puberty; skin ulcers	diffuse acute abdominal pain and tenderness on palpation; patient is uncomfortable in any position; abdomen is usually not distended; fever	»**FBC with reticulocyte count:** some degree of anaemia occurs in most patients with sickle cell disease; leukocytosis common in acute pain crises »**peripheral blood smear:** presence of nucleated red blood cells, sickle-shaped cells, and Howell-Jolly bodies »**urea and creatinine:** normal or elevated Renal infarction can cause renal dysfunction. Chronic kidney disease is a complication of sickle cell anaemia. »**LFTs:** variable Variable transaminitis and hyperbilirubinaemia in acute sickle hepatic crisis.[125] »**bacterial cultures:** pathogen detected Cultures of blood, sputum, urine, stool, and/or pus should be obtained.[125] »**abdominal ultrasound:** may show	»**haemoglobinopathy testing:** sickle cell haemoglobin mutation Performed if diagnosis not previously confirmed. Recommended method varies with age. »**chest x-ray:** presence of pulmonary infiltrate(s) may be an indication of acute chest syndrome Performed if the patient has respiratory symptoms, fever, or chest pain. »**pregnancy test:** negative Performed in women of childbearing age.

Common

◊ Sickle cell crisis

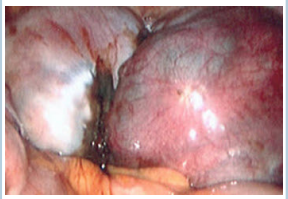
History	Exam	1st Test	Other tests
		enlarged spleen or presence of gallstones; hepatomegaly Hepatomegaly occurs with acute sickle hepatic crisis.[125] »**CT abdomen/pelvis:** may show enlarged spleen or presence of gallstones; hepatic or renal infarction An alternative to abdominal ultrasound.	

◊ Endometriosis

History	Exam	1st Test	Other tests
dysmenorrhoea; cyclical lower abdominal/pelvic/back pain, often 1-2 weeks before menstruation and during menstruation; pain during bowel movements; dyspareunia; sub-fertility; urinary or bowel obstruction; depression	discomfort and uterosacral ligament nodularity during bimanual/rectovaginal examination; tenderness on palpation in lower abdomen; fixed retroverted uterus in late stages; pelvic mass (ovarian endometriomas)	»**transvaginal ultrasound:** may show ovarian endometrioma (homogeneous, low-level echoes) or evidence of deep pelvic endometriosis such as uterosacral ligament involvement (hypoechoic linear thickening) Confirmatory for endometriomas but criteria are less well defined for peritoneal fibrosis. Ultrasound examination is limited by retroverted uterus. May detect infiltrating bladder endometriosis.	»**diagnostic laparoscopy:** direct visualisation of endometrial implants and histological confirmation of biopsies Images:  *Endometriosis: Laparoscopic image of endometriotic nodule* *From the collection of Dr Jonathon Solnik; used with permission*

Common

◊ Endometriosis

History	Exam	1st Test	Other tests
			 *Endometriosis: Laparoscopic image of ovarian endometrioma* *From the collection of Dr Jonathon Solnik; used with permission* »**rectal endoscopic ultrasound:** hypoechoic nodule or mass Designed to assess for uterosacral, rectovaginal, and intestinal endometriosis. »**MRI pelvis:** hypointense, irregular thickening or mass of uterosacral ligament; replacement of fat tissue plane between uterus and rectum/ sigmoid with tissue mass Useful for imaging the entire abdomen and pelvis. Ovarian disease can be easily seen. Sensitivity and specificity for deep pelvic disease is approximately 90%, but is consistently lower for uterosacral ligament and higher

Common

◊ Endometriosis

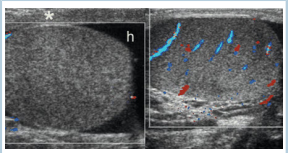
History	Exam	1st Test	Other tests
			for gastrointestinal disease.[126] »**pregnancy test:** negative Performed in women of childbearing age.

◊ Testicular torsion

History	Exam	1st Test	Other tests
history of previous on-off testicular pain; sudden-onset testicular pain with nausea and vomiting; scrotal oedema/swelling/ erythema; abdominal pain also often present	severe testicular pain and tenderness on affected side; may be swollen; affected testicle is located higher than the non-affected testicle, often in horizontal position; reduced or absent cremasteric reflex	»**surgical exploration of the scrotum:** testicular torsion A careful history and physical examination that is suspicious for testicular torsion may warrant immediate surgical exploration for repair without further delay by diagnostic testing, to optimise testicular salvageability. »**grey-scale ultrasound:** presence of fluid and the whirlpool sign (the swirling appearance of the spermatic cord from torsion as the	»**power Doppler ultrasound:** absent or decreased blood flow in the affected testicle; decreased flow velocity in the intratesticular arteries, increased resistive indices in the intratesticular arteries »**colour Doppler ultrasound:** absent or decreased blood flow in the affected testicle; decreased flow velocity in the intratesticular arteries, increased resistive indices in the intratesticular arteries Image:

Common

◊ Testicular torsion

History	Exam	1st Test	Other tests
		ultrasound probe scans downwards perpendicular to the spermatic cord) »**FBC:** normal If abnormal with WBC count elevated, usually suggests alternate diagnosis (e.g., epididymitis or orchitis).	 *Testicular torsion: Bilateral transverse color Doppler images in a 12-year-old boy with right-sided scrotal pain of sudden onset, showing no colour flow signals in the right testis, which is enlarged and has heterogeneous echogenicity; reactive hydrocele (h) and thickening of the scrotal wall (*) are also seen; testicular torsion and bell clapper deformity were confirmed at surgery* *Aso C, et al. Radiographics. 2005 Sep-Oct;25(5):1197-214; used with permission* »**spectral Doppler:** non-homogeneous and/or asymmetric vascular perfusion compared with the unaffected testis »**scintigraphy:** decreased uptake of radioactive technetium-99m to the affected testicle in

Common

◊ Testicular torsion

History	Exam	1st Test	Other tests
			patients with testicular torsion Scintigraphy has almost 100% sensitivity for identifying patients with torsion.[127] However, scintigraphy takes longer and is less readily available than Doppler ultrasound.

◊ Kidney stones

History	Exam	1st Test	Other tests
previous history of kidney stones; may be asymptomatic to severe abdominal flank pain radiating to the groin; other symptoms include nausea, vomiting, diaphoresis, haematuria; urinary frequency/urgency; occupations in hot conditions (e.g., chefs, steel workers); family history of stones	often obese; abdomen soft; when in pain, may be severe, unable to find comfortable position; tender to palpation/percussion of costovertebral angle/ flank; if urosepsis also present may be tachycardic, hypotensive, pyrexial	»**urinalysis:** dipstick positive for leukocytes, nitrates, blood; microscopic analysis positive for WBCs, red blood cells, or bacteria; may be normal Microhaematuria is seen in approximately 10% to 20% of patients with renal stones.[128] »**FBC:** normal or raised WBC count Raised WBC count may suggest infection (pyelonephritis or urinary tract infection). »**serum electrolytes, urea, and creatinine:** normal or deranged These include calcium, creatinine and urea, chloride, potassium, magnesium, phosphorus. Hypercalcaemia may suggest	»**renal ultrasound:** calcification seen within urinary tract »**retrograde urethrogram:** calcification seen within urinary tract or a filling defect seen »**intravenous pyelogram:** calcification seen within urinary tract or a filling defect seen when dye is passing through the kidney and down the ureter This test has for the most part been replaced by the CT scan for the evaluation and diagnosis of renal stones. »**pregnancy test:** negative Performed in women of childbearing age.

DIAGNOSIS

Common

◊ Kidney stones

History	Exam	1st Test	Other tests
		hyperparathyroidism as an underlying aetiology. »**uric acid level:** normal or elevated Hyperuricaemia may indicate gout. »**non-contrast helical CT abdomen/pelvis (stone protocol):** calcification seen in renal collecting system or ureter	

◊ Pyelonephritis

History	Exam	1st Test	Other tests
family history of kidney stones; history of urinary tract infection, stress incontinence, or frequent sexual intercourse; fever with chills; dysuria, frequency, urgency; flank pain; nausea, vomiting, diaphoresis, haematuria	pyrexia; flushed looking; flank pain and/or costovertebral angle tenderness on palpation/percussion	»**urinalysis:** pyuria (>10 WBCs per high-power field [HPF]), red blood cells ≥5/HPF, leukocyte esterase, nitrites, WBC casts, proteinuria up to 20 g/L (2 g/dL) »**Gram stain:** typically gram-negative rods; less typically gram-positive cocci »**urine culture:** positive »**FBC:** leukocytosis »**CRP:** elevated Non-specific result.	»**blood cultures:** may be positive If patient is septic or requires admission to hospital. »**CT abdomen/pelvis with intravenous contrast:** altered renal parenchymal perfusion; altered excretion of contrast; perinephric fluid; non-renal disease; may show abscess formation Generally undertaken if patient's clinical condition does not improve after 48 hours or deteriorates. It is both sensitive and specific and better than renal ultrasound and intravenous pyelogram. »**renal ultrasound:** gross structural abnormalities;

Common

◊ Pyelonephritis

History	Exam	1st Test	Other tests
			hydronephrosis; stones; perirenal fluid collections Ordered when CT is not suitable. »**99mTc-dimercaptosuccinic acid scintigraphy:** inflammation or scarring of the renal cortex; unequal distribution of renal function between the kidneys Ordered more often in children because the test involves less radiation than other imaging methods. Sensitivity and specificity are moderate to high. »**MRI:** structural anomalies of the genitourinary system (prenatal); renal inflammation or masses; abnormal renal vasculature; urinary obstruction Suitable alternative for patients who are allergic to iodinated dye. Clinical experience in patients with acute pyelonephritis is limited; also cost is high. Sensitivity is high, whereas specificity is moderate to high. »**pregnancy test:** negative

Common

◊ Pyelonephritis

History	Exam	1st Test	Other tests
			Performed in women of childbearing age.

Uncommon

Volvulus

History	Exam	1st Test	Other tests
steady abdominal pain that may have colicky characteristics varying from vague discomfort to excruciating (severe unremitting pain suggests gangrenous bowel); history of abdominal surgery, abdominal or inguinal hernia; nausea, vomiting, emesis may be absent in patients with sigmoid volvulus (more common in older or debilitated patients); periumbilical or hypogastric pain, diarrhoea or constipation (depending on the degree and location of the obstruction)	often diffuse abdominal distension and tenderness; faint or no bowel sounds, rigid abdomen, guarding, rebound tenderness, fever, or haematochezia	»**plain abdominal x-rays:** partial or complete obstruction; dilated bowel loops; air-fluid levels; abdominal free air with perforation Images of both flat (supine) and upright (erect) positions are taken. »**ABG:** may be normal; metabolic acidosis; elevated lactate Metabolic acidosis occurs in advanced obstruction.[64] Elevated lactate indicates reduced tissue perfusion. »**chest x-ray:** may see free air under the diaphragm Presence of free air necessitates urgent laparotomy for perforated viscus. »**FBC:** elevated WBC count Leukocytosis suggests intestinal ischaemia. »**serum electrolytes:** may be normal in	»**barium or water-soluble contrast enema:** bird's-beak sign of stricture at the site of the volvulus Diagnostic rate of nearly 90% in one series.[66] Not to be performed if diagnosis is strongly indicated from plain radiographs or there is evidence of bowel necrosis. »**CT of abdomen:** bowel obstruction with whirl pattern of mesentery[67] Usually not necessary to make diagnosis.

Uncommon

Volvulus

History	Exam	1st Test	Other tests
		early obstruction; may confirm hypochloraemia and hypokalaemia; urea and creatinine may be elevated Non-specific for diagnosis. Hypochloraemia and hypokalaemia can be associated with persistent obstruction associated with nausea and vomiting. May indicate degree of volume depletion that is secondary to the obstruction. »**CRP:** may be elevated	

Retroperitoneal haemorrhage

History	Exam	1st Test	Other tests
symptoms may be vague; groin, lower abdominal or back pain; history of risk factors (e.g., recent anticoagulation use, recent history of transfemoral catheterisation, recent obstetric procedure in women of childbearing age, malignancy, pelvic or spine fractures)	non-specific findings including unexplained tachycardia; diffuse abdominal, back, or lower quadrant abdominal pain, abdominal distension; may be bruising of flank; flank mass on palpation; diaphoresis if severe; profound hypotension with decreasing levels of consciousness if shock present	»**basic test panel (FBC, serum electrolytes, blood glucose, serum LFTs, coagulation profile, group and save):** low Hb; INR may be raised »**ECG:** normal, or tachycardia »**CT abdomen and pelvis:** haematoma may be visualised The American College of Radiology recommend that either CT of the abdomen and pelvis with IV contrast, CT of the abdomen	

Uncommon

Retroperitoneal haemorrhage

History	Exam	1st Test	Other tests
		and pelvis without and with IV contrast, or CTA of the abdomen and pelvis with IV contrast are usually appropriate for the initial imaging of clinically suspected retroperitoneal bleed in a patient.[68] »**abdominal and pelvic CT angiography:** may demonstrate active bleeding site if bleeding is ongoing The American College of Radiology recommend that either CT of the abdomen and pelvis with IV contrast, CT of the abdomen and pelvis without and with IV contrast, or CTA of the abdomen and pelvis with IV contrast are usually appropriate for the initial imaging of clinically suspected retroperitoneal bleed in a patient.[68]	

◊ Viral Hepatitis

History	Exam	1st Test	Other tests
perinatal exposure, family history of hepatitis B viral infection, blood transfusions, high-risk activities (e.g., multiple sexual partners, men who have sex with	right upper quadrant tenderness; hepatosplenomegaly; jaundice; ascites; maculopapular or urticarial rash	»**FBC:** elevated; non-specific »**LFTs:** elevated transaminases (alanine aminotransferase/ aspartate aminotransferase),	»**ultrasound right upper quadrant:** poorly defined margins and coarse, irregular internal echoes in hepatitis B »**prothrombin time:** prolonged

Uncommon

◊ Viral Hepatitis

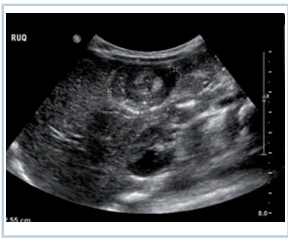
History	Exam	1st Test	Other tests
men, injection drug users, intravenous drug use); right upper quadrant pain; fever, chills, fatigue, myalgia/ arthralgia; nausea, vomiting; jaundice		alkaline phosphatase, and bilirubin »**serum electrolytes, urea, and creatinine:** usually normal Acute kidney injury can occur in severe infection. »**hepatitis serology and antigens:** positive Hepatitis A, B and D may cause an acute abdomen	Mild elevations of about 11-26 seconds are common in hepatitis A virus infection. »**pregnancy test:** negative Performed in women of childbearing age.

Intussusception

History	Exam	1st Test	Other tests
more common in children than in adults; classic presentation of severe, colicky pain alternating with lethargy; may also present with vague abdominal complaints; severe, cramp-like abdominal pain; children may be inconsolable; vomiting	occult or frank blood mixed with mucus giving currant-jelly appearance, abdominal tenderness, and palpable mass	»**ultrasound:** tubular mass in longitudinal view; target lesion in transverse view Sensitivity 98% to 100%. Specificity 88% to 100%. Negative predictive value 100%.[69] [70] The mass resulting from intussusception may be easily identified; the findings of intussusception by ultrasound closely mirror its pathophysiological process.	»**CT of abdomen and pelvis:** target lesion: intraluminal soft-tissue density mass with an eccentrically placed fatty area; reniform mass: high attenuation peripherally and lower attenuation centrally; sausage-shaped mass: alternating areas of low and high attenuation representing closely spaced bowel wall, mesenteric fat, and/or intestinal fluid and gas Normally not indicated for the evaluation of intussusception. May be used to assess for the presence and identification of a pathological lead point.[73]

Uncommon

Intussusception

History	Exam	1st Test	Other tests
		 *Intussusception: Ultrasound image showing invagination of a segment of bowel into the adjacent segment* *BMJ Case Reports 2009; doi:10.1136/ bcr.04.2009.1730*  *Intussusception: Transverse sonogram of the abdomen showing the donut sign (concentric rings within the lumen of a distended loop of bowel)* *Adapted from the Student BMJ. 2008;16:76* Can be used to monitor success of treatment with enema. »**air or water enema:** filling defect or cupping in the head of contrast as it advances	

Uncommon

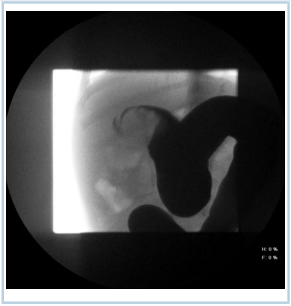
Intussusception

History	Exam	1st Test	Other tests
		to the site of the intussusception Air or hydrostatic enema can be used to reduce intussusception in 60% to 80% of childhood cases.[71] Preferred initial test for children. Contraindicated if peritonitis, shock, perforation, or an unstable clinical condition is present.[72]  *Intussusception: Abdominal x-ray showing impaired passage of barium at site of obstruction due to intussusception* *From the collection of Dr David J. Hackam*	

Uncommon

Intussusception

History	Exam	1st Test	Other tests



Intussusception: Site of intussusception as revealed by abdominal x-ray, showing the meniscus

From the collection of Dr David J. Hackam

Intussusception: Site of intussusception as revealed by abdominal x-ray, showing the meniscus

From the collection of Dr David J. Hackam

»**FBC:** elevated WBC count
Leukocytosis suggests intestinal ischaemia.

»**serum electrolytes:** may be normal in early obstruction; may

Uncommon

Intussusception

History	Exam	1st Test	Other tests
		confirm hypochloraemia and hypokalaemia; urea and creatinine may be elevated Non-specific for diagnosis. Hypochloraemia and hypokalaemia can be associated with persistent obstruction associated with nausea and vomiting. May indicate degree of volume depletion that is secondary to the obstruction. »**CRP:** may be elevated	

Perforated duodenal ulcer

History	Exam	1st Test	Other tests
acute onset of severe epigastric pain, nausea, vomiting, and loss of appetite; more common in men than women; history of melaena or bright red blood from rectum, episodic epigastric pain relieved by eating; use of non-steroidal anti-inflammatory drugs; may have latent period with symptom improvement that may last several hours, followed by peritonitis with fever, nausea, vomiting, and peritoneal signs; referred pain to	tachycardia, fever, epigastric tenderness, rigid abdomen, guarding, rebound tenderness, and occult or frank blood in stool	»**ABG:** may be normal; metabolic acidosis; elevated lactate Metabolic acidosis associated with increased mortality risk.[77] »**blood cultures:** may detect bacteraemia Ideally taken before administration of antibiotics, but should not delay antibiotic treatment.[77] »**FBC:** elevated WBC count	»**upper gastrointestinal series with water-soluble contrast:** extravasation of contrast from stomach or duodenum »**esophagogastroduodenoscopy with biopsy:** visualisation of ulcer; histological confirmation

Uncommon

Perforated duodenal ulcer

History	Exam	1st Test	Other tests
shoulders secondary to diaphragmatic irritation		Non-specific as leukocytosis is not present in all cases. »**serum electrolytes:** may show elevated creatinine and urea Acute kidney injury associated with increased mortality risk.[77] »**CRP:** usually elevated »**serum lipase or amylase:** normal Performed to exclude acute pancreatitis. Serum lipase levels remain elevated for longer (up to 14 days after symptom onset vs. 5 days for amylase), providing a higher likelihood of picking up a diagnosis of pancreatitis in patients with a delayed presentation.[36] »**CT of abdomen and pelvis:** pneumoperitoneum More sensitive than plain abdominal or chest radiographs and permits evaluation for other differential diagnoses.[77] »**plain abdominal x-rays:** abdominal free air on erect abdominal film Images of both flat (supine) and upright	

Uncommon

Perforated duodenal ulcer

History	Exam	1st Test	Other tests
		(erect) position are taken. Endoscopy is avoided when perforation is suspected because it could exacerbate perforation. »**chest x-ray:** may see free air under the diaphragm Presence of free air necessitates urgent laparotomy for perforated viscus. »**Helicobacter pylori testing:** positive result if *H pylori* present All patients with a perforated ulcer should be tested for *H pylori* .[78] Urea breath test is preferred. Stool antigen test also has high sensitivity and specificity. Serological tests should be locally validated, because they may perform differently depending on the antigenic composition of local strains.[79]	

◊ Ruptured ovarian cyst

History	Exam	1st Test	Other tests
often days 20 and 26 of a normal menstrual cycle; often follows	light vaginal bleeding; vital signs usually normal, but may be	»**transvaginal ultrasound:** enlarged ovary or portion of	

Uncommon

◊ Ruptured ovarian cyst

History	Exam	1st Test	Other tests
intercourse, exercise, or pelvic examination; sudden-onset lower abdominal pain, may be lateralised to left or right; light vaginal bleeding; postural dizziness if marked haemorrhage (associated with rupture of corpus luteum cyst, specifically among patients on anticoagulants or with bleeding disorders)	low-grade fever; may have tachycardia/ hypotension if severe bleeding in association with coagulopathy or anticoagulant use; signs of peritonitis if haemoperitoneum present	ovarian tissue; may be cystic, solid, or mixed; free pelvic fluid Interobserver agreement by skilled ultrasonographers is high. Results should characterise the size, consistency, location, and nodularity of any ovarian abnormality, determine whether it is unilateral or bilateral, and determine presence of free pelvic fluid. »**pregnancy test:** positive or negative It is important to establish pregnancy status in those of reproductive age. A positive pregnancy test may suggest a corpus luteum cyst or alternative diagnosis such as ectopic pregnancy.	

Ovarian torsion

History	Exam	1st Test	Other tests
sudden onset of unilateral pain, waxing and waning severe pelvic pain, and history of adnexal mass	severe, unilateral adnexal tenderness; adnexal mass that is often palpable and, in advanced cases, patient may develop rigid abdomen,	»**pregnancy test:** negative May be positive with concomitant pregnancy. Ectopic pregnancy may mimic presentation.	

Uncommon

Ovarian torsion

History	Exam	1st Test	Other tests
	guarding, and rebound tenderness	»**pelvic ultrasound with Doppler study:** no Doppler flow to affected ovary Doppler flow does not exclude torsion and does not preclude surgery if clinical suspicion is high.[84]	

Abdominal aortic dissection

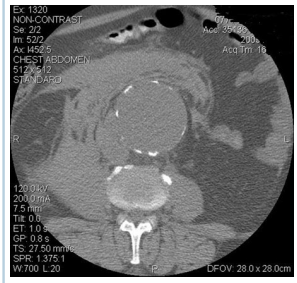
History	Exam	1st Test	Other tests
severe, sharp, or tearing pain in thorax or abdomen, pain radiates to neck or back, history of hypertension, increased risk in Marfan's syndrome and Ehlers-Danlos syndrome or other collagen vascular disorders, painless dissection is rare	hypertension in distal dissection; lower extremity pulse deficit, sensory or motor deficits (including numbness, tingling, or transient paraplegia); ischaemia and, if mesenteric arteries involved, bowel ischaemia with rigid abdomen, guarding and rebound tenderness	»**serum urea and electrolytes:** elevated urea Indicates compromised renal arteries.[85] »**plain abdominal x-rays:** aortic wall calcification consistent with abdominal aortic aneurysm; loss of psoas shadow in presence of rupture In some centres these findings in a patient with a suitable clinical picture of rupture are sufficient evidence to proceed to surgery. »**CT angiography of chest and abdomen:** two aortic lumina separated by intimal flap or displaying different rates of contrast opacification »**magnetic resonance angiography of chest and abdomen:** two aortic lumina	»**contrast aortography:** two aortic lumina separated by intimal flap; branch vessel involvement; aortic regurgitation More invasive than CT or magnetic resonance angiography. Used to obtain more anatomical detail for interventional planning.[86]

Uncommon

Abdominal aortic dissection

History	Exam	1st Test	Other tests
		separated by intimal flap; branch vessel involvement; aortic regurgitation Can be performed with and without intravenous contrast.[86] »**chest x-ray:** widened aortic silhouette; widened mediastinum Low sensitivity for aortic dissection.[86]	

Ruptured aortic aneurysm

History	Exam	1st Test	Other tests
severe abdominal pain radiating to back, flank, groin, or legs; patient unaffected by position; history of aneurysm, possible discoloration and pain in lower extremities due to ischaemia	tachycardia, hypotension, pulsatile abdominal mass, nausea, vomiting, lower extremity pulse deficit, lower extremity or back pain, loss of consciousness or confusion, limb numbness or tingling, ischaemia and livedo reticularis	»**abdominal ultrasound:** aortic aneurysm Can be done quickly at bedside. If suspicion of rupture, proceed to surgery.[87]	»**CT of chest and abdomen with intravenous contrast:** aortic aneurysm, extravasation of contrast Recommended only for clinically stable patients.  *Abdominal aortic aneurysm: CT scan of a ruptured abdominal aortic aneurysm* *University of Michigan, specifically the cases of Dr*

Uncommon

Ruptured aortic aneurysm

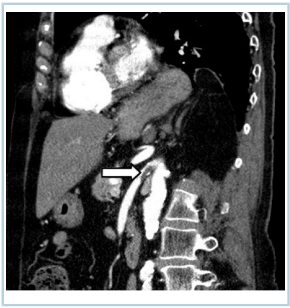
History	Exam	1st Test	Other tests
			Upchurch reflecting the Departments of Vascular Surgery and Radiology

Acute mesenteric ischaemia (AMI) and infarction

History	Exam	1st Test	Other tests
age >50 years; constant periumbilical non-radiating abdominal pain; recent history of post-prandial abdominal pain; history of atrial fibrillation, coronary artery disease, myocardial infarction, and congestive heart failure; melaena or bright red blood from rectum, and patient taking vaso-active medicines; risk factors include smoking, hypertension, hyperlipidaemia, and diabetes	initially, pain out of proportion to examination findings with soft, non-tender abdomen despite severe abdominal pain, followed by rigid abdomen, guarding, and rebound tenderness with bowel necrosis and perforation, and, in advanced cases, fever, tachycardia, and hypotension will be present	»**CT of abdomen:** vessel thrombosis; thickened bowel wall; abnormal bowel wall enhancement; pneumatosis; portal or mesenteric venous gas If the use of contrast material is possible, biphasic contrast material-enhanced multi-detector CT is the imaging test of choice for early diagnosis of the disease and for differentiation from other causes of acute abdomen. The diagnostic performance for detection of AMI using multi-detector CT is reported to be high, with a sensitivity of 64%-96% and a specificity of 92%-100%.[88] [89] If abnormal, proceed to angiography or laparotomy.	»**mesenteric angiography:** arterial or venous obstruction Definitive test. Sensitivity of 90% and specificity is nearly 100%.[92]

Uncommon

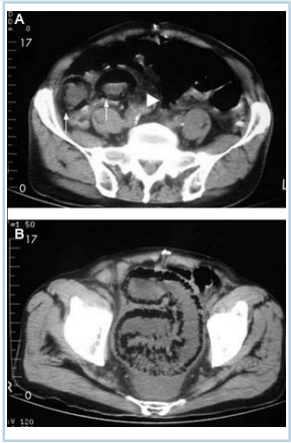
Acute mesenteric ischaemia (AMI) and infarction

History	Exam	1st Test	Other tests
		 *Ischaemic bowel disease: CT scan showing colonic thickening with pneumatosis intestinalis* *From the collection of Dr Jennifer Holder-Murray and Dr Alessandro Fichera*  *Ischaemic bowel disease: CT angiogram: acute superior mesenteric artery thrombus* *From the collection of Dr Jennifer Holder-Murray and Dr Alessandro Fichera*	

DIAGNOSIS

Uncommon

Acute mesenteric ischaemia (AMI) and infarction

History	Exam	1st Test	Other tests
			

Ischaemic bowel disease: 84-year-old man presenting with symptoms suggestive of ischaemic bowel disease: (A) Abdominal CT revealing a massive circumferential and band-like air formation as intestinal pneumatosis (arrows) and pronounced edema of mesenteric fat (arrowhead) around necrotic bowel loops; (B) Another slice of abdominal CT showing long segmental pneumatosis of the small bowel
Lin I, Chang W, Shih S, et al. Bedside echogram in ischaemic bowel. BMJ Case Reports. 2009:bcr.2007.053462

DIAGNOSIS

Uncommon

Acute mesenteric ischaemia (AMI) and infarction

History	Exam	1st Test	Other tests
		»**plain abdominal x-rays:** may see dilated loops of bowel; air-fluid level; bowel wall thickening; formless loops of large or small bowel; pneumatosis; vascular gas Images of both flat (supine) and upright (erect) position are taken. Often normal in early AMI. Useful to rule out other causes of acute abdomen. »**chest x-ray:** may see free air under the diaphragm Presence of free air necessitates urgent laparotomy for perforated viscus. »**FBC:** elevated WBC count WBC count may be >15.0 × 10^9/L (>15,000 cells/microL). More than 90% of patients have leukocytosis.[90] Normal WBC count does not exclude diagnosis. »**serum lactate:** elevated Elevation varies with institution (dependent	

Uncommon

Acute mesenteric ischaemia (AMI) and infarction

History	Exam	1st Test	Other tests
		on institutional normal values).[91] »**ABG:** metabolic acidosis »**serum electrolytes:** uraemia, elevated creatinine	

Myocardial infarction

History	Exam	1st Test	Other tests
epigastric pain, diaphoresis, shortness of breath, nausea, vomiting; may be risk factors such as atherosclerosis, diabetes, smoking, hypertension, obesity, dyslipidaemia; atypical symptoms more common in women, older people, and those with diabetes	often normal; may be tachycardia, bradycardia, hypotension, third and fourth heart sound, paradoxical splitting of second heart sound	»**ECG:** ST-T wave changes or ischaemic changes »**cardiac troponins:** >99th percentile of normal	

Meckel's diverticulitis

History	Exam	1st Test	Other tests
sudden-onset severe abdominal pain, often starts periumbilical with migration to right lower quadrant; nausea, vomiting, anorexia, fever, diarrhoea	fever, tachycardia, patient may be lying in right lateral decubitus position with hips flexed; no or decreased bowel sounds; pain commonly originates near the umbilicus or the epigastrium; right lower quadrant (McBurney's point) tenderness with rigid abdomen; guarding and rebound tenderness; psoas sign (right lower	»**FBC:** low haemoglobin and haematocrit; leukocytosis with left shift »**technetium-99m pertechnetate scan ('Meckel scan'):** ectopic focus or 'hot spot'; enhancement of diverticulum	»**plain abdominal radiography:** dilated bowel loops with air-fluid levels and paucity of distal gas suggests bowel obstruction; free air on upright film suggests a perforation; a density in the right side of the abdomen suggests an intussusception »**CT scan of the abdomen and pelvis:** blind-ending fluid-filled and/or gas-filled

Uncommon

Meckel's diverticulitis

History	Exam	1st Test	Other tests
	quadrant pain with right thigh extension)		structure in continuity with distal ileum »**ultrasound of the abdomen:** tubular mass in longitudinal views and a doughnut or target appearance in transverse views suggests intussusception

◊ Hepatic abscess

History	Exam	1st Test	Other tests
biliary tract abnormalities; age >50 years; malignancy; diabetes mellitus; history of interventional biliary or hepatic procedures; travel to endemic area for amoebiasis; right upper quadrant pain, fever, chills, anorexia, and malaise; nausea and vomiting; cough, shortness of breath, may have had recent episode of gastrointestinal disease or biliary disease such as appendicitis, diverticulitis, or cholangitis	fever; hepatomegaly; weight loss; shortness of breath; jaundice; pleural effusion right lower zone; signs of shock with severe disease; rarely ascites	»**FBC:** leukocytosis, elevated neutrophil count, anaemia »**LFTs:** elevated alkaline phosphatase, mildly elevated aminotransferases and bilirubin, hypoalbuminaemia »**blood culture:** pyogenic: may be positive for causative bacterial organism; fungal: may be positive for *Candida* species »**prothrombin time and activated partial thromboplastin time:** usually normal »**CRP:** may be elevated »**chest x-ray:** in presence of pleural effusion: blunting of the costophrenic angles »**liver ultrasound:** demonstrates a variably echoic lesion »**contrast-enhanced abdominal CT scan:** demonstrates hypodense liver	»**pregnancy test:** negative Performed in women of childbearing age.

Uncommon

◊ Hepatic abscess

History	Exam	1st Test	Other tests
		lesions; gas within the lesion is highly suggestive of a pyogenic abscess Can provide information of extent of abscess and likely pathology.  *Liver abscess: CT scan showing a liver abscess (7 cm x 5 cm) in a 46-year-old man who presented with fever, fatigue, and cough* *From the collection of Massachusetts General Hospital radiology images*	

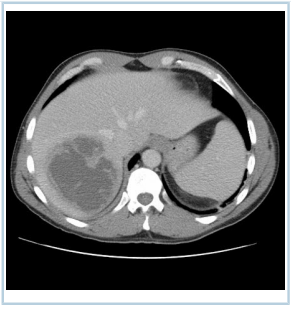
Uncommon

◊ Hepatic abscess

History	Exam	1st Test	Other tests
		 *Liver abscess: CT scan showing 8 cm by 8 cm superinfected and ruptured echinococcal cyst, and a 4 cm by 4 cm echinococcal cyst in a 69-year-old man who presented with hypotension and chest pain radiating to the epigastric region* *From the collection of MGH Massachusetts General Hospital radiology images*	

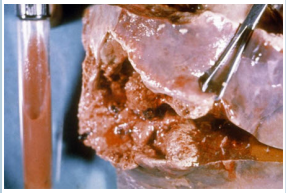
Uncommon

◊ Hepatic abscess

History	Exam	1st Test	Other tests
		 *Liver abscess: CT scan (coronal view) showing liver abscess in a 46-year-old man who presented with fever, fatigue, and cough* *From the collection of Massachusetts General Hospital radiology images*  *Liver abscess: A non-contrast abdominal CT scan showing a huge gas-containing liver abscess (arrow)* *Adapted from BMJ Case Reports 2009 (doi:10.1136/bcr.08.2008.0638)*	

Uncommon

◊ Hepatic abscess

History	Exam	1st Test	Other tests
		 *Liver abscess: Gross pathology of amoebic abscess of liver; tube of 'chocolate' pus from abscess* *CDC; Dr. Mae Melvin; Dr E. West of Mobile, AL* »**stool Entamoeba histolytica antigen detection test:** positive in amoebiasis »**Gram stain and culture of aspirated abscess fluid:** pyogenic: positive for causative bacterial organism; fungal: may be positive for *Candida* species »**polymerase chain reaction (PCR) or real-time quantitative PCR of aspirated abscess fluid:** amplification of amoebic DNA	

◊ Psoas abscess

History	Exam	1st Test	Other tests
fever, chills, nausea, vomiting, flank or low abdominal/groin pain, malaise; new-onset limp	mild pyrexia, rigors, flank or abdominal tenderness; hip flexion deformity; pain with active hip flexion and passive extension	»**FBC:** elevated WBC count »**CRP:** elevated »**CT abdomen/pelvis with intravenous**	»**ultrasound abdomen/pelvis:** visualisation of abscess »**MRI abdomen/pelvis:** visualisation of abscess

Uncommon

◊ Psoas abscess

History	Exam	1st Test	Other tests
		contrast: visualisation of abscess	»**aspiration of abscess, Gram stain and culture:** may culture causative organism

◊ Tuberculosis

History	Exam	1st Test	Other tests
male, black or Hispanic ethnicity; diffuse abdominal pain, right lower quadrant pain	fever, cachexia, abdominal swelling, abdominal mass, hepatosplenomegaly, lymphadenopathy	»**chest x-ray:** consolidation, pulmonary infiltrates, mediastinal or hilar lymphadenopathy, upper zone fibrosis Evidence of unrecognised pulmonary TB or evidence of old healed TB (e.g., upper lobe fibrosis) may be present; such abnormalities should prompt sputum collection for smear, culture, and nucleic acid amplification testing. »**sputum acid-fast bacilli smear and culture:** presence of acid-fast bacilli (Ziehl-Neelsen stain) in specimen Testing of 3 specimens (minimum 8 hours apart, including an early morning specimen) is recommended in many countries; consult local guidance.[113]	»**lateral flow urine lipoarabinomannan (LF-LAM) assay:** positive One Cochrane review found the lateral flow urine lipoarabinomannan (LF-LAM) assay to have a sensitivity of 42% in diagnosing TB in HIV-positive individuals with TB symptoms, and 35% in HIV-positive individuals not assessed for TB symptoms.[120] WHO recommends that LF-LAM can be used to assist in the diagnosis of active TB in HIV-positive adults, adolescents, and children with signs and symptoms of TB, or in those with advanced HIV or who are seriously ill.[119] Culture would still be required for drug susceptibility testing (DST).

Uncommon

◊ Tuberculosis

History	Exam	1st Test	Other tests
		Sputum specimen should be tested in patients with suspected extrapulmonary TB, as active pulmonary TB is seen in 15% to 20% of patients with extrapulmonary TB.[114] [115] [116] Culture of Mycobacterium tuberculosis typically takes several weeks (up to 8), decisions on treatment are usually made before culture results are known. »**acid-fast bacilli smear and culture of extrapulmonary biopsy specimen:** positive Microscopy should be performed on specimens collected from sites of suspected extrapulmonary TB.[113] [117] Patients in whom urogenital-TB is suspected should have three early morning urines on consecutive days sent for AFB microscopy and culture.[118] Culture result may take several weeks. »**nucleic acid amplification tests**	

Uncommon

◊ Tuberculosis

History	Exam	1st Test	Other tests
		(NAAT): positive for *M tuberculosis* Although NAATs were originally designed and approved for respiratory specimens, they may also be requested on specimens from other sites where involvement of TB is suspected (e.g., cerebrospinal fluid, lymph node aspirate, lymph node biopsy, pleural fluid, peritoneal fluid, pericardial fluid, synovial fluid or urine). [113] [119] In the US, use of NAATs for extrapulmonary specimens is not approved by the Food and Drug Administration, and use would be off-label. Several rapid NAATs are available for the diagnosis of TB and some are also able to detect genes encoding resistance to TB drugs.[119]	

Oesophageal perforation (Boerhaave's syndrome)

History	Exam	1st Test	Other tests
history of vomiting followed by chest	mediastinal crunching sound on auscultation;	»**FBC:** elevated WBC count	»**contrast oesophagram:**

Uncommon

Oesophageal perforation (Boerhaave's syndrome)

History	Exam	1st Test	Other tests
pain; recent oesophagogastroduodenoscopy or chest/neck trauma; neck, chest, epigastric, or upper back pain; dysphagia; respiratory distress; fever, tachycardia	subcutaneous emphysema of neck or chest; decreased breath sounds (usually on left side); tachypnoea and respiratory distress	»**erect chest x-ray:** may show pneumomediastinum, subcutaneous emphysema, pleural effusions typically located left side	visualisation of perforation Initially performed with oral water soluble contrast. If negative and oesophageal perforation is still suspected, plan for barium study. Although barium has better sensitivity, it can cause mediastinitis if it leaks into mediastinum, so water soluble contrast is recommended first. »**CT chest with oral and intravenous contrast:** visualisation of perforation Used if oesophagram not available or possible. »**upper gastrointestinal endoscopy:** visualisation of perforation

◊ Fitz-Hugh Curtis syndrome

History	Exam	1st Test	Other tests
female with history of pelvic inflammatory disease; severe right upper quadrant abdominal pain, possibly referred to right shoulder and worse on coughing, sneezing, or movement; fever, chills; headaches; malaise; hiccups; night	right upper quadrant pain and tenderness on palpation; lower abdominal tenderness, cervical excitation pain, tender adnexa	»**ultrasound right upper quadrant:** no gallstones »**CT abdomen/ pelvis with oral and intravenous contrast:** may show enhancement of liver capsule »**nucleic acid amplification test or culture of vaginal**	»**diagnostic laparoscopy with lysis of adhesions and peritoneal cultures:** may see peritonitis of liver surface and adjacent peritoneal surface; lysis of adhesions may provide relief of chronic symptoms; may culture

Uncommon

◊ Fitz-Hugh Curtis syndrome

History	Exam	1st Test	Other tests
sweats, nausea, and vomiting		**secretions:** may culture *Neisseria gonorrhoeae* or *Chlamydia trachomatis*	*N gonorrhoeae* or *C trachomatis* »**pregnancy test:** negative Performed in women of childbearing age.

Ischaemic colitis

History	Exam	1st Test	Other tests
fever, vomiting, diarrhoea, abdominal pain, and bloody stools; history of vascular disease, recent abdominal aortic aneurysm repair, sepsis, myocardial infarct, or atrial fibrillation	diffuse abdominal pain or localised to area of colon affected with little or no distension	»**FBC:** elevated WBC count »**serum lactate:** elevated if tissue hypoxia »**CT abdomen/ pelvis with oral and intravenous contrast:** may show thickened and inflamed segments of colon; pneumatosis or gas in mesenteric veins suggestive of ischaemia »**colonoscopy:** pale or bluish mucosa with haemorrhagic lesions	»**obstruction series:** pneumatosis or gas in mesenteric or portal vein but not specific to ischaemic colitis »**MRI abdomen with contrast:** may show thickened and inflamed segments of colon; pneumatosis or gas in mesenteric veins suggestive of ischaemia »**diagnostic laparoscopy:** full thickness ischaemia may be seen; ischaemia restricted to mucosa will not be seen

Ruptured splenic artery aneurysm

History	Exam	1st Test	Other tests
females and pregnant women; acute abdominal pain, may start in epigastrium or left upper quadrant and become diffuse; occasionally presents as gastrointestinal haemorrhage;	hypovolaemic shock; pallor; abdominal distension and tenderness	»**CT abdomen/pelvis with intravenous contrast:** visualisation of aneurysm and haemorrhage Only undertaken if patient is haemodynamically stable and diagnosis	

Uncommon

Ruptured splenic artery aneurysm

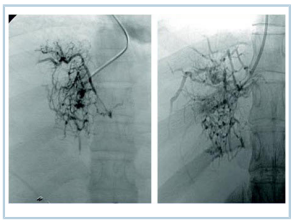
History	Exam	1st Test	Other tests
dizziness, weakness, collapse		unclear. If patient is unstable, operative exploration is recommended. Endovascular approaches can be used if the centre is well established and able to provide haemodynamic resuscitation and monitoring.	

Budd-Chiari syndrome

History	Exam	1st Test	Other tests
female, age in third or fourth decade of life; use of oral contraceptive, pregnancy, and immediate postpartum period; history of myeloproliferative disorder and/or hypercoagulable states; right upper quadrant pain, history of liver failure/cirrhosis, variceal bleeding, ascites	right upper quadrant pain and tenderness; hepatosplenomegaly; jaundice; muscle wasting; ascites; leg oedema; truncal venous collaterals; disturbances of consciousness, intellectual function, behaviour, and neuromuscular function (hepatic encephalopathy)	»**colour-flow Doppler ultrasound:** alterations in hepatic and/or caval veins in the form of thrombosis, stenosis, fibrotic cord, or insufficient recanalisation of the vessels 89% sensitivity, 68% specificity.[121]	»**MRI with pulsed sequencing:** thrombus, compression, and/or stenosis along the whole length of the inferior vena cava (IVC) or hepatic veins; necrosis and focal nodular hyperplasia in liver parenchyma; detect other lesions 93% sensitivity, 55% specificity.[121] »**CT abdomen/pelvis with triple-phase contrast:** occlusion of hepatic veins and/or IVC; areas with necrotic liver parenchyma; detect other lesions »**hepatic venography:** spider web pattern Definitive investigation, but invasive so performed only if

Uncommon

Budd-Chiari syndrome

History	Exam	1st Test	Other tests
			non-invasive studies negative and still clinically suspicious Budd-Chiari syndrome.  *Budd-Chiari syndrome: Hepatic venogram demonstrating 'spider web' and thrombus in the inferior vena cava* *Liver Transplantation Journal. 2006 Nov;12(11 suppl 2):S21-2; reprinted with permission of John Wiley & Sons, Inc*

Splenic infarct

History	Exam	1st Test	Other tests
ranges from asymptomatic to left upper quadrant pain, nausea, vomiting, fever, chills; may have pleuritic chest pain or left shoulder pain	tender left upper quadrant	»**CT abdomen/pelvis with intravenous contrast:** visualisation of infarct	»**MRI abdomen/ pelvis intravenous gadolinium contrast:** visualisation of infarct

◊ Abdominal wall haematoma

History	Exam	1st Test	Other tests
spontaneous or secondary to trauma, exercise, coughing,	signs of hypovolaemia with hypotension and tachycardia; localised	»**ultrasound abdominal wall:** haematoma visualised	»**CT abdomen/pelvis with intravenous**

Uncommon

◊ Abdominal wall haematoma

History	Exam	1st Test	Other tests
or procedure; acute abdominal pain with fever, nausea, vomiting; may report a mass or lump	abdominal pain and tenderness with non-pulsatile mass that is firm and painful; no mass may be palpable depending on location and depth of haematoma	Sensitivity 80% to 90%.[122]	**contrast:** haematoma visualised 100% sensitivity and specificity, can be helpful in ruling out other causes of abdominal pain/ mass.[122] »**FBC:** normal or low haemoglobin »**coagulation studies:** normal or deranged

◊ Uraemia

History	Exam	1st Test	Other tests
confusion, depressed mental status; oliguria; tachycardia; pallor; fatigue; diffuse abdominal pain; thirst; excessive urination at night	diffuse abdominal pain, poor skin turgor, low blood pressure	»**creatinine clearance:** reduced, usually <10 mL/min »**glomerular filtration rate:** reduced »**serum electrolytes:** abnormal »**urinalysis:** abnormal	»**CT abdomen/ pelvis with oral and intravenous contrast:** may reveal alternative cause for acute abdomen

◊ Addisonian crisis

History	Exam	1st Test	Other tests
weight loss, nausea, vomiting, abdominal pain, anorexia, salt craving, fatigue, postural dizziness, syncope, confusion	cutaneous and mucosal hyperpigmentation, hypotension, pyrexia, and abdominal pain and/or guarding	»**random cortisol level:** decreased »**rapid adrenocorticotropic hormone (ACTH) stimulation test:** limited increase in cortisol levels in response to ACTH stimulation »**CT abdomen/ pelvis with oral**	

Uncommon

◊ Addisonian crisis

History	Exam	1st Test	Other tests
		and intravenous contrast: may show bilateral enlargement of adrenal glands, adrenal haemorrhage, infiltrating diseases, or atrophic glands; may rule out other causes of abdominal pain and hypotension »**serum electrolytes:** often abnormal, typically with hypercalcaemia, hyponatremia, and hyperkalaemia	

◊ Hypercalcaemia

History	Exam	1st Test	Other tests
bone pain; depression; fatigue; confusion; nausea, anorexia; constipation; abdominal or flank pain; polyuria, polydipsia	non-specific findings; abdominal pain, hyperreflexia, tongue fasciculations, bony tenderness on palpation; hypertension and bradycardia	»**corrected or ionised calcium:** elevated »**12-lead ECG:** typically short QT interval and widened T waves »**serum parathyroid hormone:** elevated	»**ultrasound neck:** may indicate hyperparathyroidism »**nuclear scan neck:** may indicate hyperparathyroidism »**MRI neck:** may indicate hyperparathyroidism »**CT abdomen/ pelvis with oral and intravenous contrast:** may indicate alternative source of acute abdomen

◊ Acute intermittent porphyria (AIP)

History	Exam	1st Test	Other tests
family history of acute porphyria, female sex predominates, nutritional alterations (e.g., fasting, dieting), intercurrent illness,	epigastric pain, tenderness, distension; fever, tachycardia, and hypertension; dark or red urine; central nervous system signs	»**urinary porphobilinogen (PBG):** elevated; reddish colour Presence of PBG can be confirmed in	»**obstruction series:** may show ileus »**CT abdomen/ pelvis with oral and intravenous contrast:** may indicate

Uncommon

◊ Acute intermittent porphyria (AIP)

History	Exam	1st Test	Other tests
and exposure to drugs or hormones known to provoke attacks of AIP; intermittent acute severe abdominal pain for days with symptoms out of proportion to the physical examination, often epigastric and colicky; nausea, vomiting; psychiatric symptoms (minor behavioural changes and insomnia to depression, agitation, and confusion); weakness in lower limbs; constipation; urinary hesitancy and dysuria	such as seizures, mental status changes, cortical blindness, and coma; weakness starting in lower limbs and ascending	a single-void urine specimen using a PBG test kit. If not elevated then AIP is eliminated from differential diagnosis.	alternative source of acute abdomen

◊ Familial Mediterranean fever

History	Exam	1st Test	Other tests
mainly people of Mediterranean ancestry, especially from Arabian countries, Turkey, and Armenia; age <20 years; male sex; positive family history; episodic acute fever and pain in various places, the abdomen being the most common; pain can also occur in chest, joints, muscles, and skin; altered bowel habit (usually constipation)	fever, tachypnoea, acute abdominal pain with rigidity, rebound tenderness	»**FBC:** leukocytosis ± thrombocytosis »**erythrocyte sedimentation rate:** elevated »**CRP:** elevated »**serum fibrinogen:** elevated »**LFTs:** rarely: elevated alanine aminotransferase and aspartate aminotransferase »**urinalysis:** proteinuria; haematuria suggests infection or vasculitis »**CT abdomen:** serositis; may show fluid and/or inflammation	»**genetic testing:** positive for mutation »**pregnancy test:** negative Performed in women of childbearing age.

Uncommon

Typhlitis (neutropenic enterocolitis)

History	Exam	1st Test	Other tests
history of haematological malignancy and/or receiving chemotherapy or other immunosuppressive medicines; fever, abdominal pain, particularly right lower quadrant; nausea, vomiting, diarrhoea (sometimes bloody)	pyrexia; hypovolaemia from dehydration; marked abdominal pain and tenderness; may have septic shock; peritonitis	»**CT abdomen/pelvis with oral and intravenous contrast:** dilated/distended caecum with thickening and inflammation; may show pneumatosis, localised perforation, phlegmon, or abscess formation Preferred imaging modality due to low false-negative rate compared with ultrasound or obstruction series. »**absolute neutrophil count:** neutropenia »**blood cultures:** may culture infective organism »**stool culture (including Clostridium difficile toxin):** may culture infective organism	»**ultrasound abdomen:** may show distended caecum; free fluid »**obstruction series:** usually non-specific; may show distended caecum and thumbprinting or pneumatosis »**diagnostic laparoscopy:** direct visualisation of pathology Only if diagnosis is unclear following other investigations. »**pregnancy test:** negative Performed in women of childbearing age.

◊ Radiation enteritis

History	Exam	1st Test	Other tests
history of radiation treatment in recent or distant past; acute radiation enteritis produces nausea, vomiting, abdominal pain, diarrhoea, anorexia, diarrhoea/watery stools; chronic radiation enteritis produces obstructive symptoms (distention, nausea, vomiting, reduced flatus) if	abdominal pain and tenderness without distension in acute enteritis; passage of blood or mucus per rectum; obstructive findings include distension with tenderness and guarding, tympanism, tinkling bowel sounds, dehydration; abdominal bloating, mild abdominal tenderness;	»**CT abdomen/pelvis with oral and intravenous contrast:** thickening and inflammation of bowel segments affected	»**upper gastrointestinal series with small bowel follow-through:** shows extent of radiation injury; stricturing of bowel; fistula formation; thickening of bowel wall »**enteroclysis:** shows extent of radiation injury; stricturing of bowel; fistula formation; thickening of bowel wall

Uncommon

◊ Radiation enteritis

History	Exam	1st Test	Other tests
stricturing has occurred or malabsorptive symptoms (bloating, cramping, flatus, bulky stools, diarrhoea, weight loss) if mucosal integrity has been damaged; gastrointestinal bleeding if intestinal ulceration has occurred	steatorrhoea, weight loss with malabsorption		More sensitive and detailed than upper gastrointestinal series, but more uncomfortable due to placement of nasoenteric tube for contrast instillation. »**endoscopy:** shows mucosal integrity Care required to prevent iatrogenic perforation/injury to inflamed tissues.

◊ Heavy metal poisoning

History	Exam	1st Test	Other tests
medical/environmental/ occupational history consistent with exposure; nausea, persistent vomiting, diarrhoea, abdominal pain	anaemia, dehydration, neurological findings, abdominal pain and tenderness; encephalopathy, cardiomyopathy, dysrhythmias, acute tubular necrosis, and metabolic acidosis	»**FBC with blood smear:** haematocrit and haemoglobin values reduced; smear either normochromic and normocytic or hypochromic and microcytic »**serum electrolytes and urea:** may be normal or deranged »**LFTs:** normal or elevated »**urinalysis:** presence of heavy metal at elevated levels »**venous blood lead level:** elevated in lead exposure	

Uncommon

◊ Spider bite

History	Exam	1st Test	Other tests
possible spider bite (e.g., black widow spider); fever, chills, nausea, vomiting, and severe, acute diffuse abdominal pain	diffuse abdominal pain and tenderness; abdominal muscle rigidity; profuse sweating; tachycardia	»**clinical diagnosis:** diagnosis is based on history and examination	

Guidelines

United Kingdom

Ectopic pregnancy and miscarriage: diagnosis and initial management (https://www.nice.org.uk/guidance/NG126)

Published by: National Institute of Health and Care Excellence
Last published: 2023

Europe

Diverticular disease: diagnosis and management (https://www.nice.org.uk/guidance/ng147)

Published by: National Institute for Health and Care Excellence
Last published: 2019

Guideline for the diagnostic pathway in patients with acute abdominal pain (https://www.karger.com/Article/FullText/371583)

Published by: Association of Surgeons of the Netherlands
Last published: 2015

Guidelines of diagnostics and treatment of acute left-sided colonic diverticulitis (https://www.karger.com/Article/FullText/354035)

Published by: Netherlands Society of Surgery; Netherlands Societies of Internal Medicine, Gastroenterologists, Radiology, Health Technology Assessment and Dieticians
Last published: 2013

North America

2024 clinical practice guideline update by the Infectious Diseases Society of America on complicated intra-abdominal infections: risk assessment, diagnostic imaging, and microbiological evaluation in adults, children, and pregnant people (https://www.idsociety.org/practice-guideline/practice-guidelines/#/+/0/date_na_dt/desc)

Published by: Infectious Diseases Society of America
Last published: 2024

North America

SAGES guideline for the diagnosis and treatment of appendicitis (https://www.sages.org/publications/guidelines)

Published by: Society of American Gastrointestinal and Endoscopic Surgeons
Last published: 2024

ACR appropriateness criteria: left lower quadrant pain (https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria)

Published by: American College of Radiology
Last published: 2023

Diagnosis and management of acute left-sided colonic diverticulitis: a clinical guideline from the American College of Physicians (https://www.acponline.org/clinical-information/guidelines)

Published by: American College of Physicians
Last published: 2022

ACR appropriateness criteria: right lower quadrant pain (https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria)

Published by: American College of Radiology
Last published: 2022

ACR appropriateness criteria: right upper quadrant pain (https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria)

Published by: American College of Radiology
Last published: 2022

ACR appropriateness criteria: acute nonlocalized abdominal pain (https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria)

Published by: American College of Radiology
Last published: 2018

ACOG practice bulletin: tubal ectopic pregnancy (https://www.acog.org/clinical/clinical-guidance/practice-bulletin)

Published by: American College of Obstetricians and Gynecologists
Last published: 2018 (reaffirmed 2022)

North America

Ultrasound in pregnancy (https://www.acog.org/clinical/clinical-guidance/practice-bulletin)

Published by: American College of Obstetricians and Gynecologists
Last published: 2016 (reaffirmed 2022)

Asia

Practice guidelines for primary care of acute abdomen 2015 (https://onlinelibrary.wiley.com/doi/pdf/10.1002/jhbp.303)

Published by: Japanese Society for Abdominal Emergency Medicine
Last published: 2016

Key articles

- American College of Radiology. ACR Appropriateness Criteria: acute nonlocalized abdominal pain. 2018 [internet publication]. Full text (https://acsearch.acr.org/docs/69467/Narrative) Abstract
- American College of Radiology. ACR Appropriateness Criteria: right lower quadrant pain. 2022 [internet publication]. Full text (https://acsearch.acr.org/docs/69357/Narrative) Abstract
- American College of Radiology. ACR Appropriateness Criteria: left lower quadrant pain. 2023 [internet publication]. Full text (https://acsearch.acr.org/docs/69356/Narrative?_ga=2.121442568.1438736546.1681892229-1248040660.1583244817&_gl=1*jl1hrl*_ga*MTI0ODA0MDY2MC4xNT
- American College of Radiology. ACR Appropriateness Criteria: right upper quadrant pain. 2022 [internet publication]. Full text (https://acsearch.acr.org/docs/69474/Narrative)

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Images

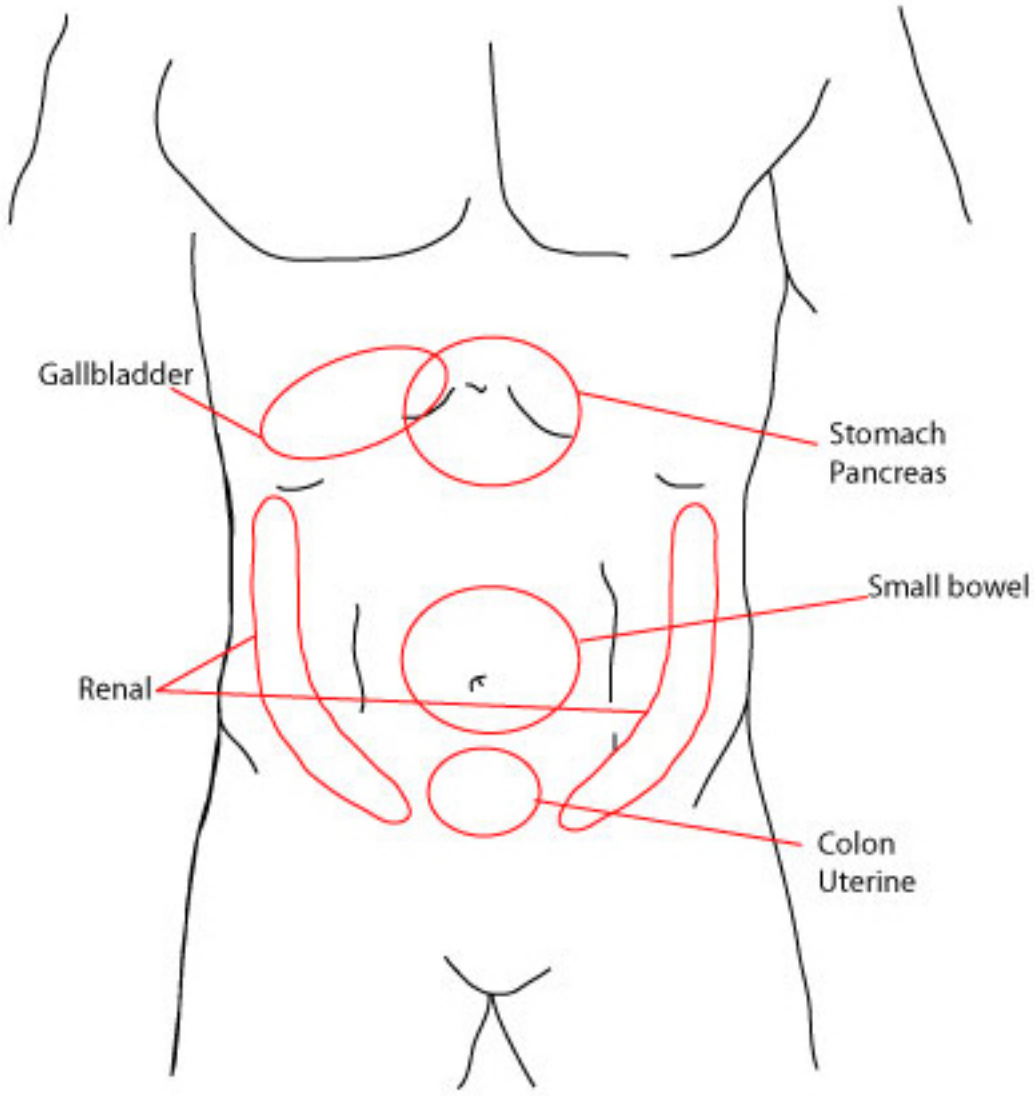

Figure 1: Common locations of visceral pain

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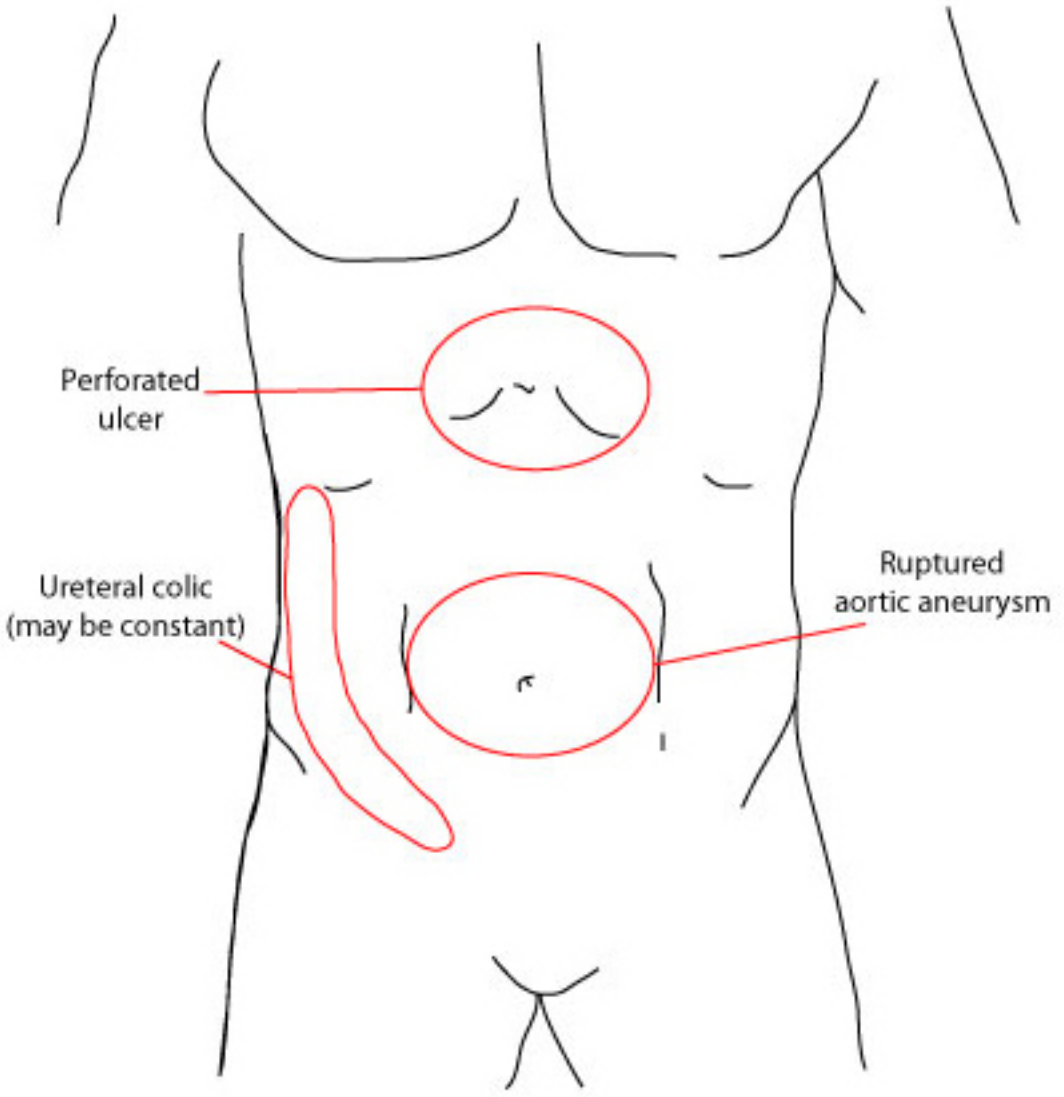

Figure 2: Areas of pain that present suddenly and severe in onset

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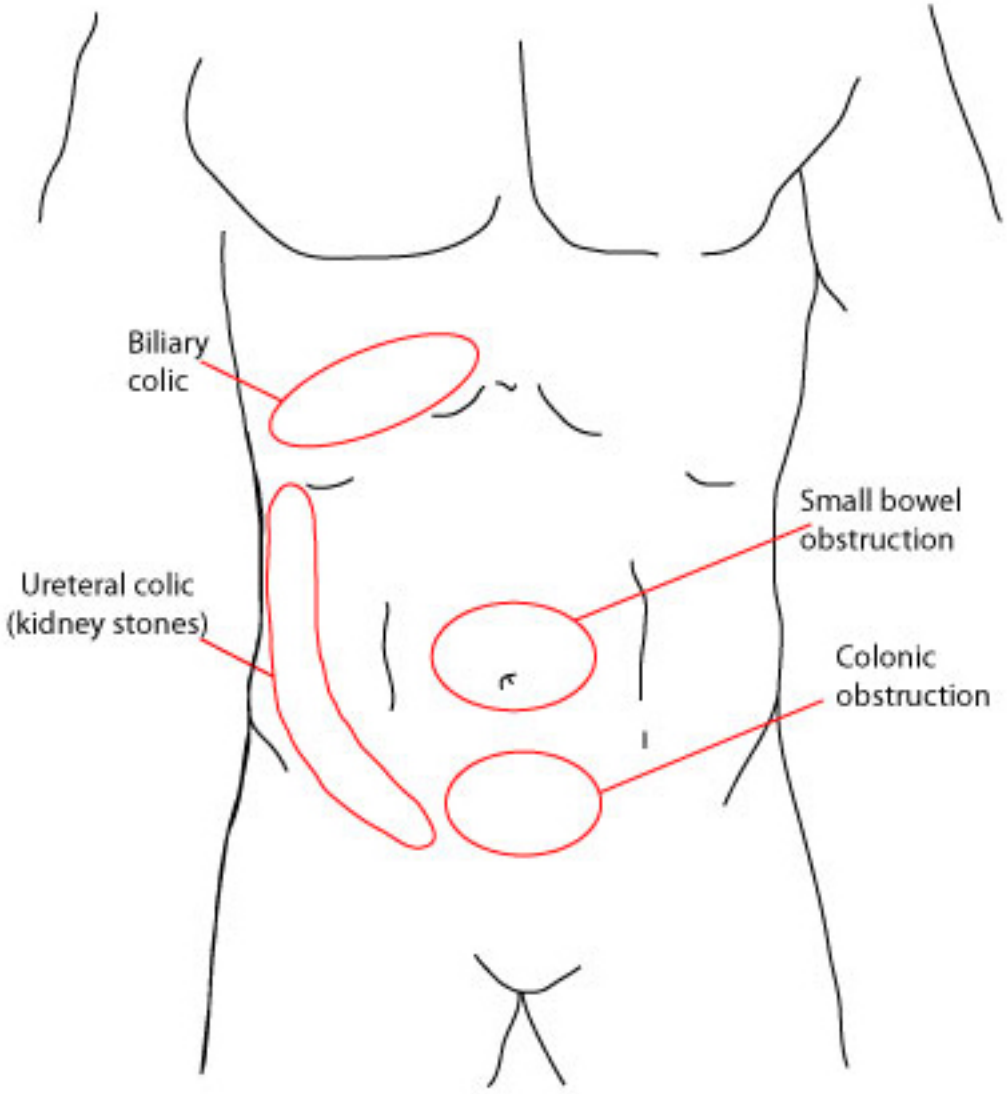

Figure 3: Areas of pain that present more colicky, crampy, and intermittent in nature

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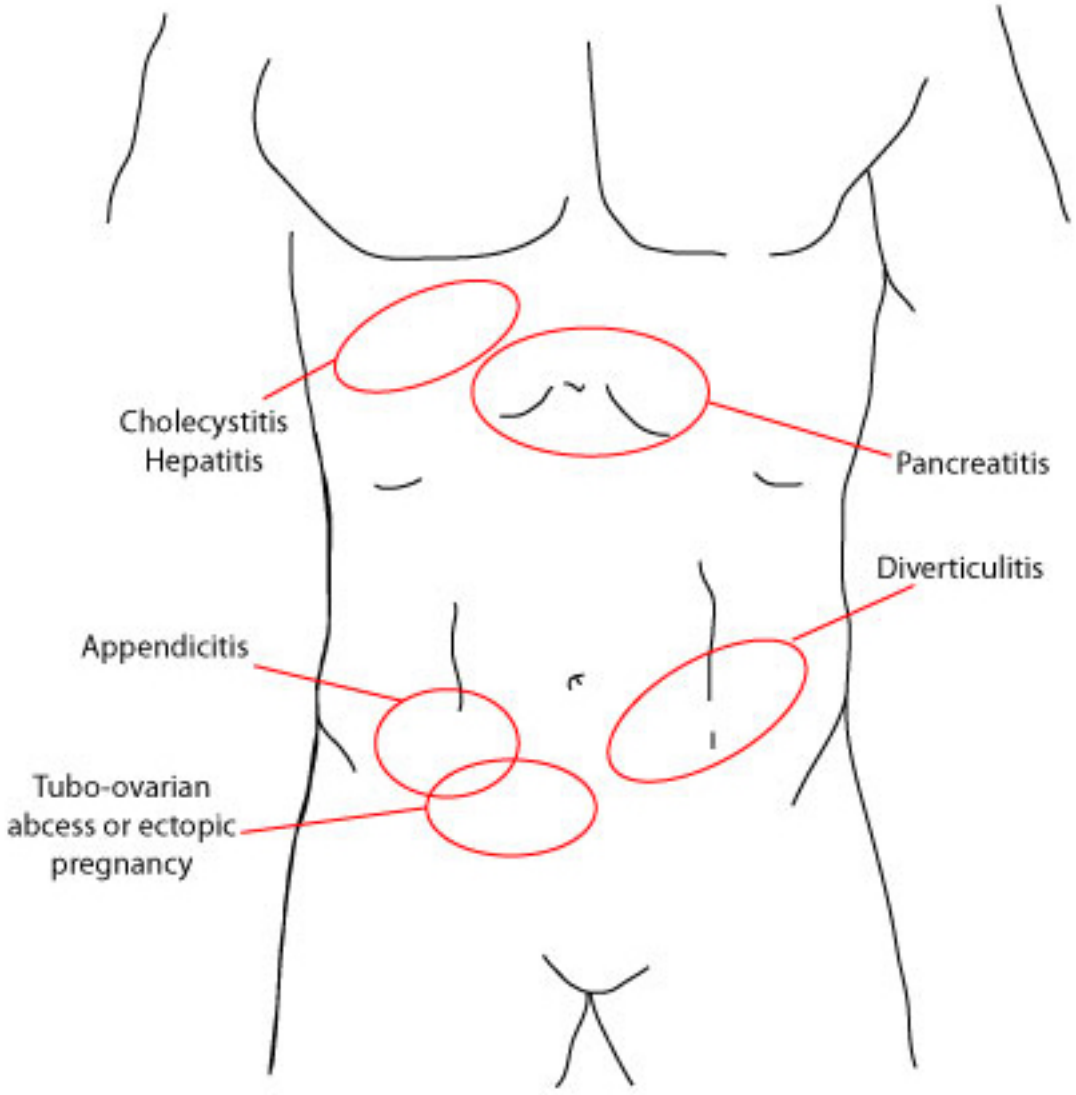

Figure 4: Areas of pain that present gradually or more progressively

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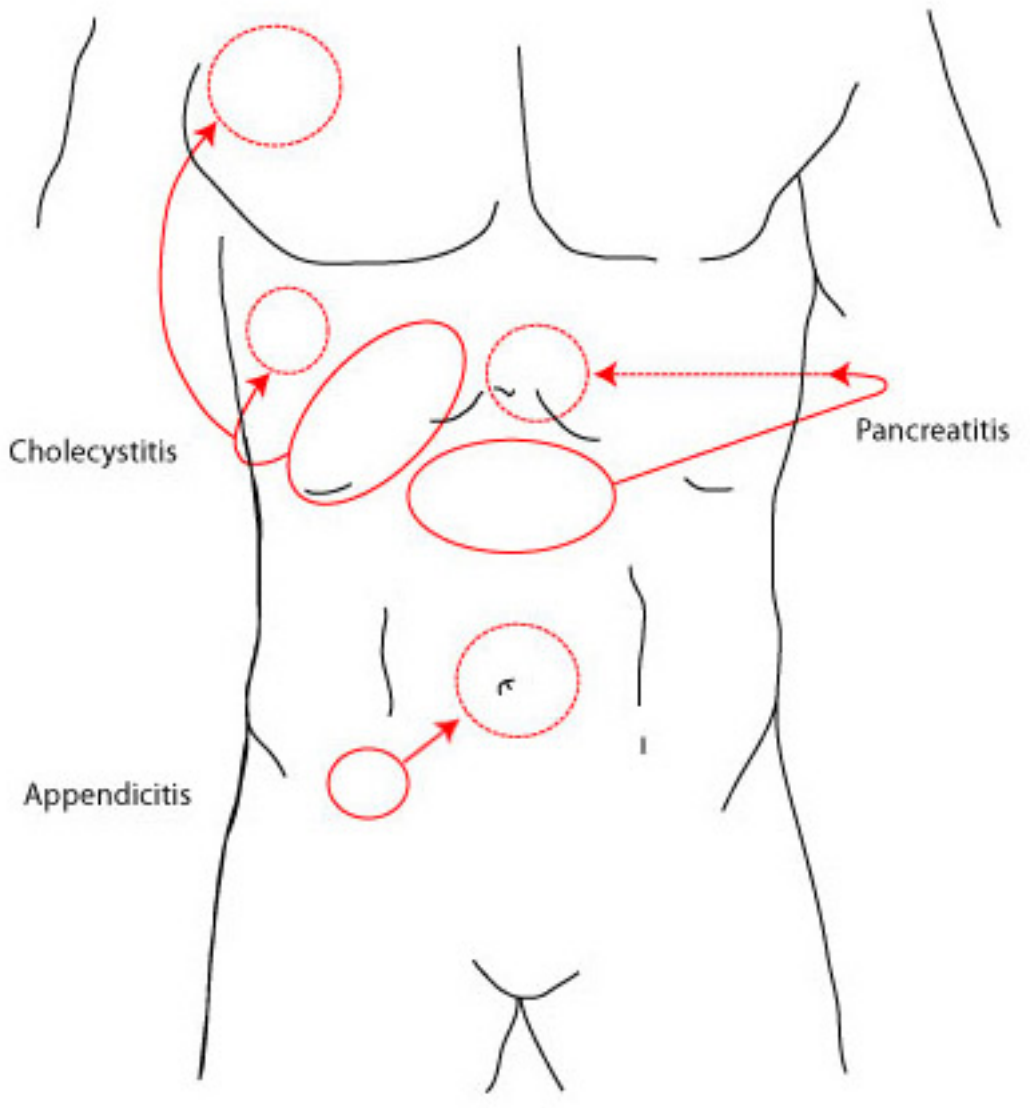

Figure 5: Solid circles represent the primary sites of pain and dotted circles represent the areas of referred pain

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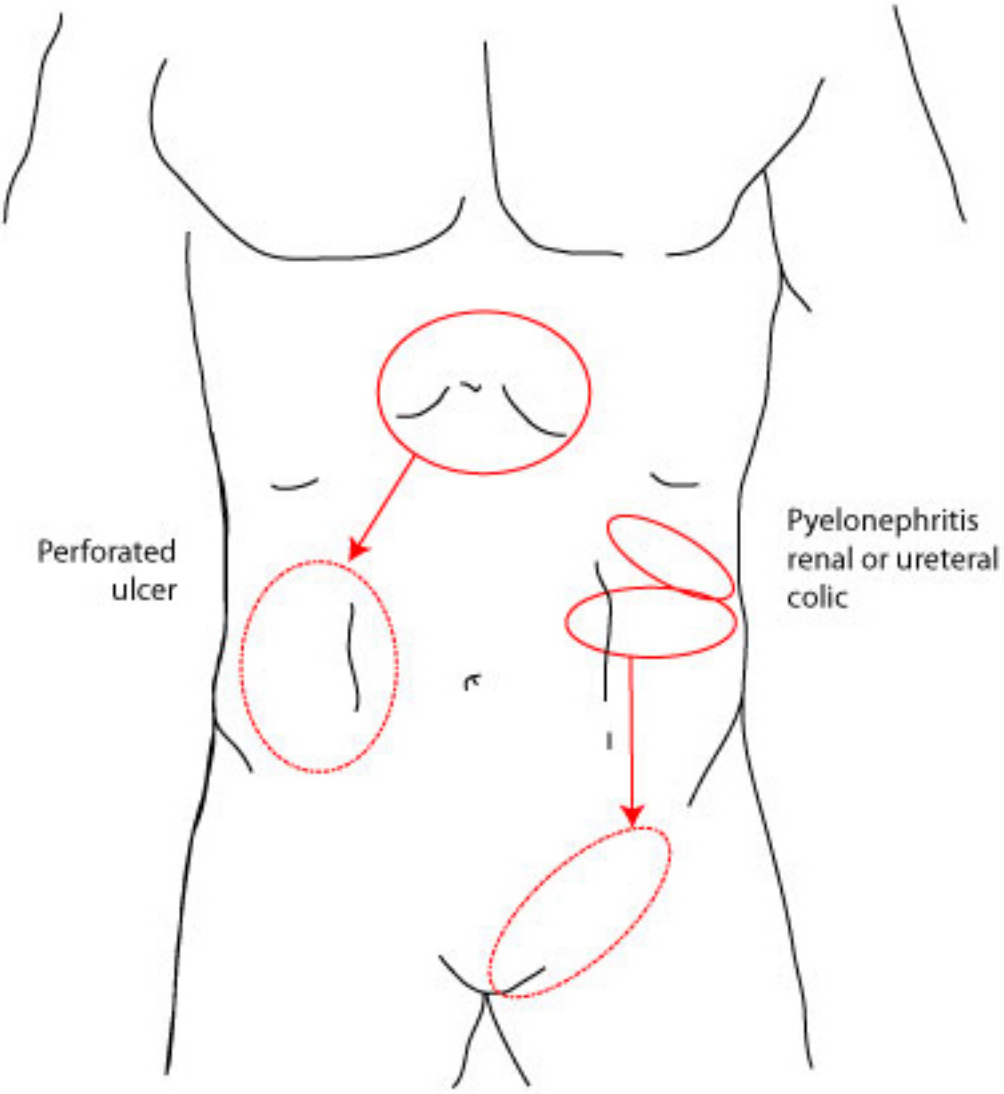

Figure 6: Solid circles represent the primary sites of pain and the dotted circles represent the areas of referred pain

Created by the BMJ Evidence Centre

Figure 7: Cullen sign (periumbilical discoloration) in a 36-year-old man who presented with a 4-day history of severe epigastric pain following an alcoholic binge

Courtesy of Herbert L. Fred MD and Hendrik A van Dijk

Figure 8: Grey-Turner sign (bruising of the flanks) in a 40-year-old woman with worsening epigastric pain of 5 days' duration

Courtesy of Herbert L. Fred MD and Hendrik A. van Dijk

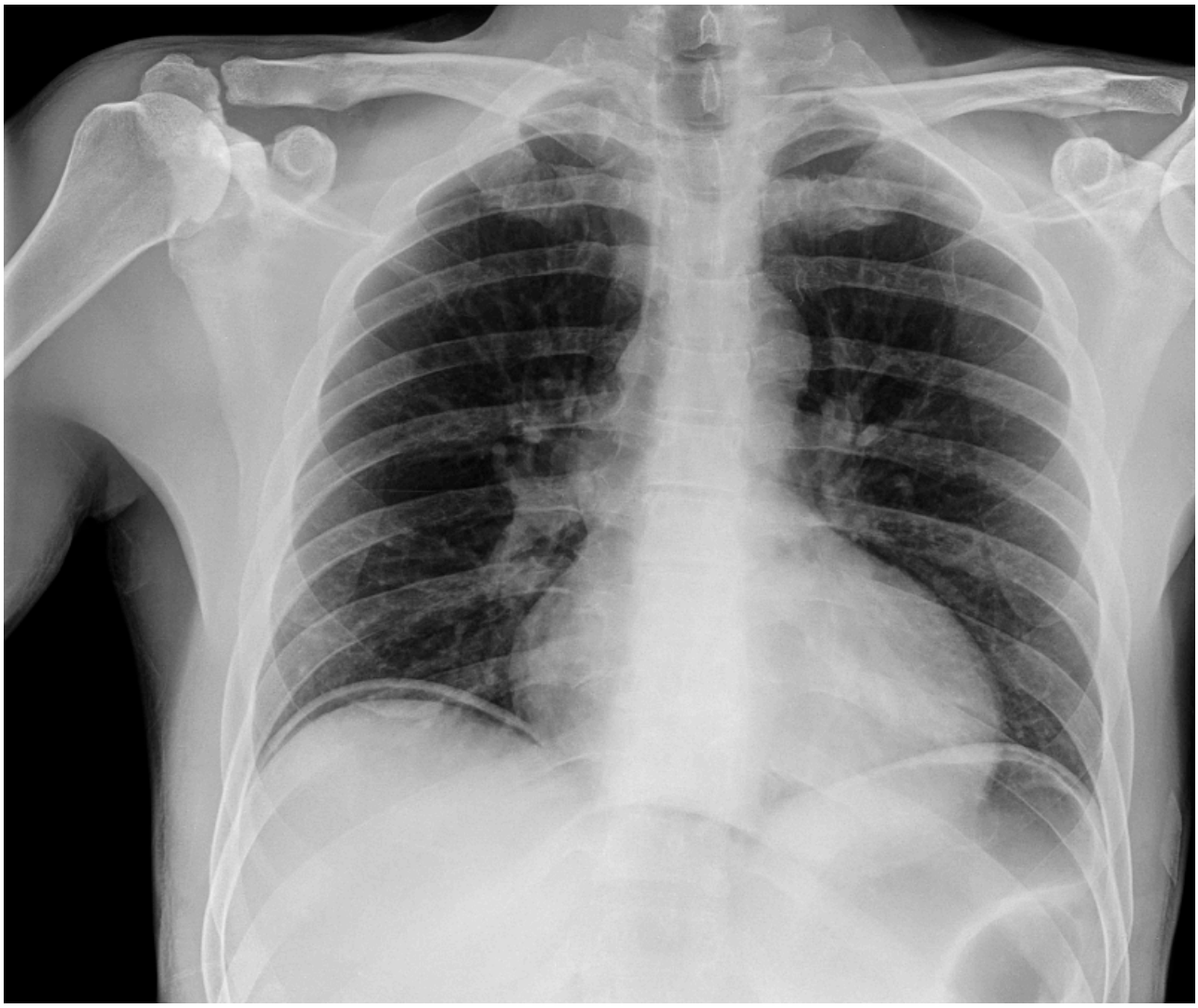

Figure 9: Abdominal free gas pockets, x-ray

Science Photo Library; used with permission

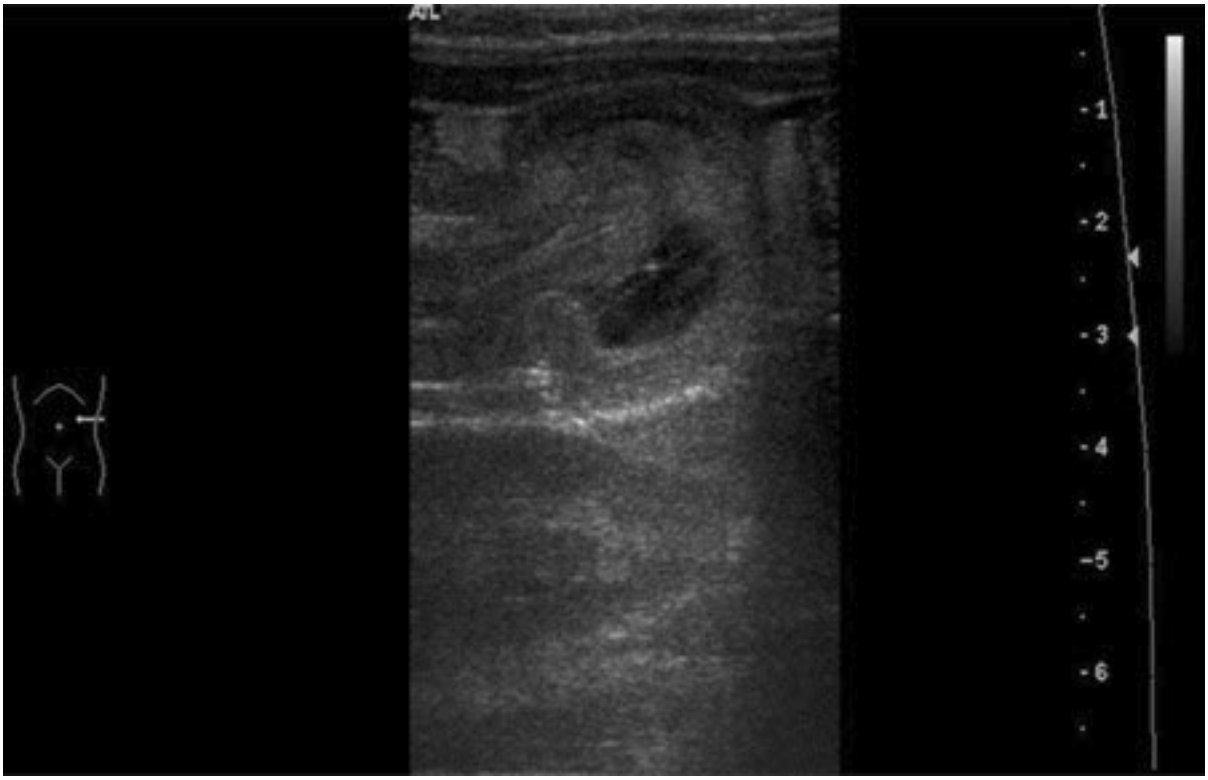

Figure 10: Intussusception: Ultrasound image showing invagination of a segment of bowel into the adjacent segment

BMJ Case Reports 2009; doi:10.1136/bcr.04.2009.1730

Figure 11: Intussusception: Transverse sonogram of the abdomen showing the donut sign (concentric rings within the lumen of a distended loop of bowel)

Adapted from the Student BMJ. 2008;16:76

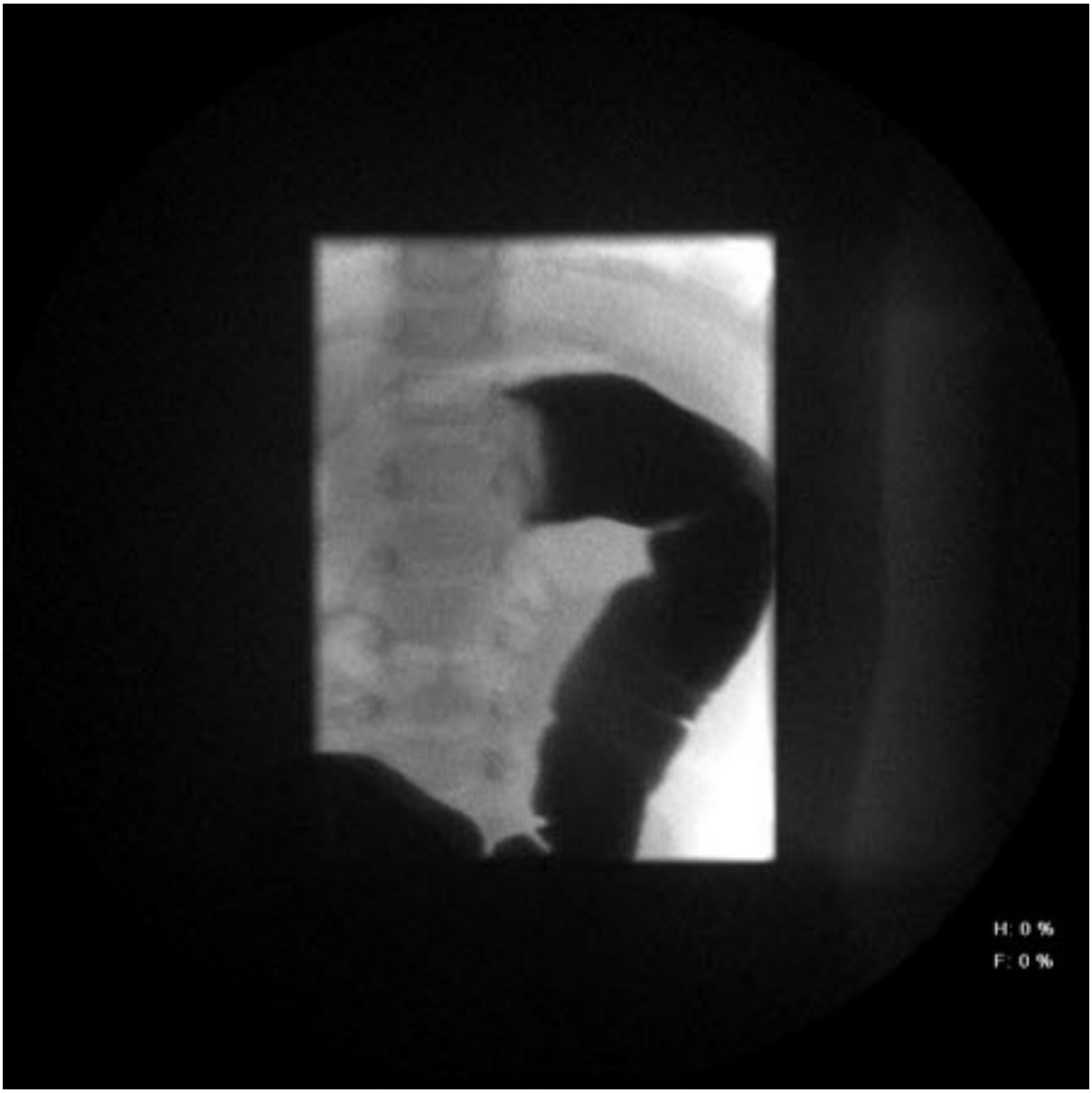

Figure 12: Intussusception: Abdominal x-ray showing impaired passage of barium at site of obstruction due to intussusception

From the collection of Dr David J. Hackam

Figure 13: Intussusception: Site of intussusception as revealed by abdominal x-ray, showing the meniscus

From the collection of Dr David J. Hackam

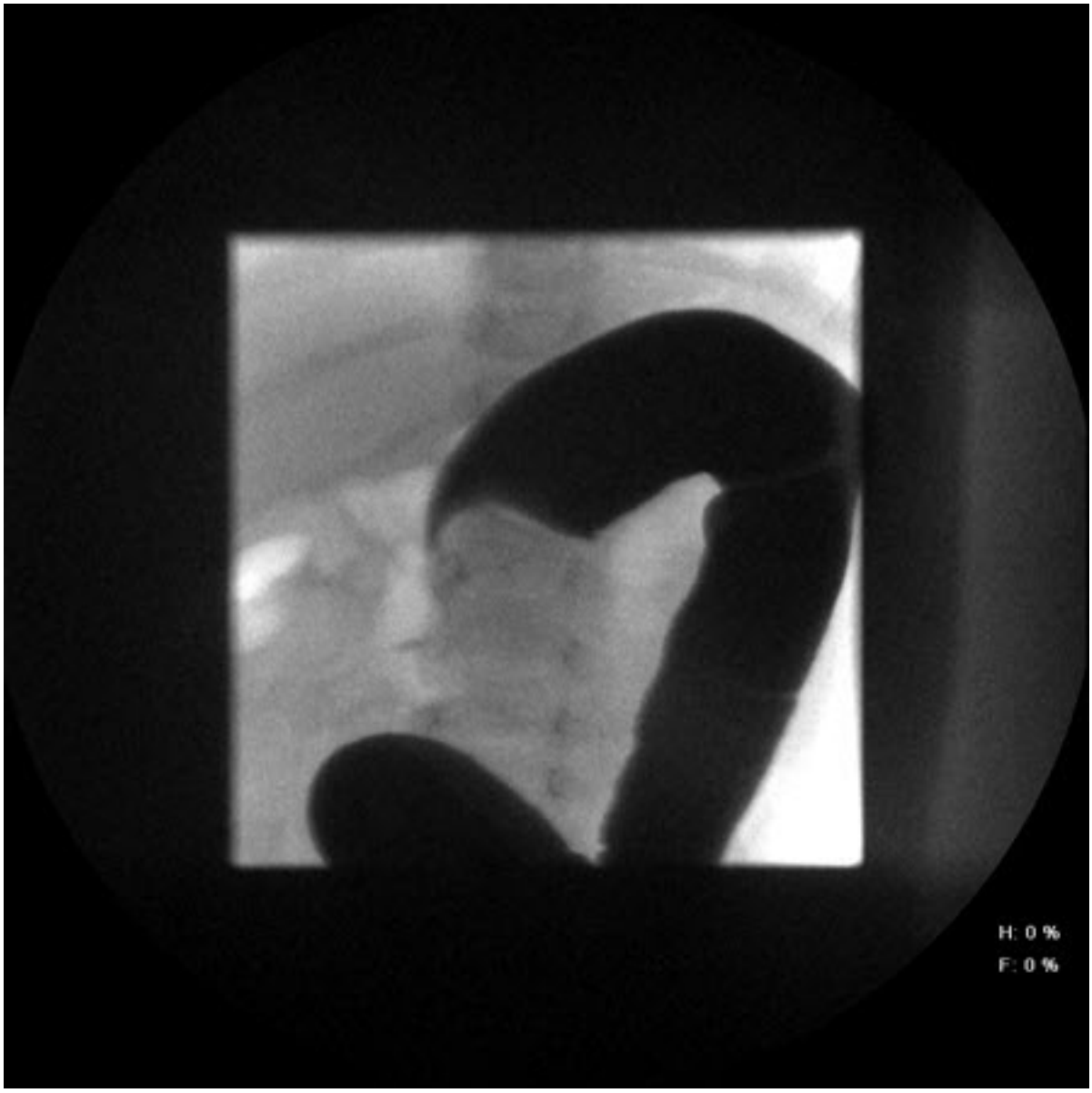

Figure 14: Intussusception: Site of intussusception as revealed by abdominal x-ray, showing the meniscus

From the collection of Dr David J. Hackam

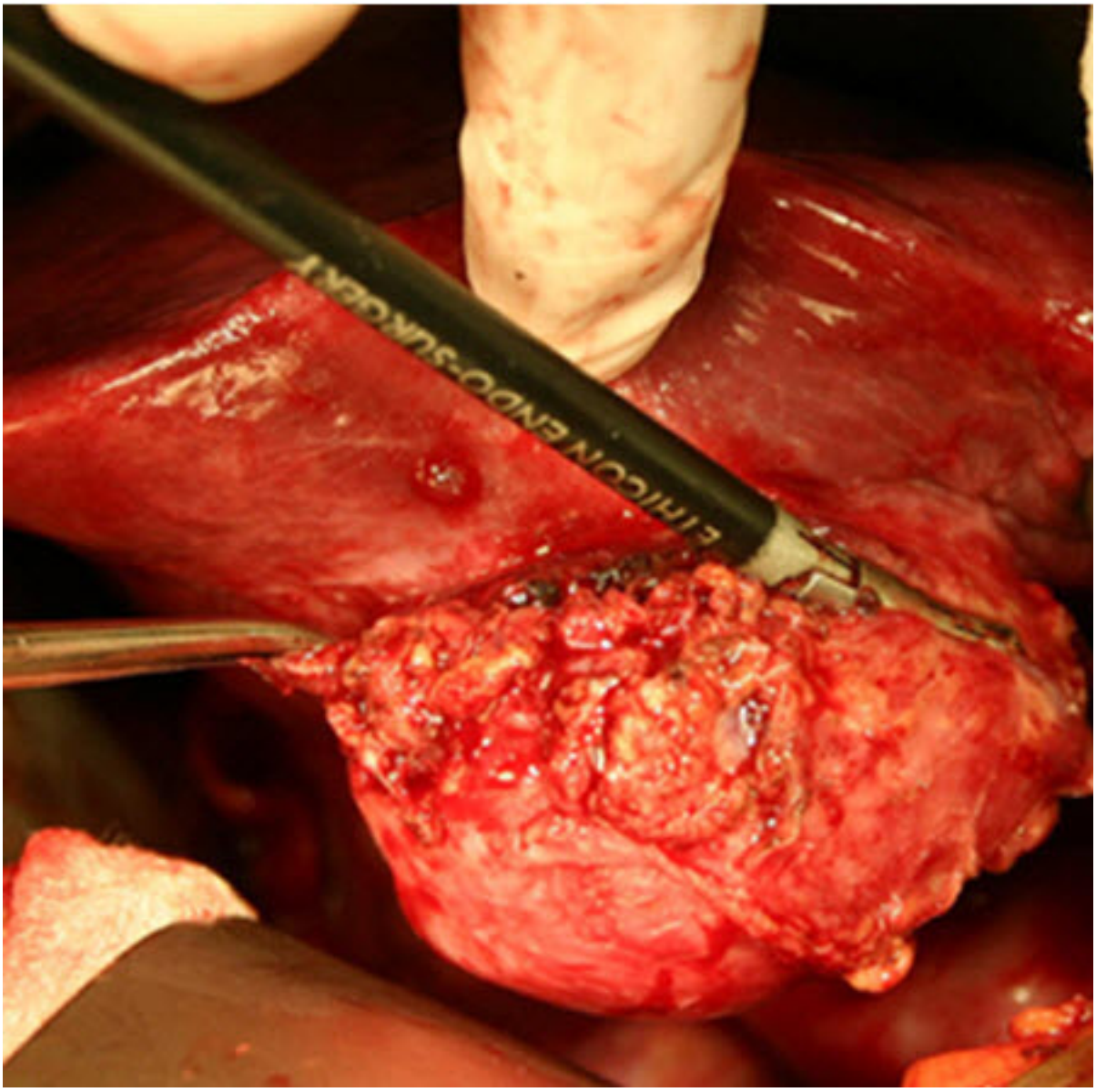

Figure 15: Cholecystitis: Operative photo showing acute cholecystitis

From the collection of Dr Charles Bellows

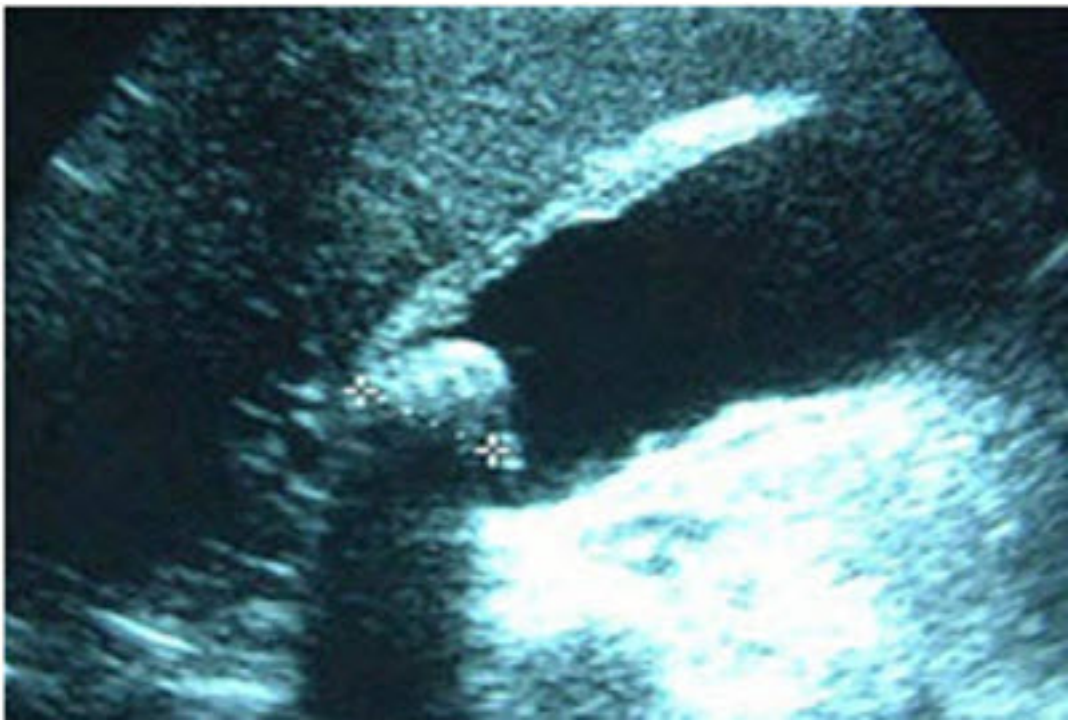

Figure 16: Cholecystitis: Ultrasound of acute cholecystitis and presence of gallstones

From the collection of Dr Charles Bellows

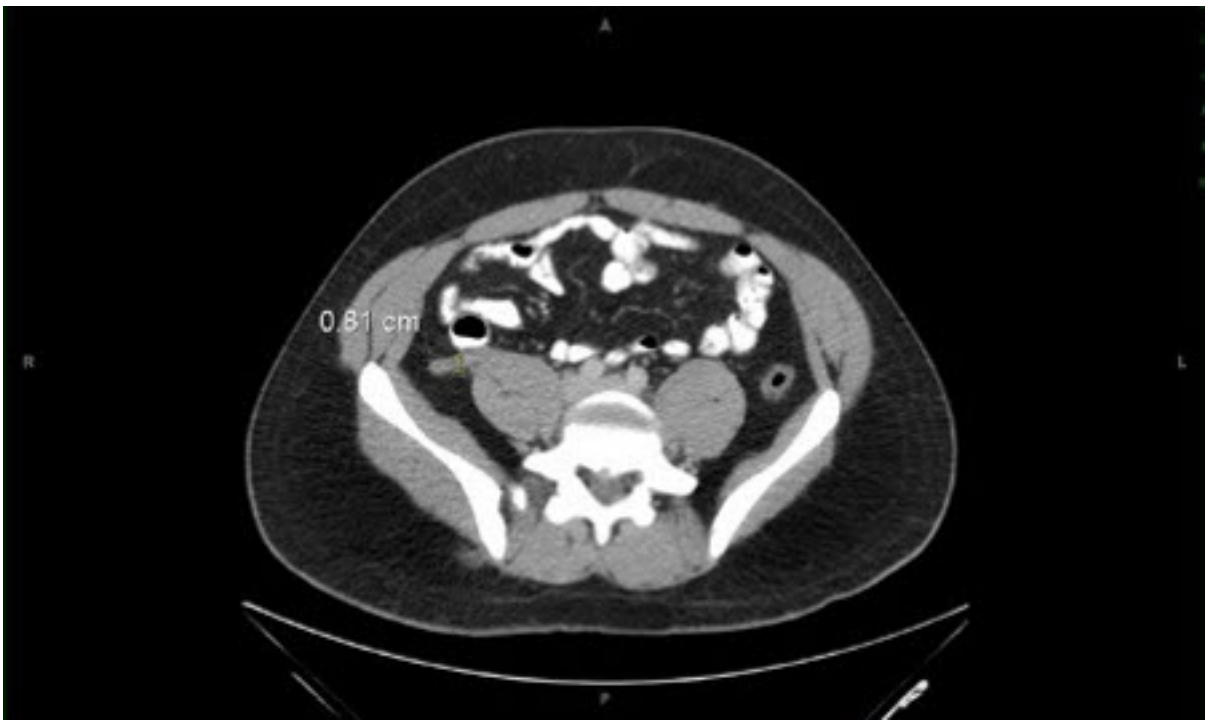

Figure 17: Appendicitis: CT abdomen showing thickened appendix

Courtesy of Nasim Ahmed, MBBS, FACS

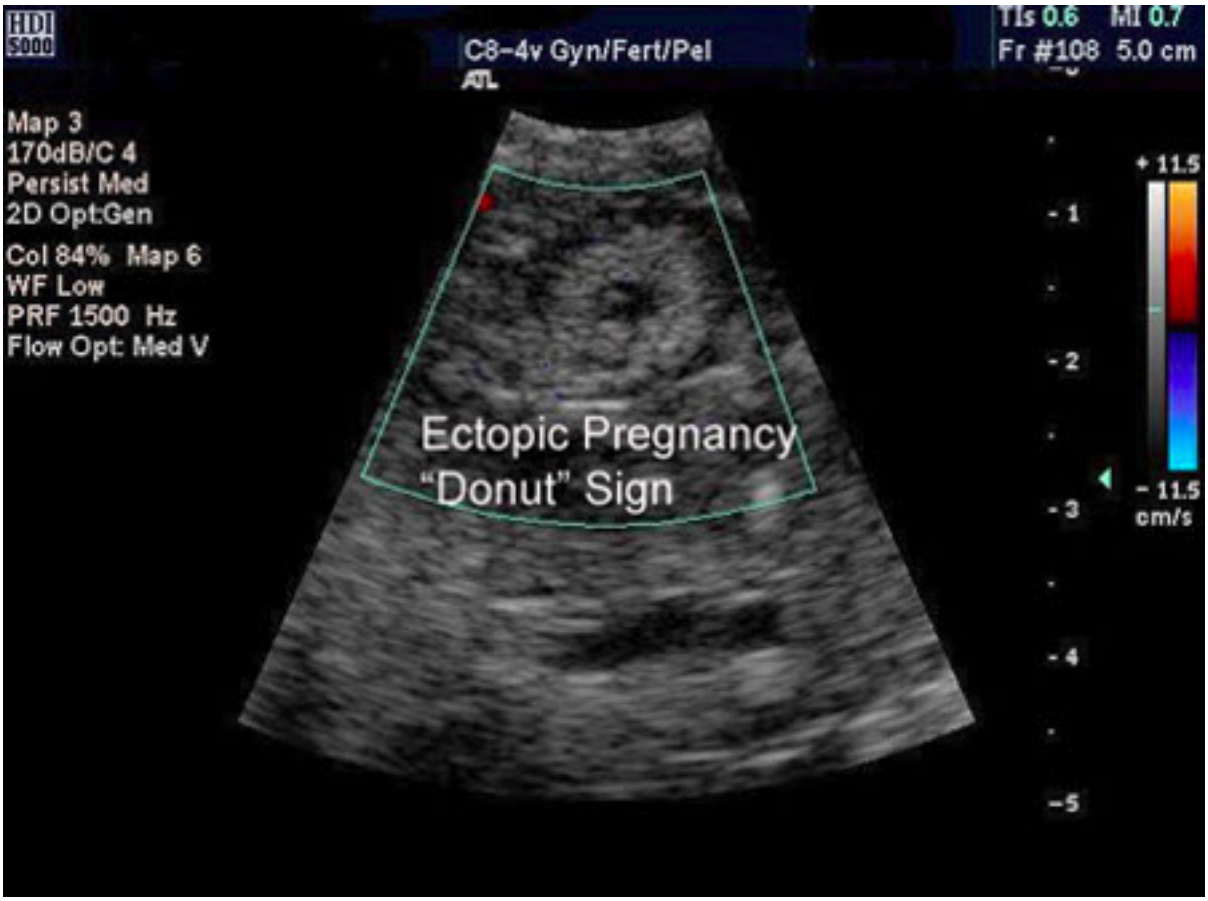

Figure 18: Ectopic pregnancy: Ultrasound image of ectopic pregnancy showing the donut sign

From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission

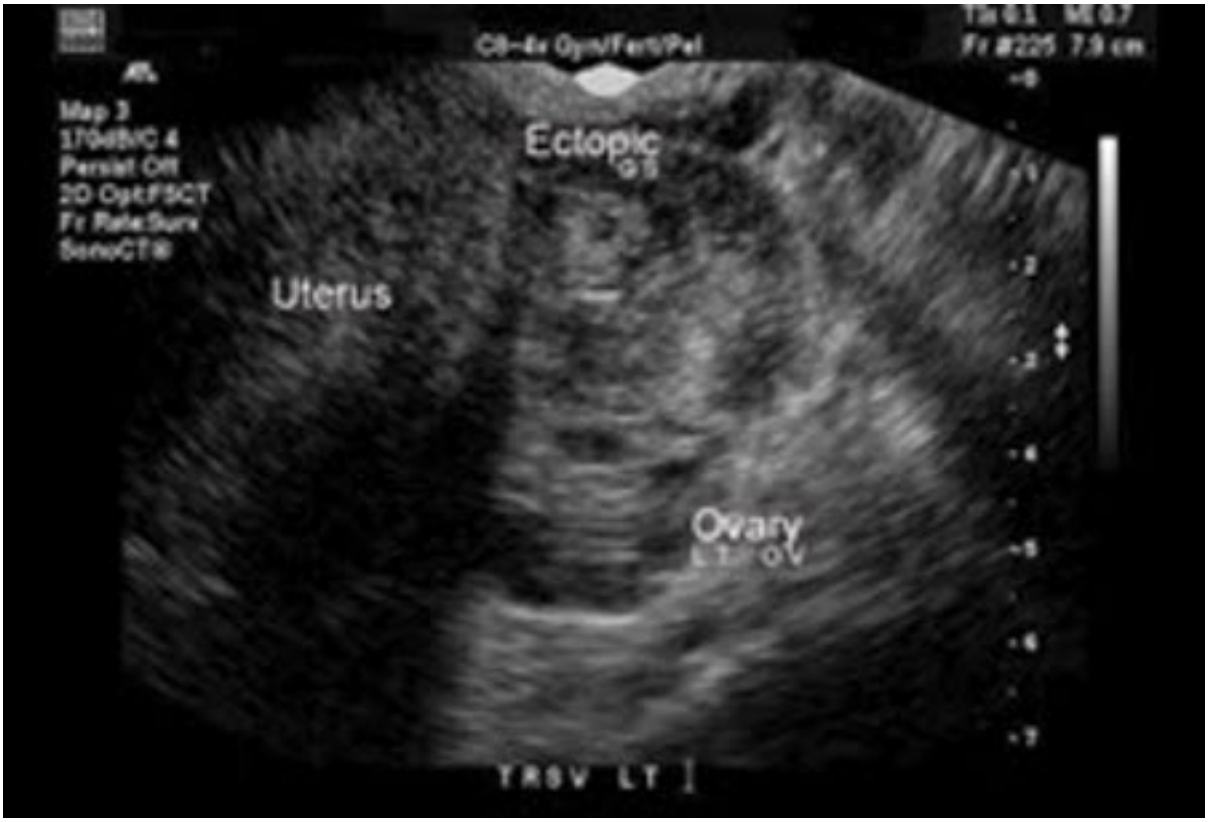

Figure 19: Ectopic pregnancy: Ultrasound image of ectopic pregnancy

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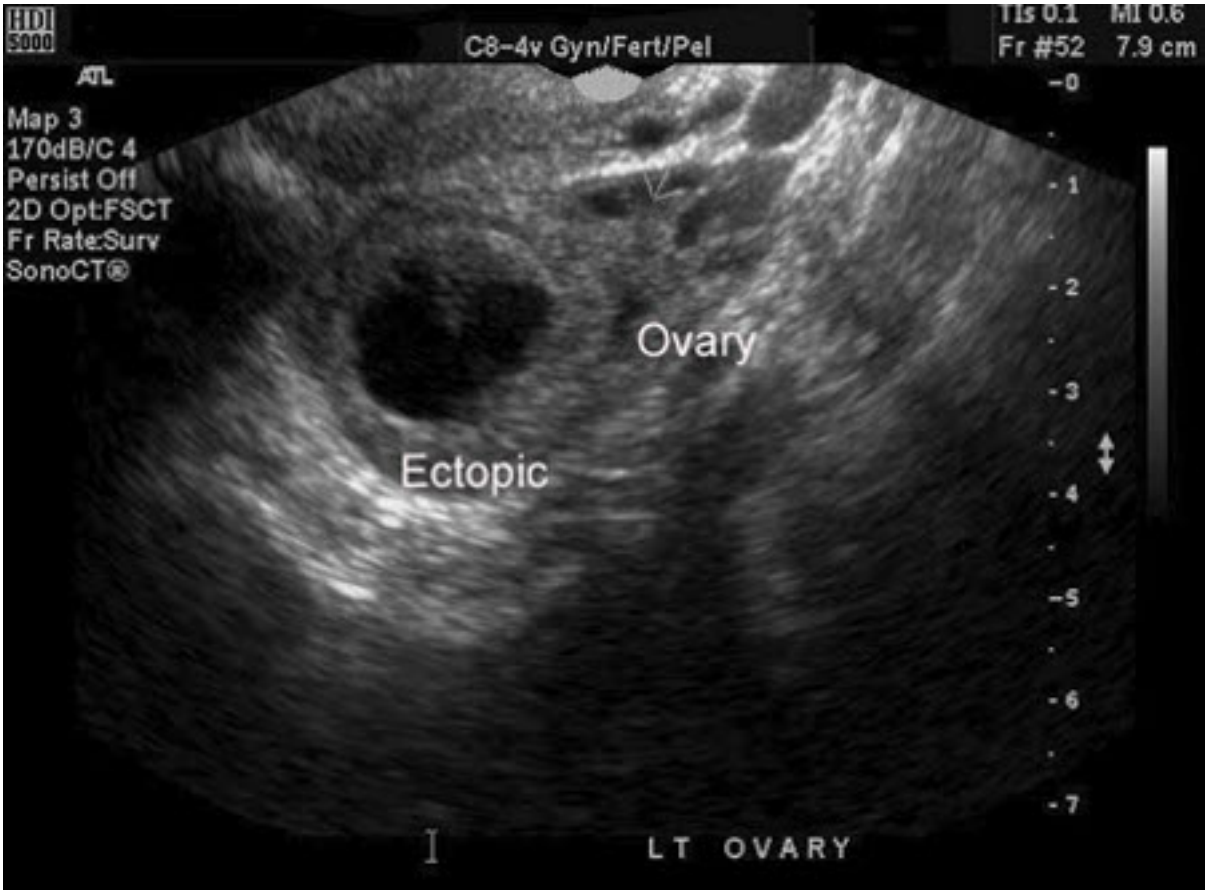

Figure 20: Ectopic pregnancy: Ultrasound image of ectopic pregnancy

From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission

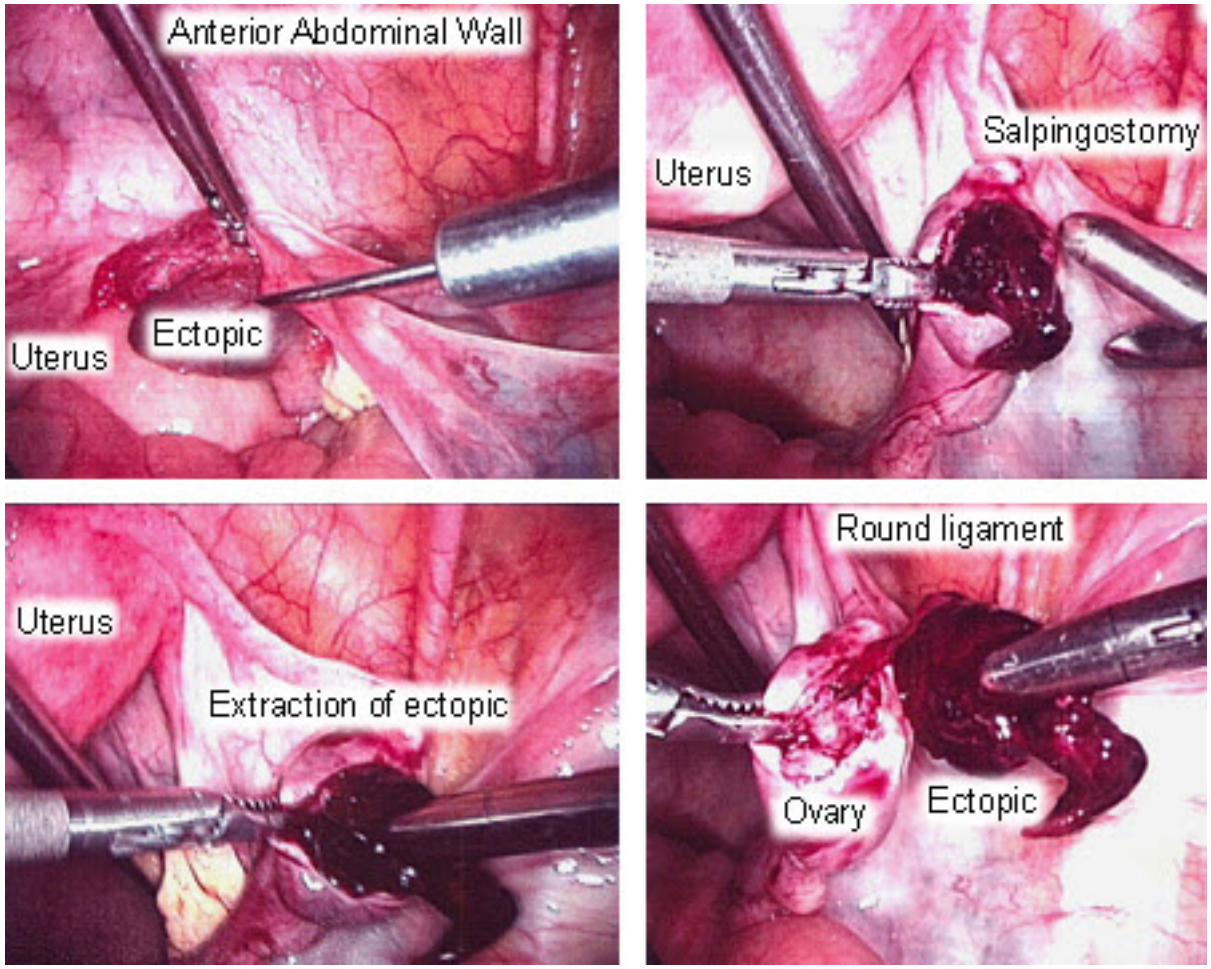

Figure 21: Ectopic pregnancy: Surgical extraction of ectopic pregnancy

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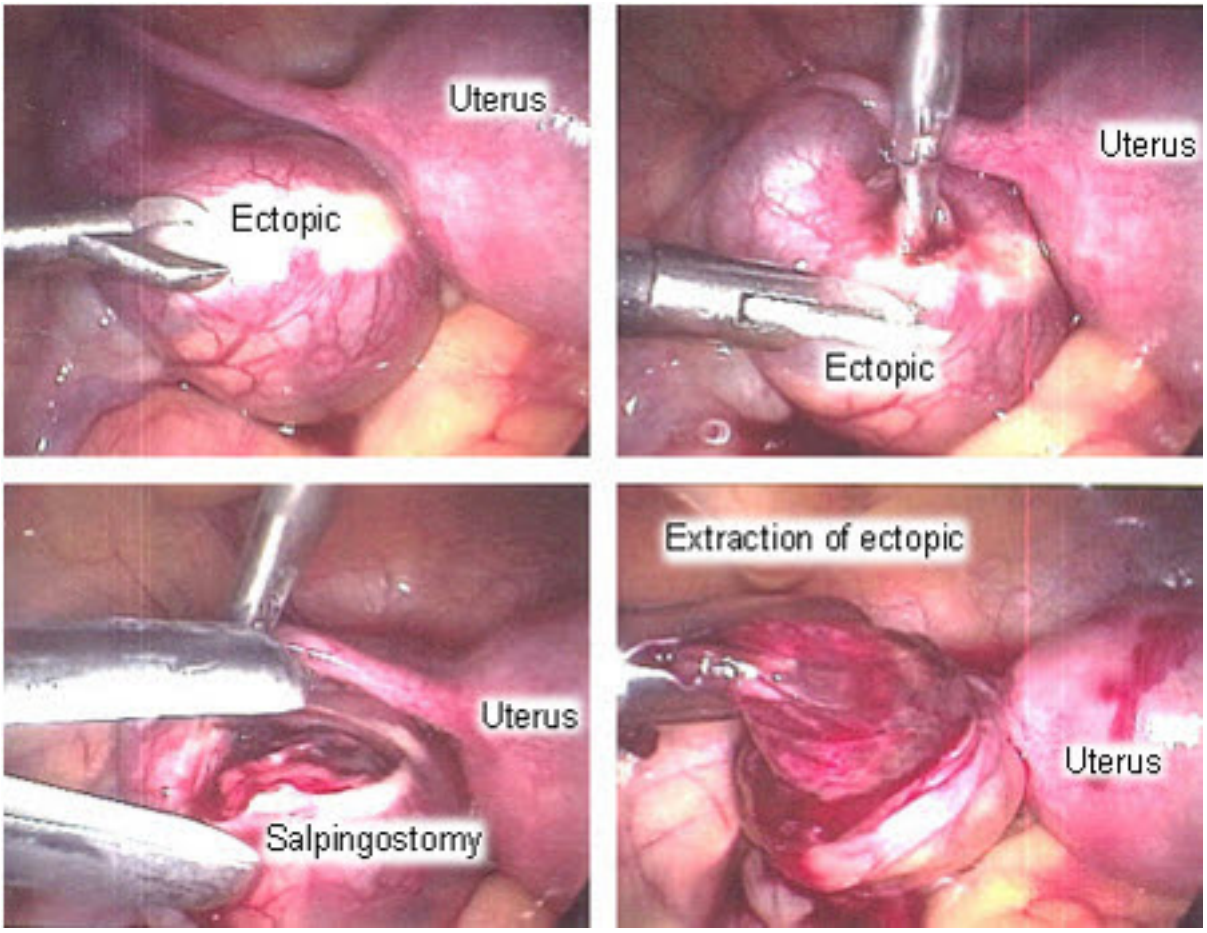

Figure 22: Ectopic pregnancy: Surgical extraction of ectopic pregnancy

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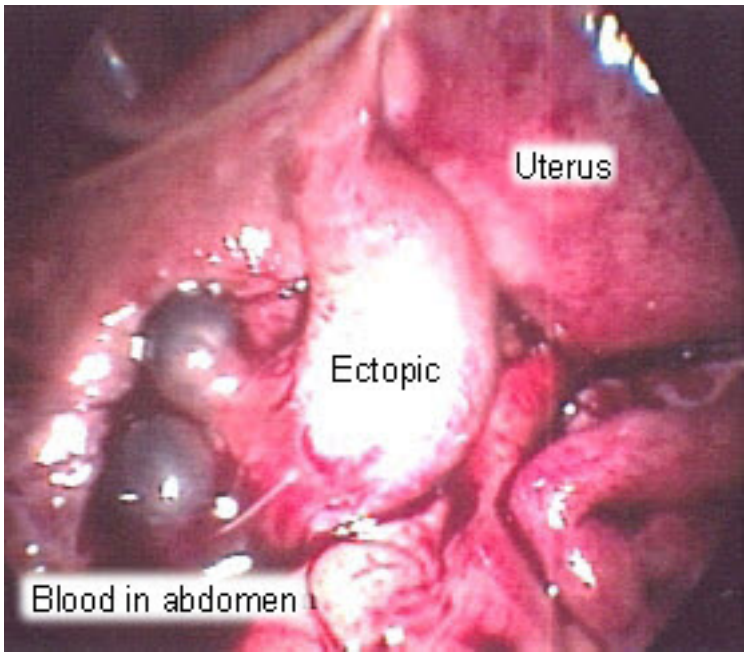

Figure 23: Ectopic pregnancy: Blood in the abdomen

From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission

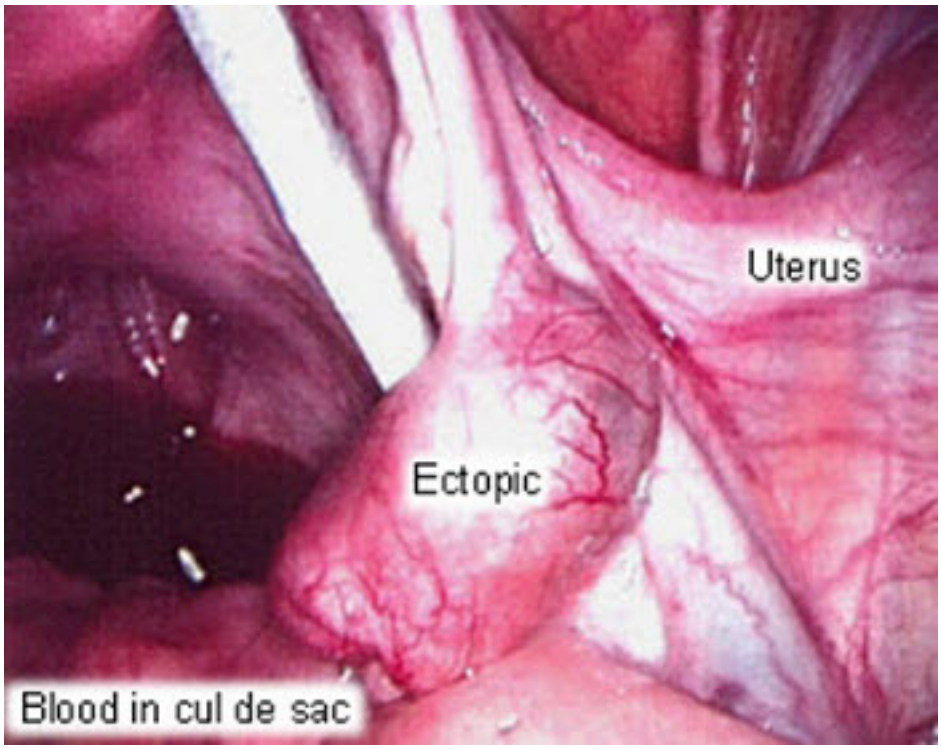

Figure 24: Ectopic pregnancy: Blood in cul de sac

From the personal collection of Dr Melissa Fries, Washington Hospital Center; used with permission

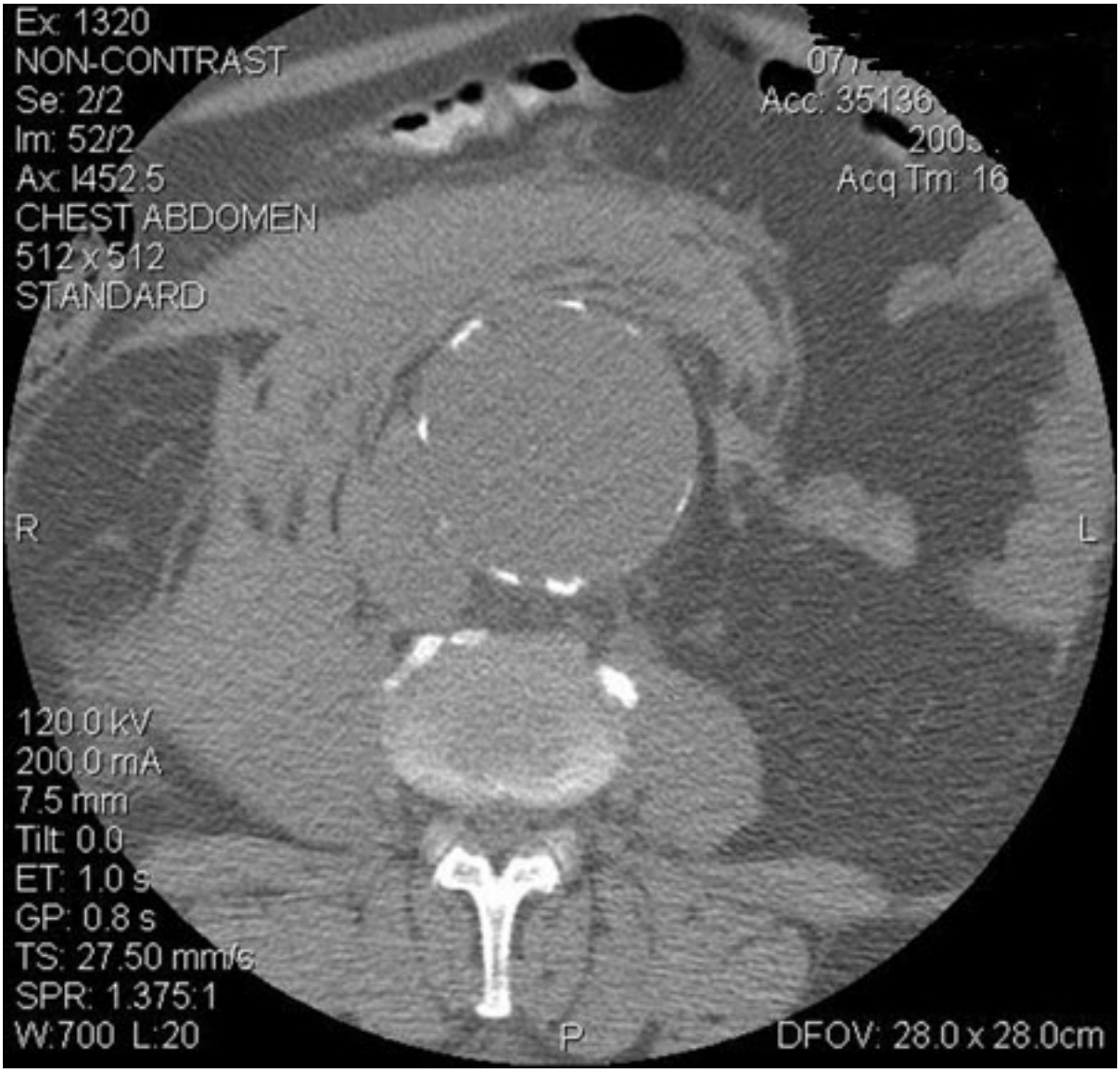

Figure 25: Abdominal aortic aneurysm: CT scan of a ruptured abdominal aortic aneurysm

University of Michigan, specifically the cases of Dr Upchurch reflecting the Departments of Vascular Surgery and Radiology

Figure 26: Ischaemic bowel disease: CT scan showing colonic thickening with pneumatosis intestinalis

From the collection of Dr Jennifer Holder-Murray and Dr Alessandro Fichera

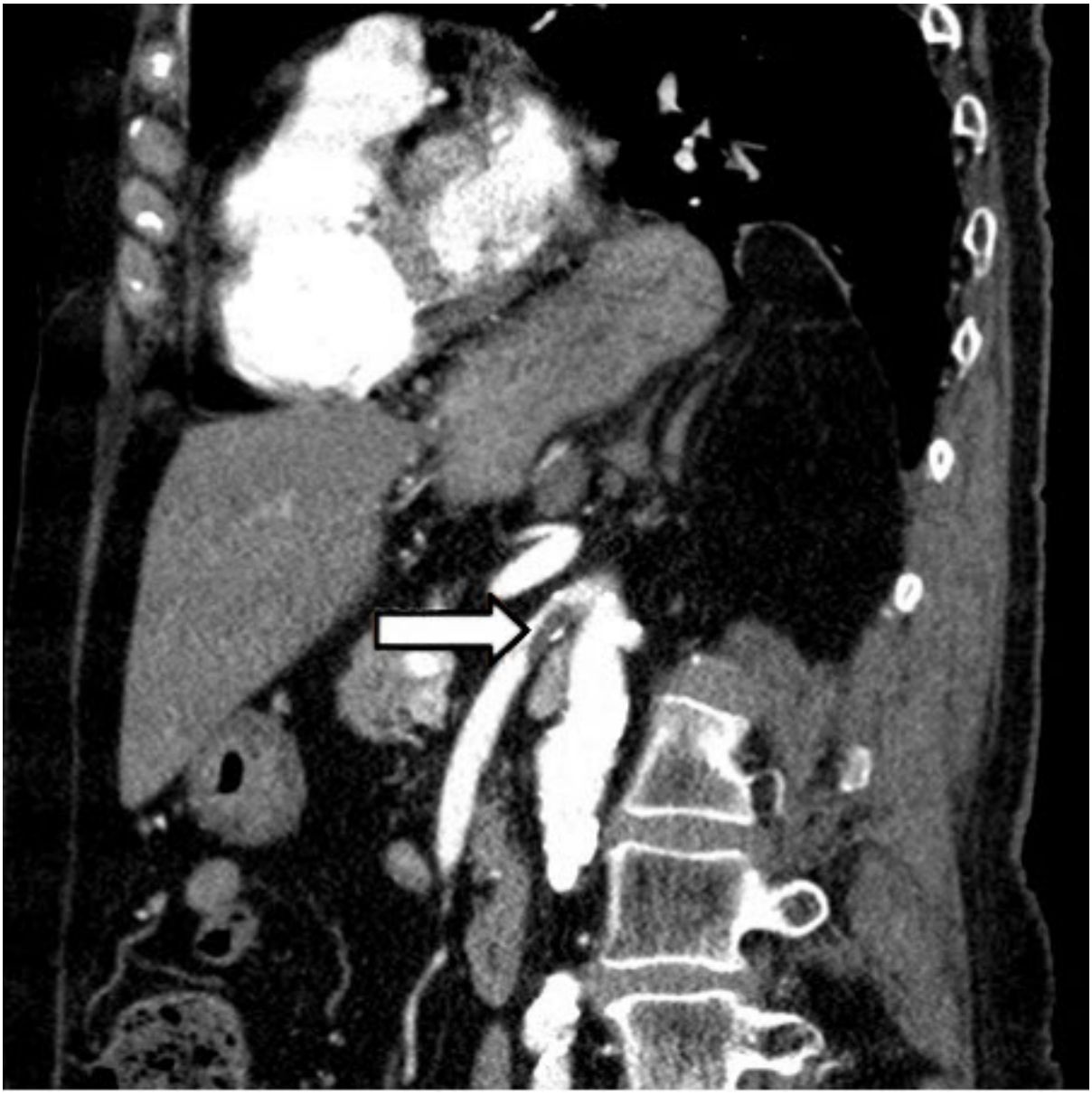

Figure 27: Ischaemic bowel disease: CT angiogram: acute superior mesenteric artery thrombus

From the collection of Dr Jennifer Holder-Murray and Dr Alessandro Fichera

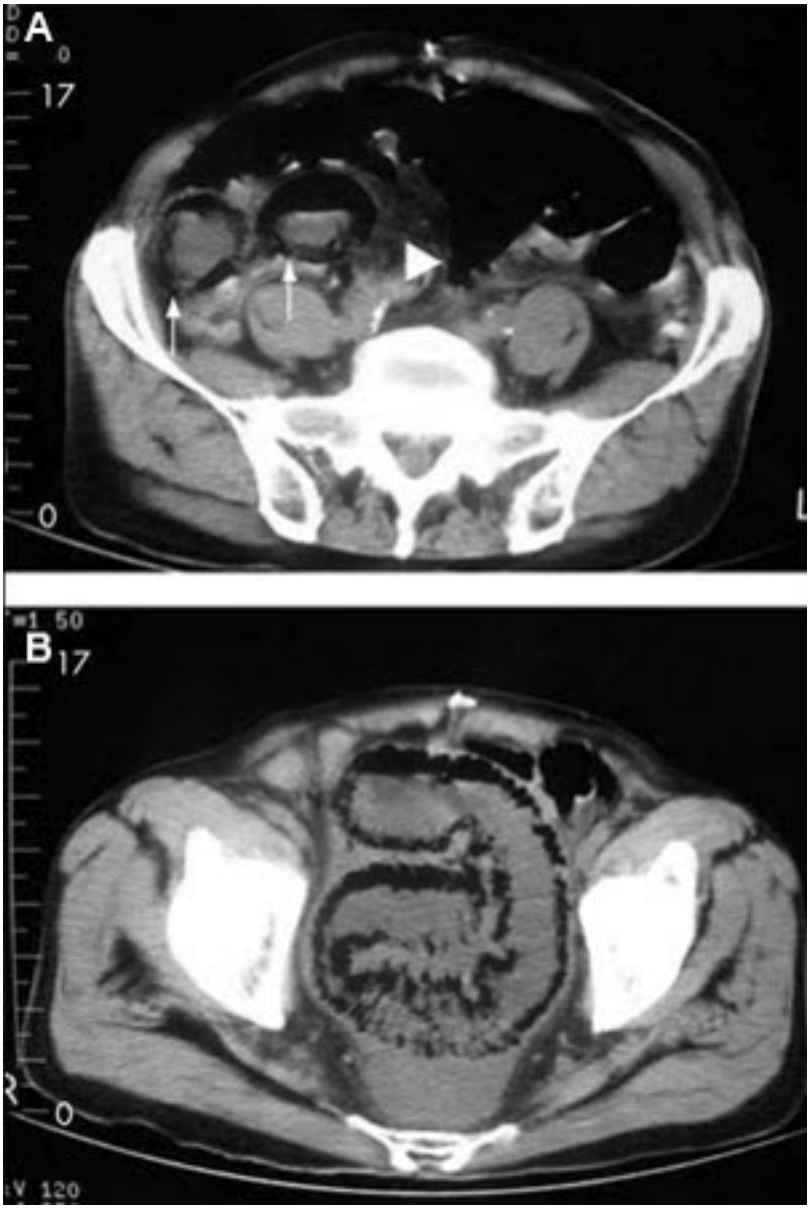

Figure 28: Ischaemic bowel disease: 84-year-old man presenting with symptoms suggestive of ischaemic bowel disease: (A) Abdominal CT revealing a massive circumferential and band-like air formation as intestinal pneumatosis (arrows) and pronounced edema of mesenteric fat (arrowhead) around necrotic bowel loops; (B) Another slice of abdominal CT showing long segmental pneumatosis of the small bowel

Lin I, Chang W, Shih S, et al. Bedside echogram in ischaemic bowel. BMJ Case Reports. 2009:bcr.2007.053462

Figure 29: Crohn's disease: CT scan demonstrating thickening of the terminal ileum in a patient with Crohn's disease exacerbation

Provided by Drs Wissam Bleibel, Bishal Mainali, Chandrashekhar Thukral, and Mark A. Peppercorn

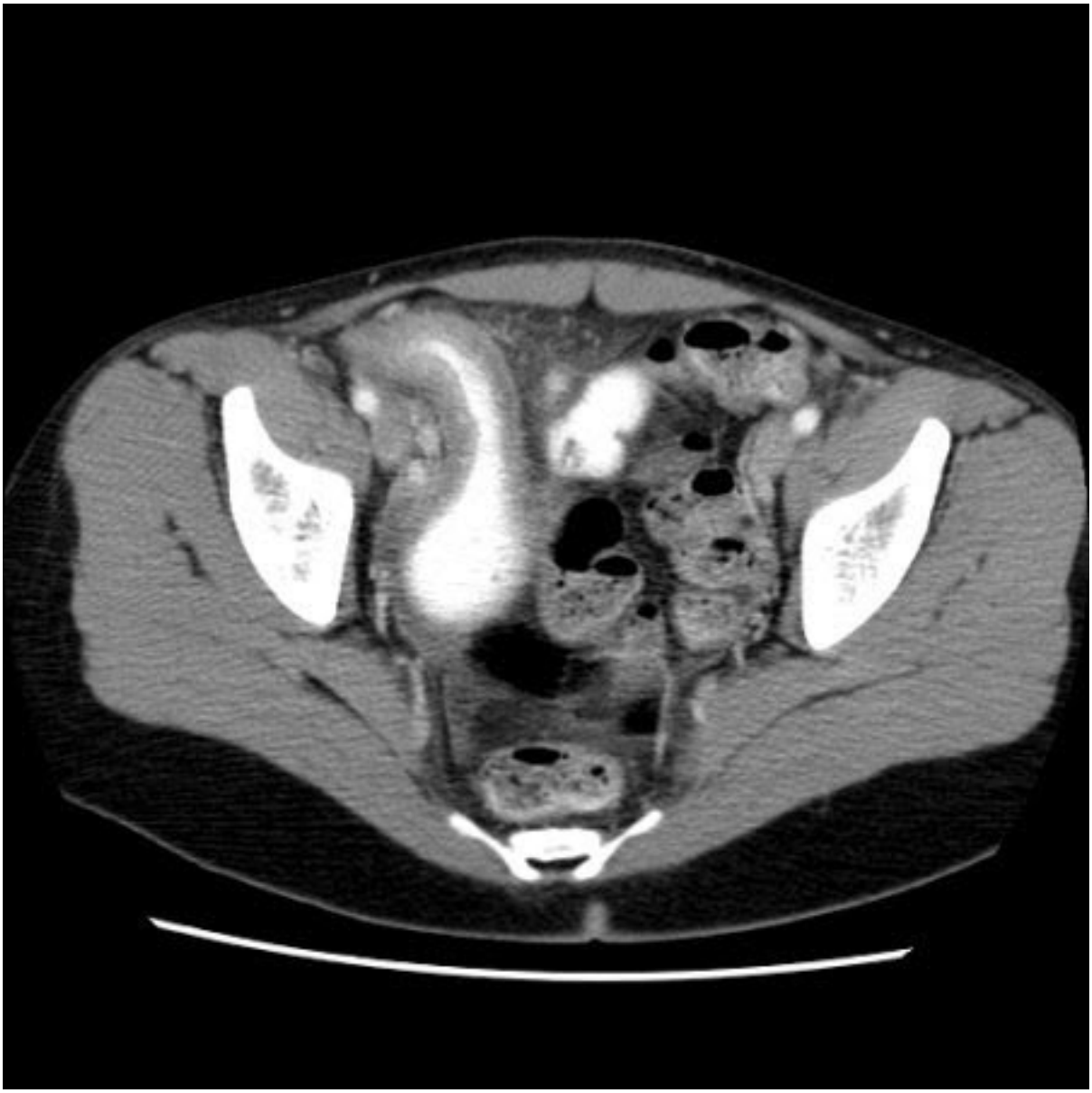

Figure 30: Crohn's disease: CT scan demonstrating thickening of the terminal ileum in a patient with Crohn's disease exacerbation

Provided by Drs Wissam Bleibel, Bishal Mainali, Chandrashekhar Thukral, and Mark A. Peppercorn

Figure 31: Crohn's disease: Endoscopic view of Crohn's ileitis

Provided by Drs Wissam Bleibel, Bishal Mainali, Chandrashekhar Thukral, and Mark A. Peppercorn

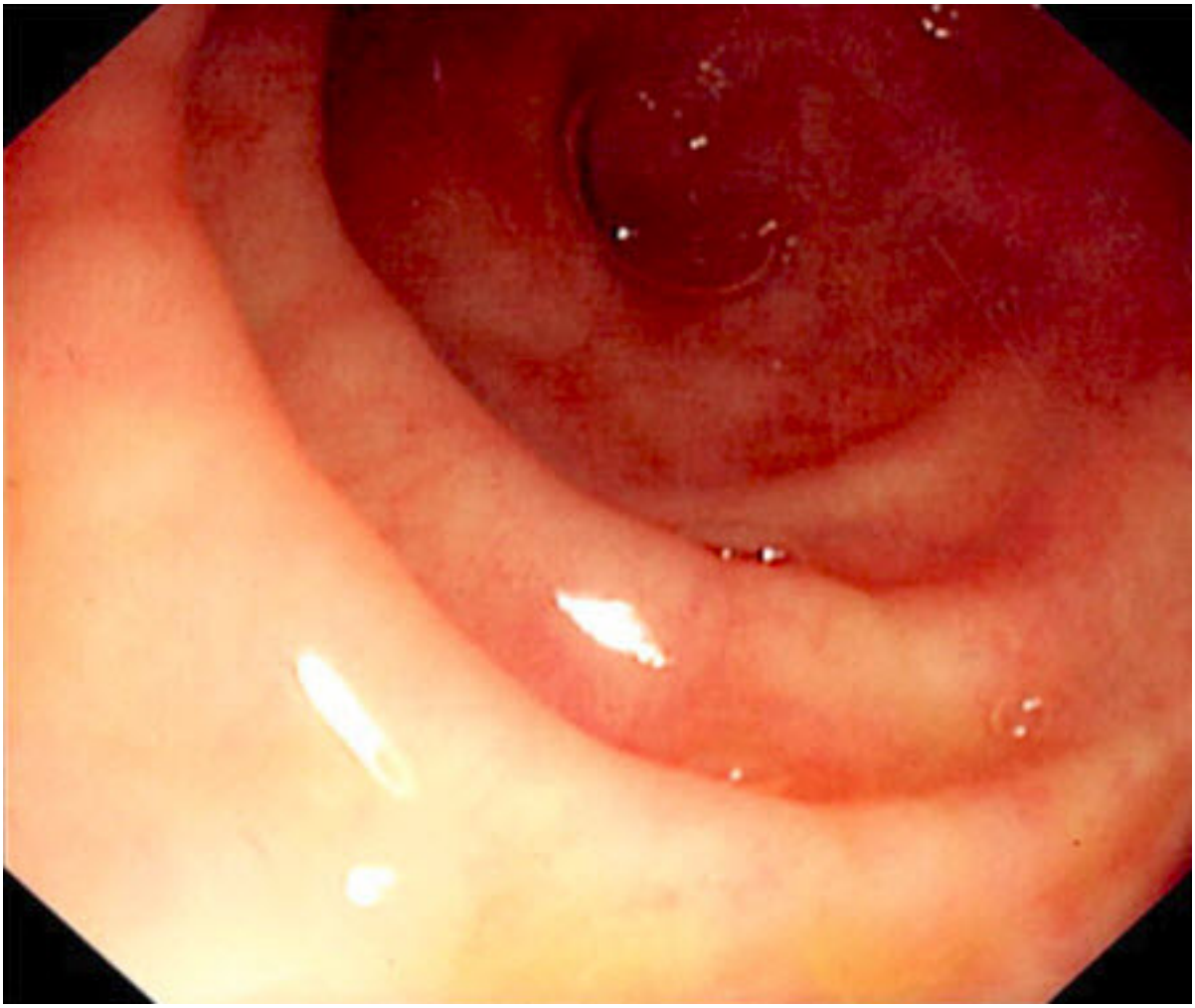

Figure 32: Crohn's disease: Endoscopic view of normal terminal ileum

From the personal collection of Dr Charlotte Ford, North Middlesex Hospital Trust, London, UK

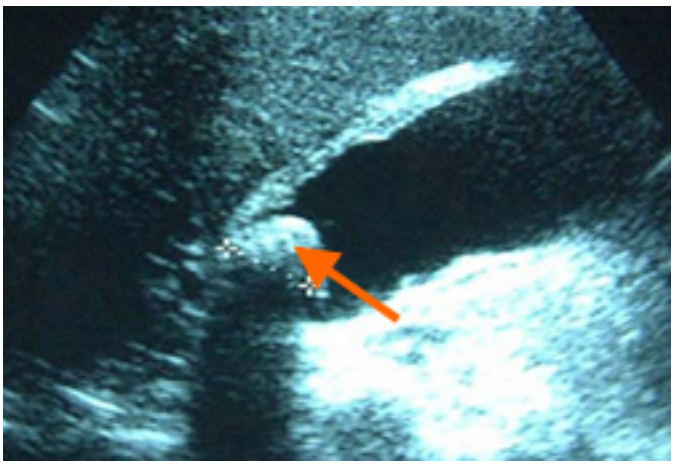

Figure 33: Ultrasound of acute cholecystitis and presence of gallstones: the arrow points to a gallstone in the fundus of the gallbladder with its echogenic shadow below

Courtesy of Charles Bellows and W. Scott Helton; used with permission

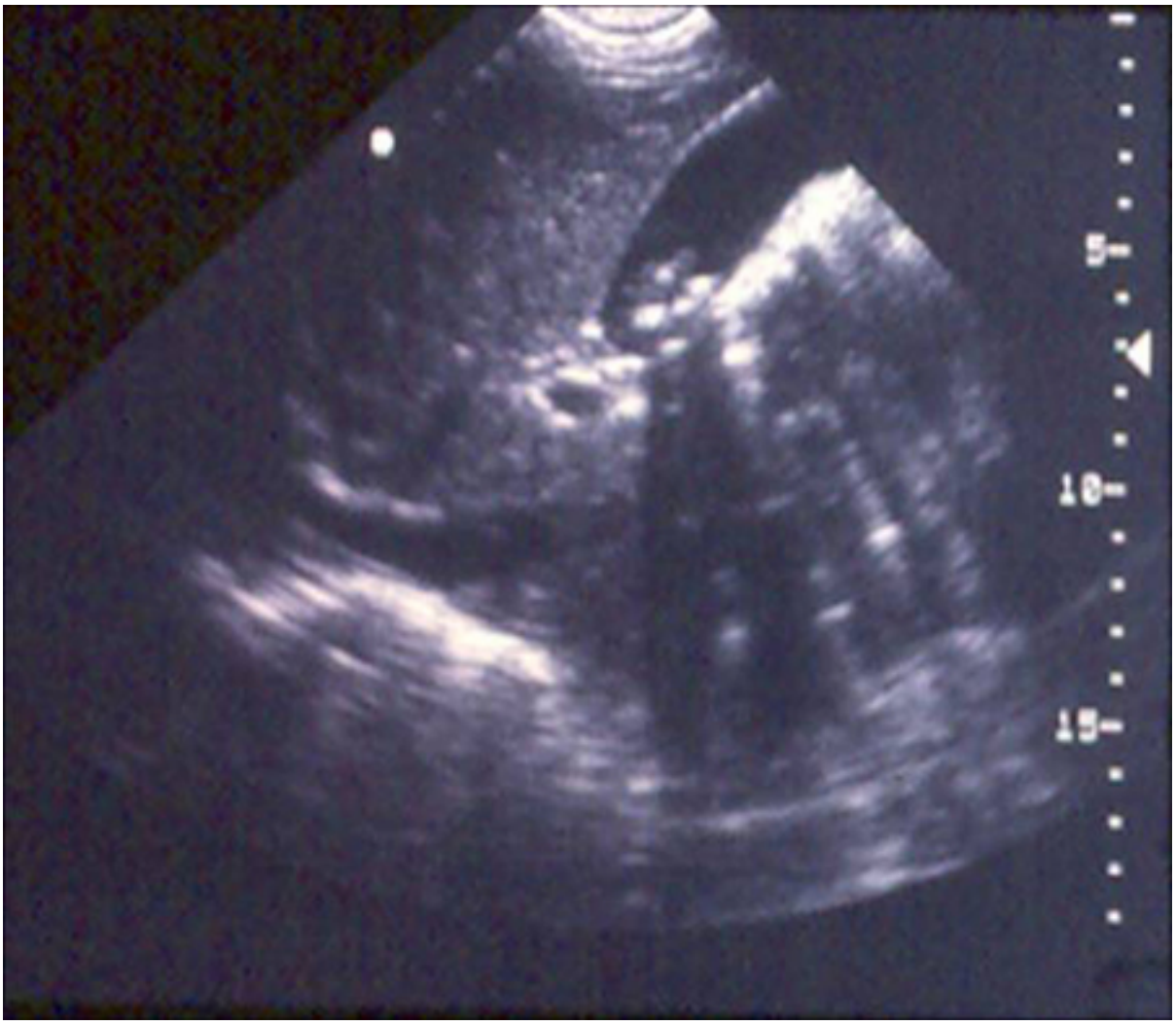

Figure 34: Gallbladder ultrasound demonstrating cholelithiasis with characteristic shadowing

Courtesy of Kuojen Tsao; used with permission

Figure 35: Liver abscess: CT scan showing a liver abscess (7 cm x 5 cm) in a 46-year-old man who presented with fever, fatigue, and cough

From the collection of Massachusetts General Hospital radiology images

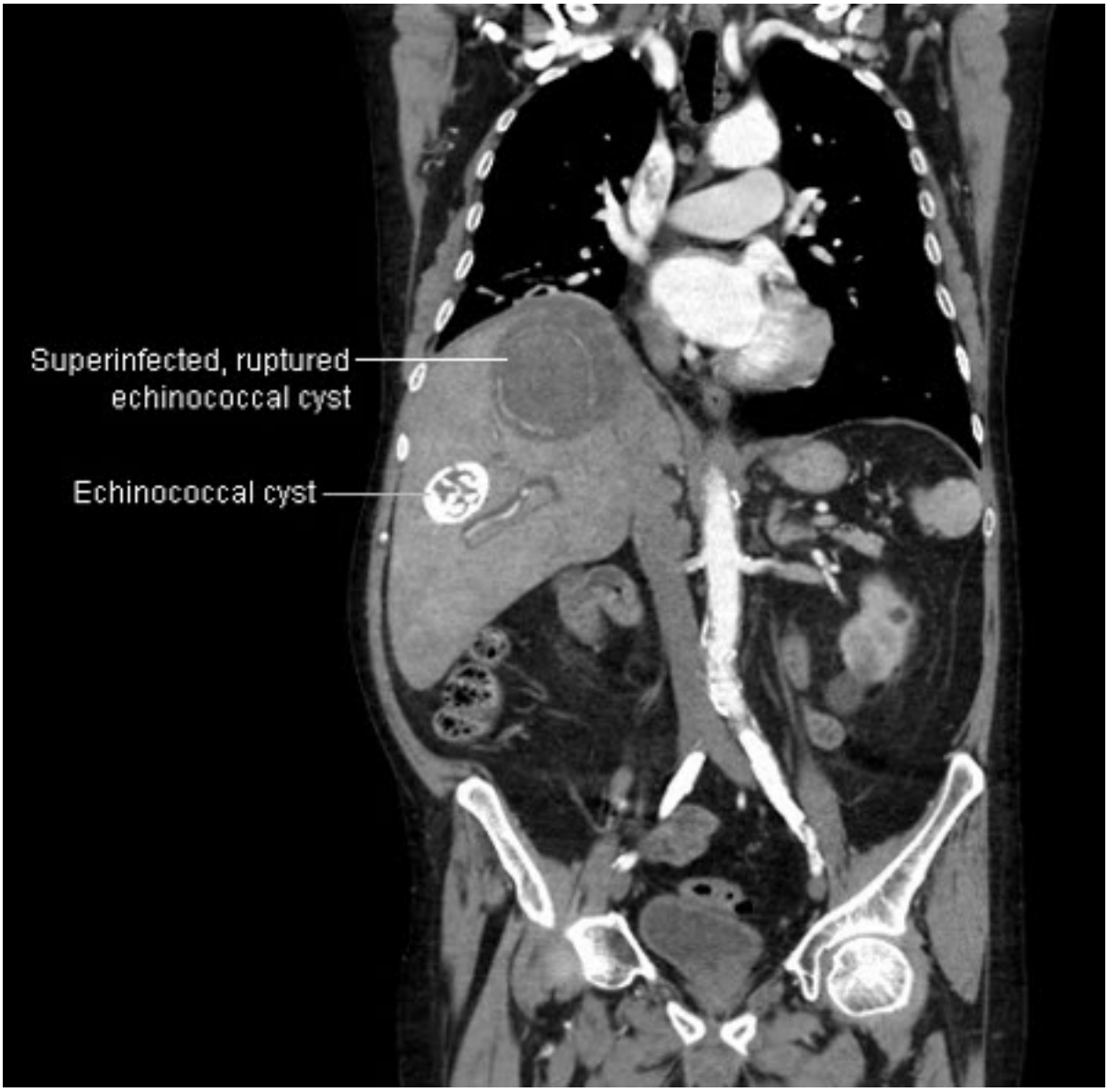

Figure 36: Liver abscess: CT scan showing 8 cm by 8 cm superinfected and ruptured echinococcal cyst, and a 4 cm by 4 cm echinococcal cyst in a 69-year-old man who presented with hypotension and chest pain radiating to the epigastric region

From the collection of MGH Massachusetts General Hospital radiology images

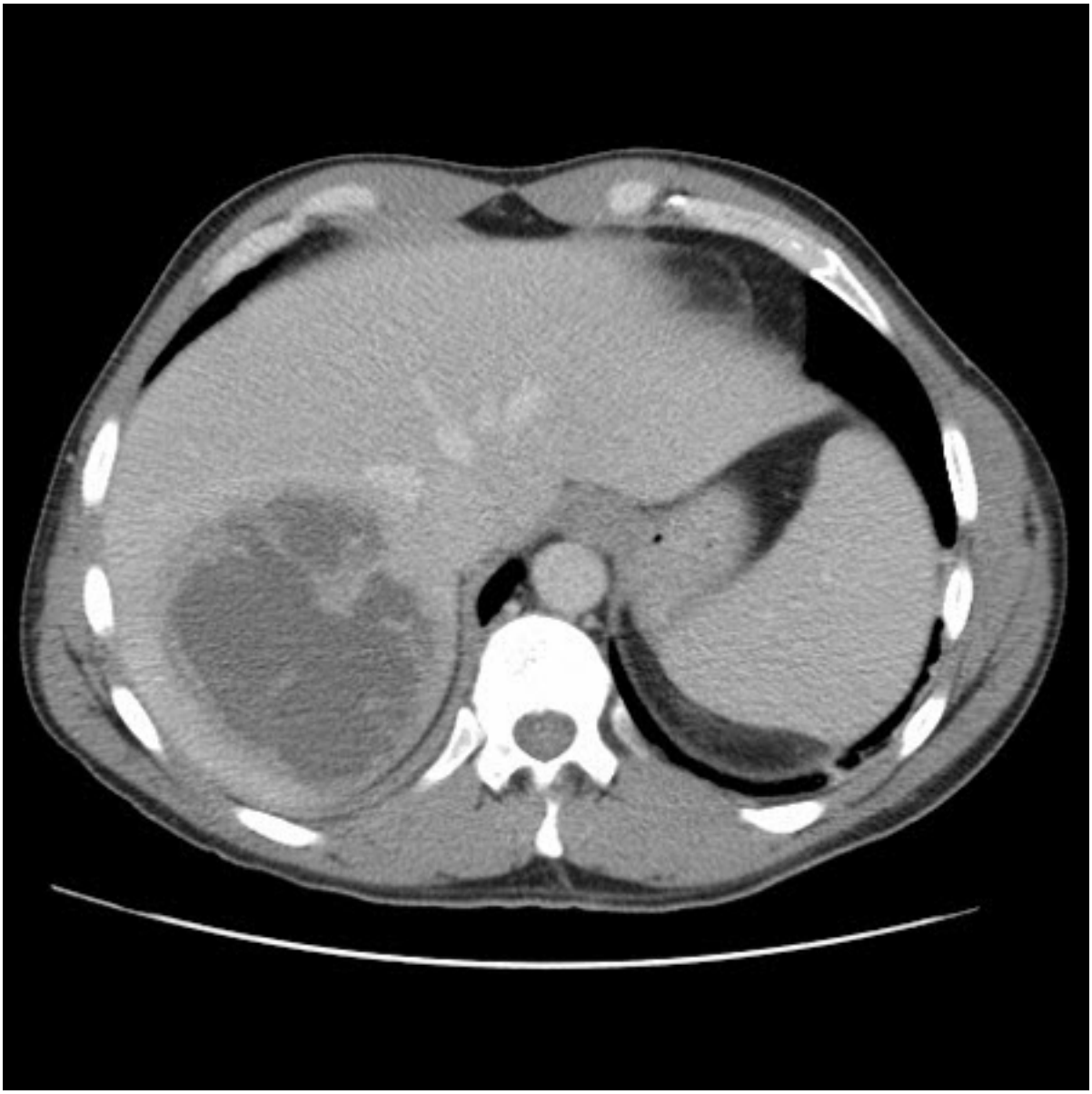

Figure 37: Liver abscess: CT scan (coronal view) showing liver abscess in a 46-year-old man who presented with fever, fatigue, and cough

From the collection of Massachusetts General Hospital radiology images

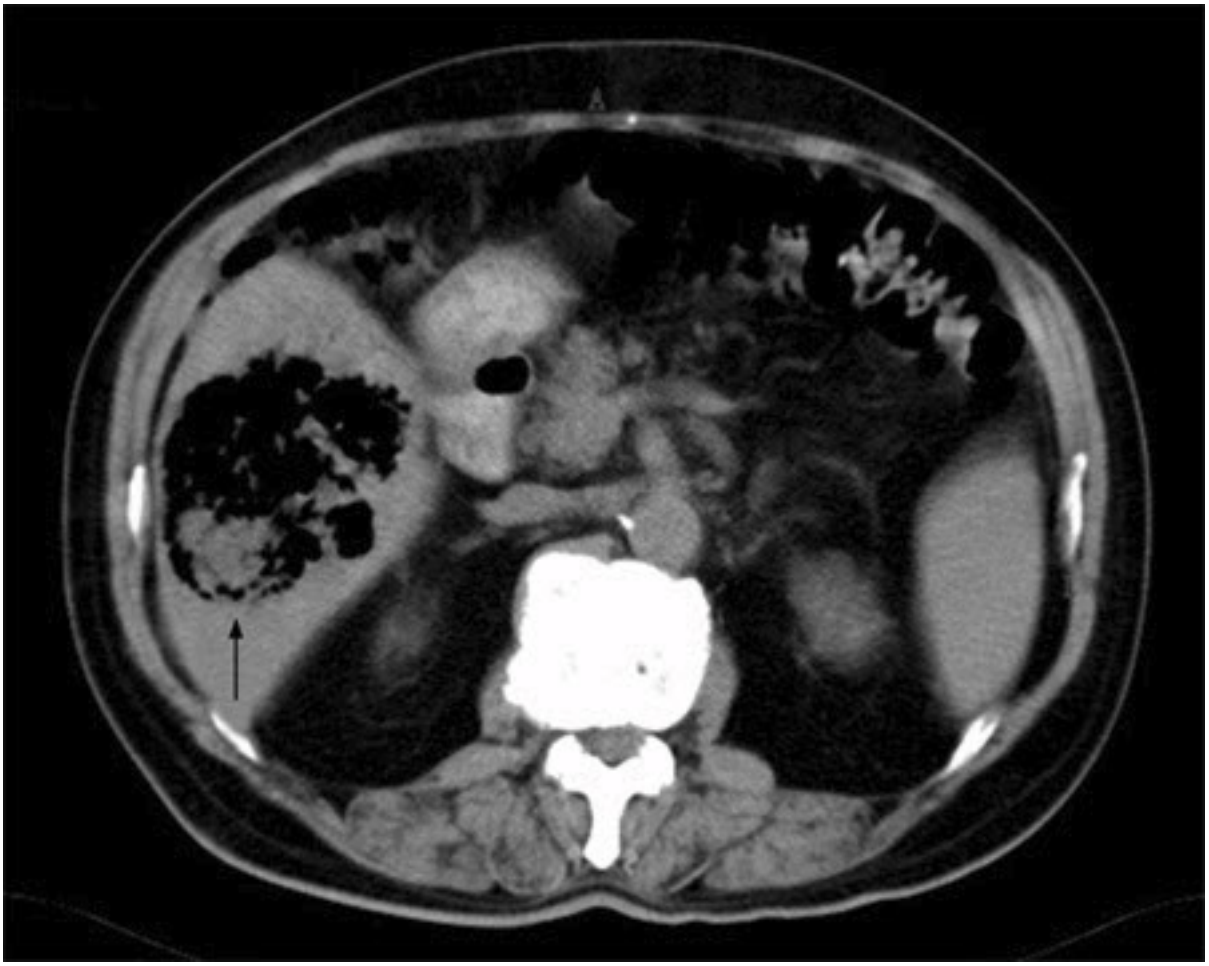

Figure 38: Liver abscess: A non-contrast abdominal CT scan showing a huge gas-containing liver abscess (arrow)

Adapted from BMJ Case Reports 2009 (doi:10.1136/bcr.08.2008.0638)

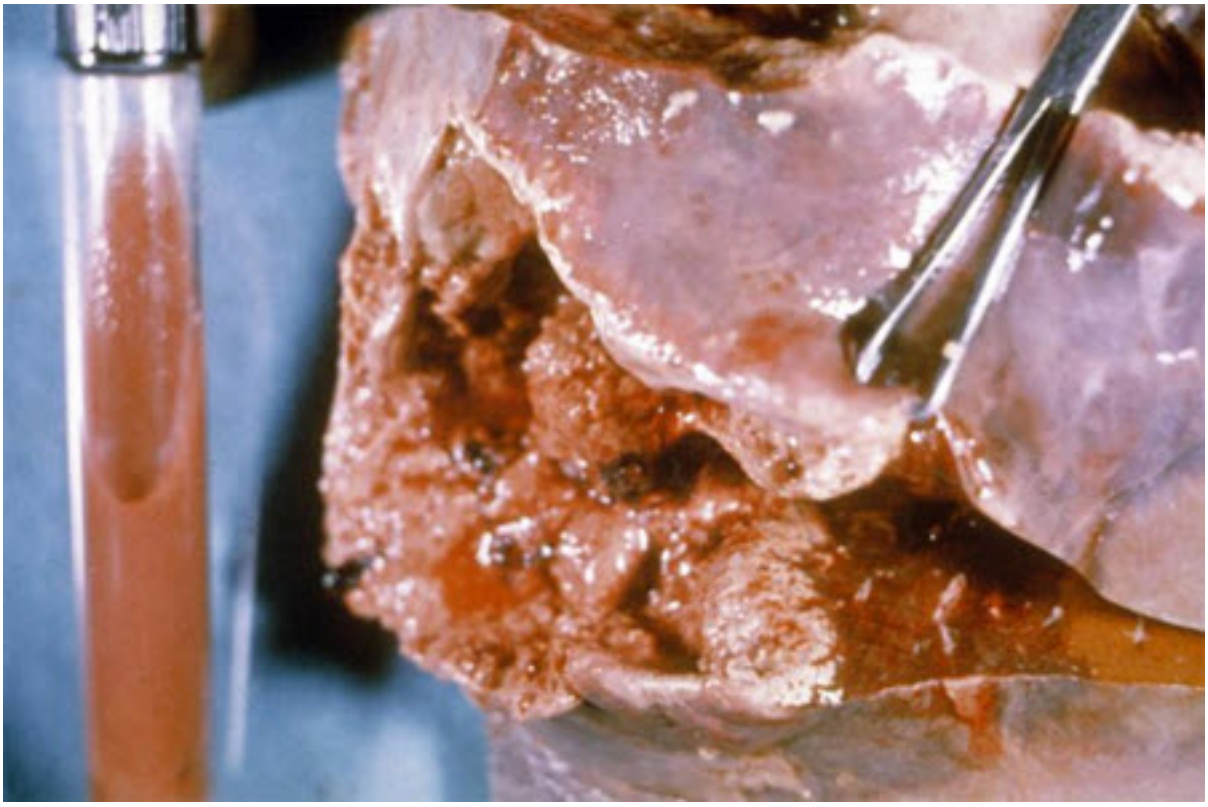

Figure 39: Liver abscess: Gross pathology of amoebic abscess of liver; tube of 'chocolate' pus from abscess

CDC; Dr. Mae Melvin; Dr E. West of Mobile, AL

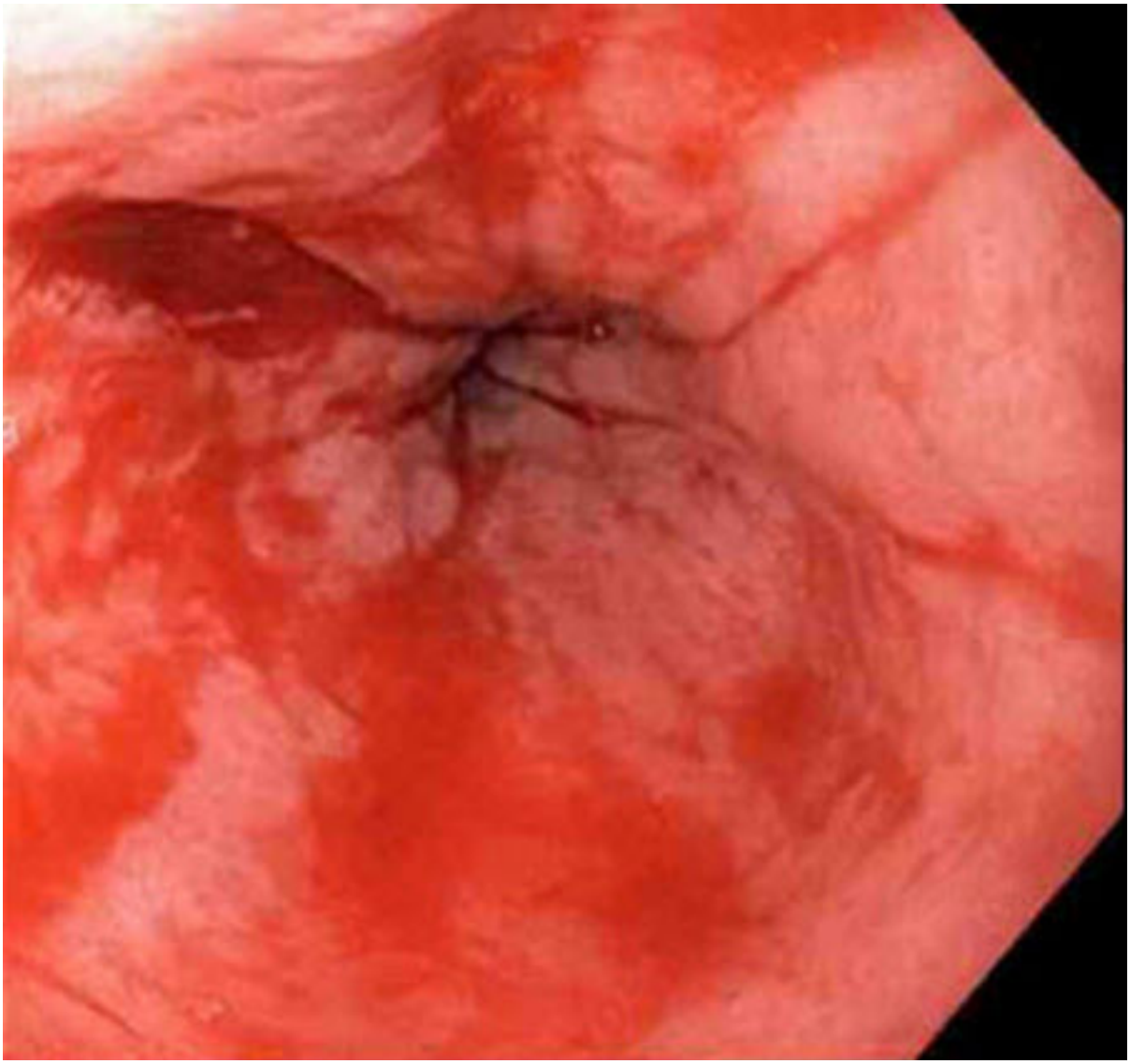

Figure 40: Mallory-Weiss tear: Actively bleeding tear appears as a red longitudinal defect with normal surrounding mucosa

From the collection of Juan Carlos Munoz, MD, University of Florida

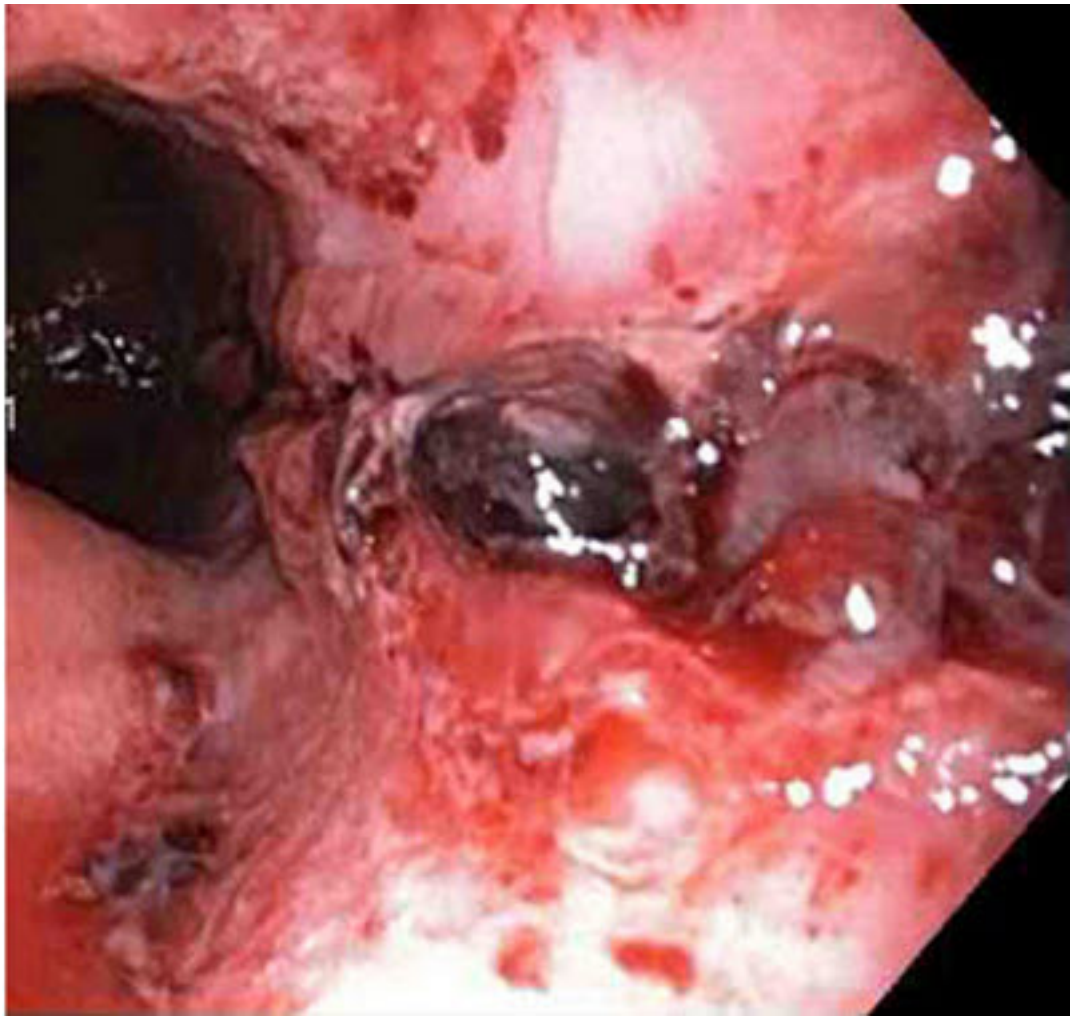

Figure 41: Mallory-Weiss tear: Non-bleeding adherent clot

From the collection of Juan Carlos Munoz, University of Florida

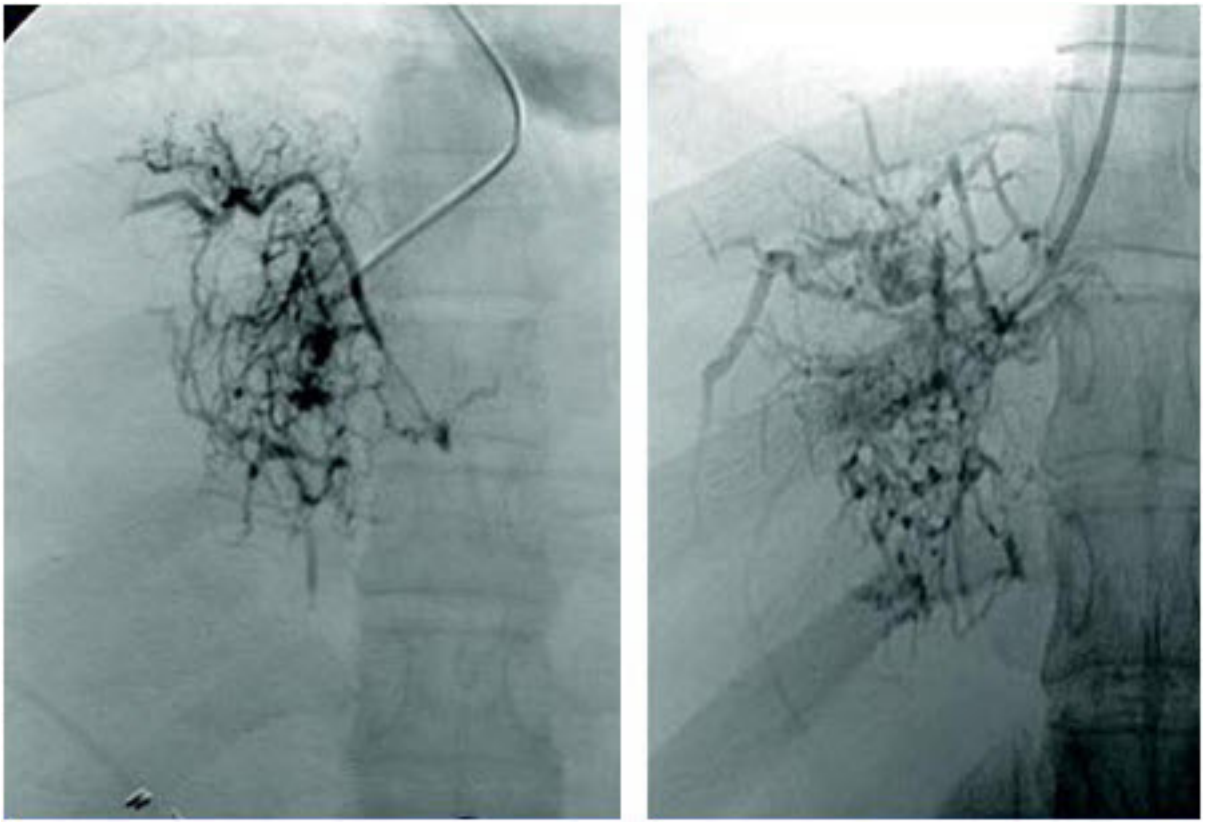

Figure 42: Budd-Chiari syndrome: Hepatic venogram demonstrating 'spider web' and thrombus in the inferior vena cava

Liver Transplantation Journal. 2006 Nov;12(11 suppl 2):S21-2; reprinted with permission of John Wiley & Sons, Inc

Figure 43: Clostridium difficile-associated disease: CT scan of the abdomen showing gross thickening of the large bowel wall and obliteration of the lumen

Yates B, Murphy CM, et al. Pseudomembranous colitis in four patients with cystic fibrosis following lung transplantation. BMJ Case Reports. 2009; doi: 10.1136/bcr.11.2008.1218

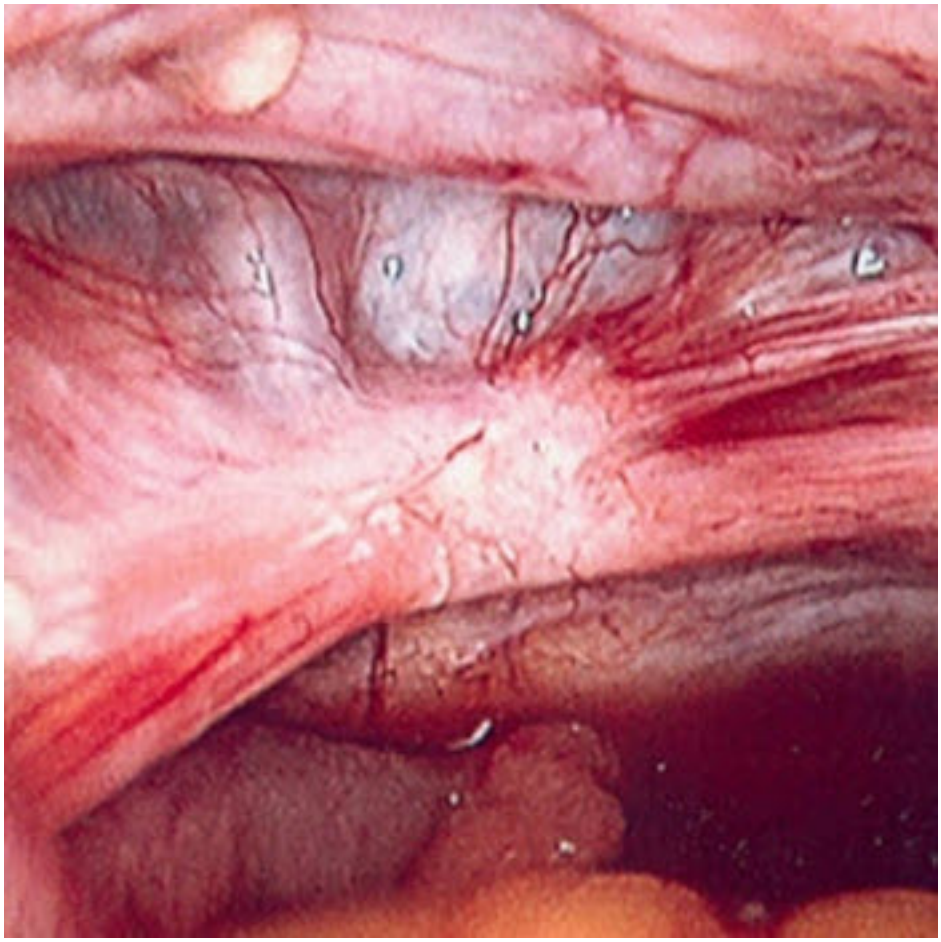

Figure 44: Endometriosis: Laparoscopic image of endometriotic nodule

From the collection of Dr Jonathon Solnik; used with permission

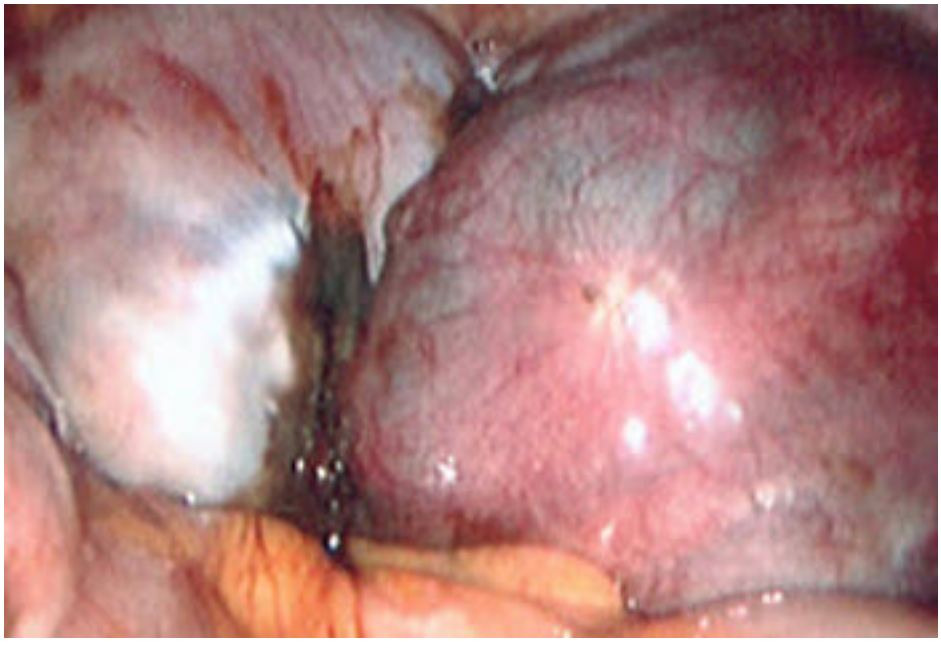

Figure 45: Endometriosis: Laparoscopic image of ovarian endometrioma

From the collection of Dr Jonathon Solnik; used with permission

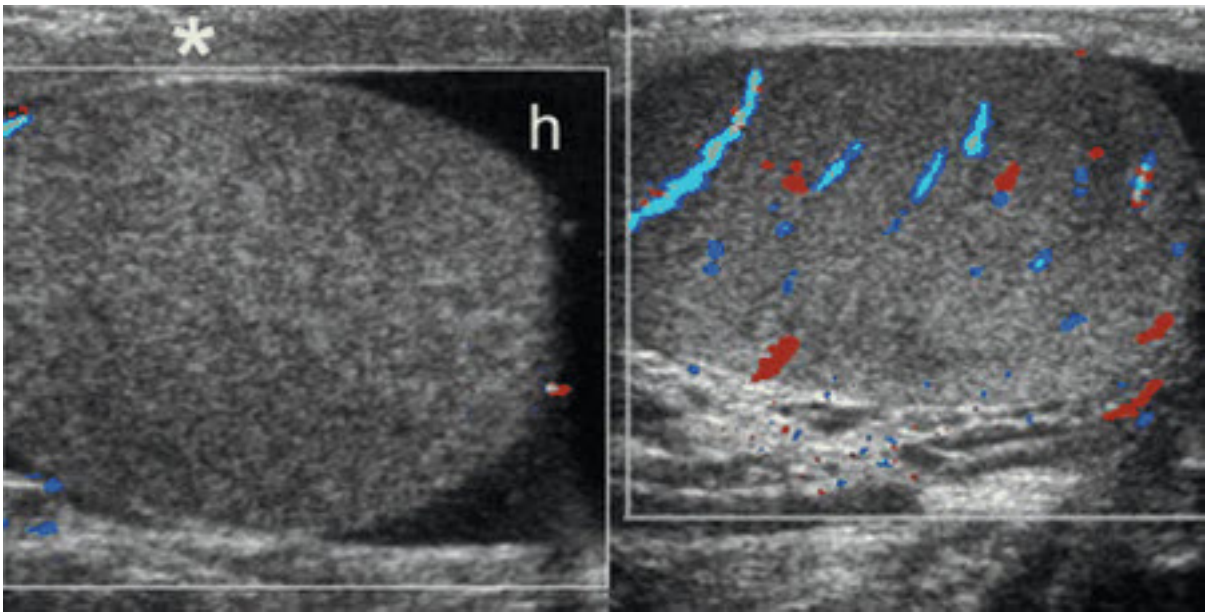

Figure 46: Testicular torsion: Bilateral transverse color Doppler images in a 12-year-old boy with right-sided scrotal pain of sudden onset, showing no colour flow signals in the right testis, which is enlarged and has heterogeneous echogenicity; reactive hydrocele (h) and thickening of the scrotal wall (*) are also seen; testicular torsion and bell clapper deformity were confirmed at surgery

Aso C, et al. Radiographics. 2005 Sep-Oct;25(5):1197-214; used with permission

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Please note that recommended formulations and doses may differ between drug databases drug names and brands, drug formularies, or locations. A local drug formulary should always be consulted for full prescribing information.

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Regardless of the language in which the content is displayed, numerals are displayed according to the original English-language numerical separator standard. For example 4 digit numbers shall not include a comma nor a decimal point; numbers of 5 or more digits shall include commas; and numbers stated to be less than 1 shall be depicted using decimal points. See Figure 1 below for an explanatory table.

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This approach is in line with the guidance of the International Bureau of Weights and Measures Service.

Figure 1 – BMJ Best Practice Numeral Style

5-digit numerals: 10,000

4-digit numerals: 1000

numerals < 1: 0.25

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