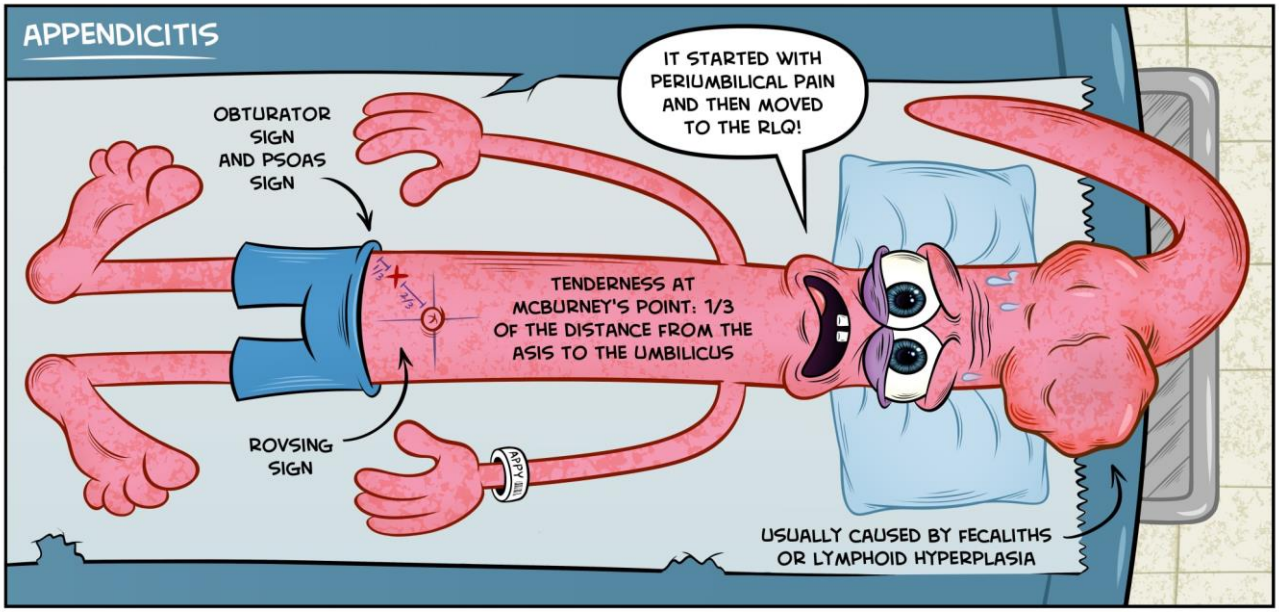


Abdominal Stomas

(See separate Stomas file)

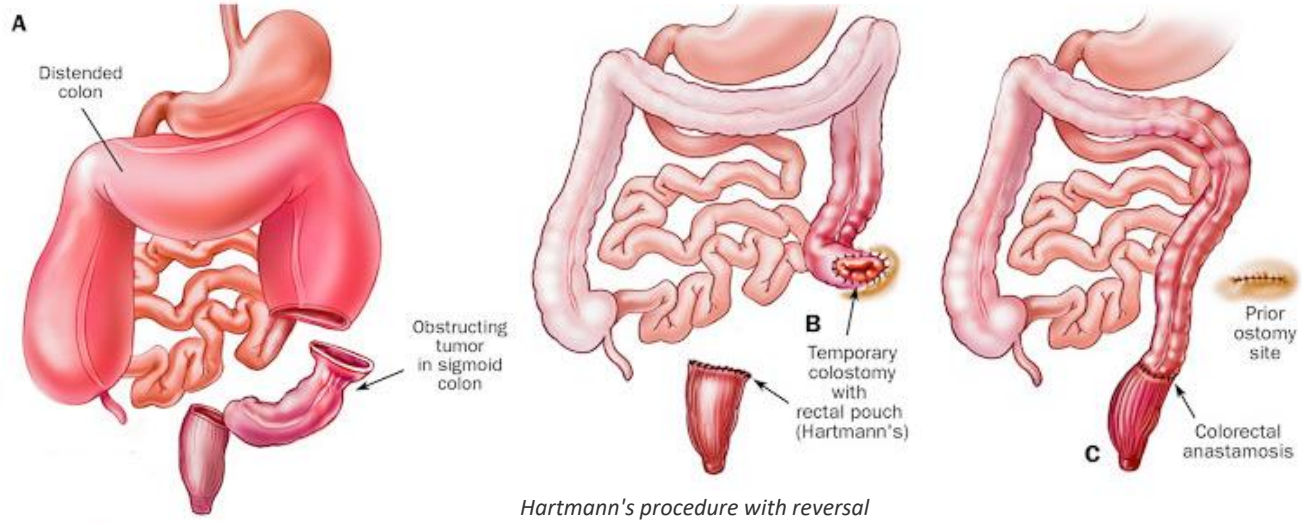
Stomas may be sited during a range of abdominal procedures and involve bringing the lumen or visceral contents onto the skin. In most cases this applies to the bowel. However, other organs or their contents may be diverted in case of need.

With bowel stomas the type method of construction and to a lesser extent the site will be determined by the contents of the bowel. In practice, small bowel stomas should be spouted so that their irritant contents are not in contact with the skin. Colonic stomas do not need to be spouted as their contents are less irritant.

In the ideal situation the site of the stoma should be marked with the patient prior to surgery. Stoma siting is important as it will ultimately influence the ability of the patient to manage their stoma and also reduce the risk of leakage. Leakage of stoma contents and subsequent maceration of the surrounding skin can rapidly progress into a spiraling loss of control of stoma contents.

Types of stomas

Name of stoma	Use	Common sites
Gastrostomy	• Gastric decompression or fixation • Feeding	Epigastrium
Loop jejunostomy	• Seldom used as very high output • May be used following emergency laparotomy with planned early closure	Any location according to need
Percutaneous jejunostomy	• Usually performed for feeding purposes and site in the proximal bowel	Usually left upper quadrant
Loop ileostomy	• Defunctioning of colon e.g. following rectal cancer surgery • Does not decompress colon (if ileocaecal valve competent)	Usually right iliac fossa
End ileostomy	• Usually following complete excision of colon or where ileocolic anastomosis is not planned • May be used to defunction colon, but reversal is more difficult	Usually right iliac fossa
End colostomy	Where a colon is diverted or resected and anastomosis is not primarily achievable or desirable	Either left or right iliac fossa
Loop colostomy	• To defunction a distal segment of colon • Since both lumens are present the distal lumen acts as a vent	May be located in any region of the abdomen, depending upon colonic segment used
Caecostomy	Stoma of last resort where loop colostomy is not possible	Right iliac fossa
Mucous fistula	• To decompress a distal segment of bowel following colonic division or resection • Where closure of a distal resection margin is not safe or achievable	May be located in any region of the abdomen according to clinical need

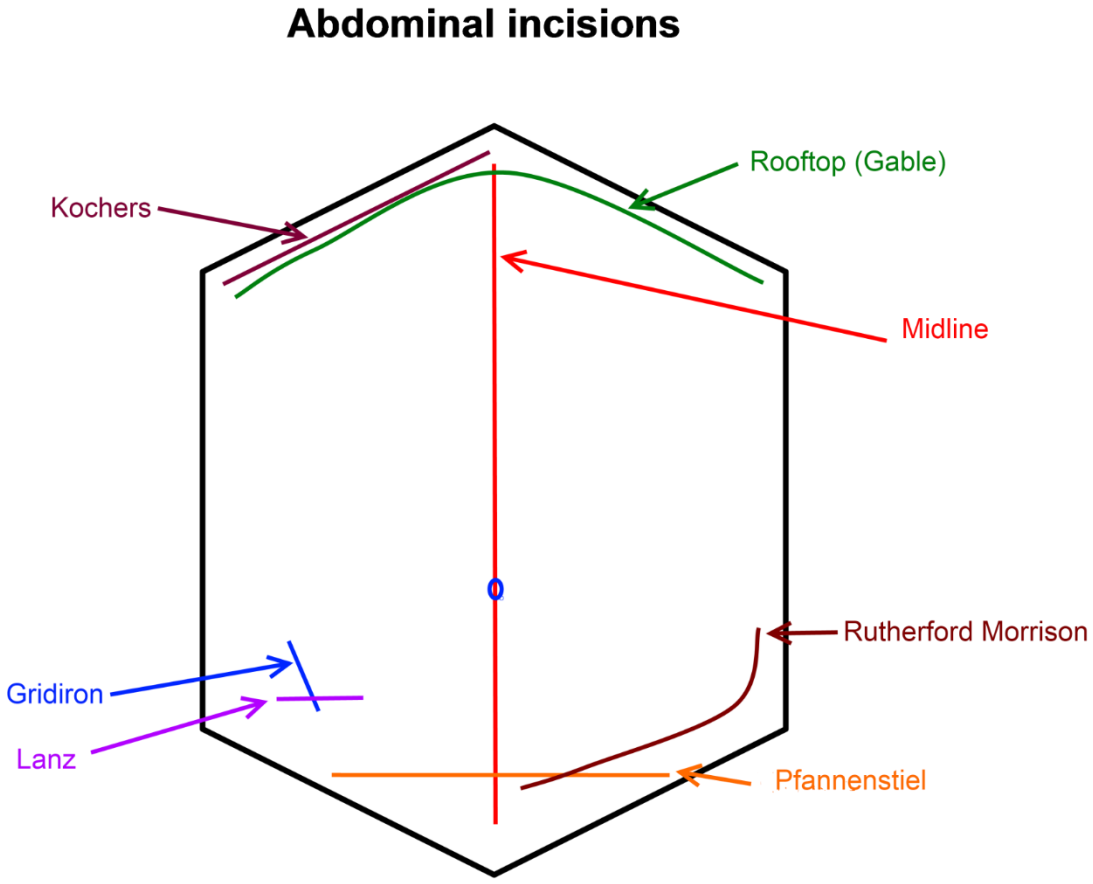


Hartmann's procedure with reversal

Abdominal Incisions

Midline incision	• Commonest approach to the abdomen • Structures divided: linea alba, transversalis fascia, extraperitoneal fat, peritoneum (avoid falciform ligament above the umbilicus) • Bladder can be accessed via an extraperitoneal approach through the space of Retzius
Paramedian incision	• Parallel to the midline (about 3-4cm) • Structures divided/retracted: anterior rectus sheath, rectus (retracted), posterior rectus sheath, transversalis fascia, extraperitoneal fat, peritoneum • Incision is closed in layers
Battle	• Similar location to paramedian but rectus displaced medially (and thus denervated) • Now seldom used
Kocher's	Incision under right subcostal margin e.g. Cholecystectomy (open)
Lanz	Incision in right iliac fossa e.g. Appendicectomy
Gridiron	Oblique incision centered over McBurney's point- usually appendicectomy (less cosmetically acceptable than Lanz
Gable	Rooftop/Chevron/Double Kocher incision e.g. Pancreatectomy, Liver transplantation
Pfannenstiel's	Transverse supra pubic, primarily used to access pelvic organs, C-section
McEvedy's	Groin incision e.g. Emergency repair strangulated femoral hernia
Rutherford Morrison	Extraperitoneal approach to left or right lower quadrants. Gives excellent access to iliac vessels and is the approach of choice for first time renal transplantation.

In neonates, laparotomy is performed via transverse supra umbilical incision.



Abdominal Compartment Syndrome

Background

Intra-abdominal pressure is the steady state pressure concealed within the abdominal cavity.

- In critically ill adults the normal intra-abdominal pressure = 5-7mmHg
- Intra-abdominal hypertension has pressures of 12-25mmHg
- Changes >15mmHg are associated with microvascular hypoperfusion
- Abdominal compartment syndrome is defined as **sustained intra-abdominal pressure >20mmHg coupled with new organ dysfunction / failure**
- It may occur either primarily without previous surgical intervention e.g. Following intestinal ischaemia or secondarily following a surgical procedure
- Diagnosis is typically made by transvesical pressure measurements coupled with an index of clinical suspicion.

Management

Once the diagnosis is made non operative measures should be instituted including:

- Gastric decompression
- Improve abdominal wall compliance e.g. muscle relaxants/ sedation
- Drain abdominal fluid collections.
- Consider fluid restriction/ diuretics if clinically indicated.

In those whom non operative treatment is failing; the correct treatment is laparotomy and laparostomy. Options for laparostomy are many although the Bogota bag or VAC techniques are the most widely practised. Re-look laparotomy and attempts at delayed closure will follow in due course.

Acute Abdominal Pain - Diagnoses

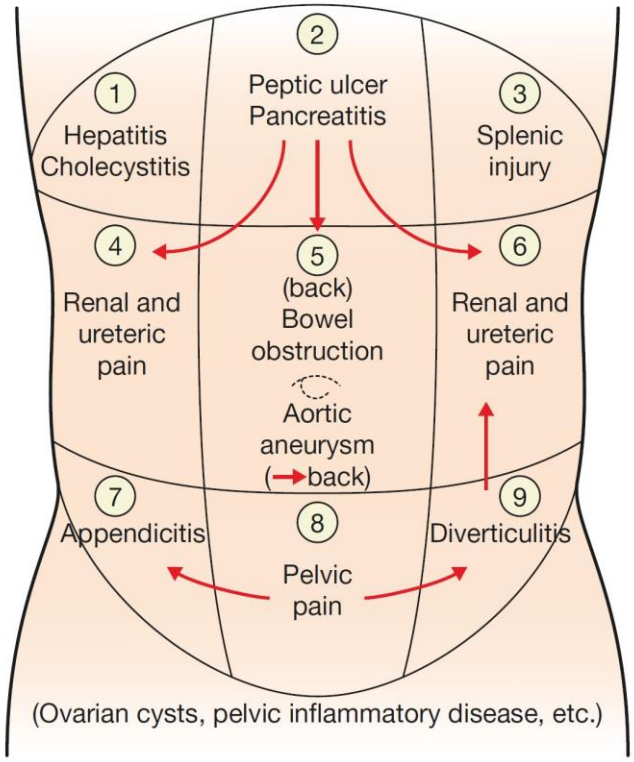
Pain is the most common of all abdominal symptoms and may be due to inflammatory, infective, obstructive, neoplastic or ischaemic pathology. Sometimes no organic cause can be found, a situation often labelled 'functional abdominal pain' for want of a better term.

Classic presentations of abdominal pathology

- Obstructive and inflammatory pathology must be excluded in patients with abdominal pain and altered bowel habit
- Closed-loop obstruction with tenderness in the right iliac fossa is indicative of imminent caecal rupture
- Caecal cancer classically presents with anaemia
- Patients who have had previous abdominal surgery may have adhesions
- Check carefully for small incarcerated hernias, particularly femoral, in obese patients

Nerves responsible for abdominal pain

- Abdominal wall and parietal peritoneum are supplied by the somatic nerves
- Abdominal organs and the visceral peritoneum are supplied by the autonomic nervous system
- Skin, muscles and parietal peritoneum are supplied by the iliohypogastric and ilioinguinal nerves and the lower six intercostal nerves
- Afferent pain fibres from the abdominal organs and visceral peritoneum travel with sympathetic nerves



Nine sites of abdominal pain: 1, right subcostal; 2, epigastrium; 3, left subcostal; 4, right flank; 5, periumbilical; 6, left flank; 7, right iliac fossa; 8, suprapubic/hypogastrium; 9, left iliac fossa.

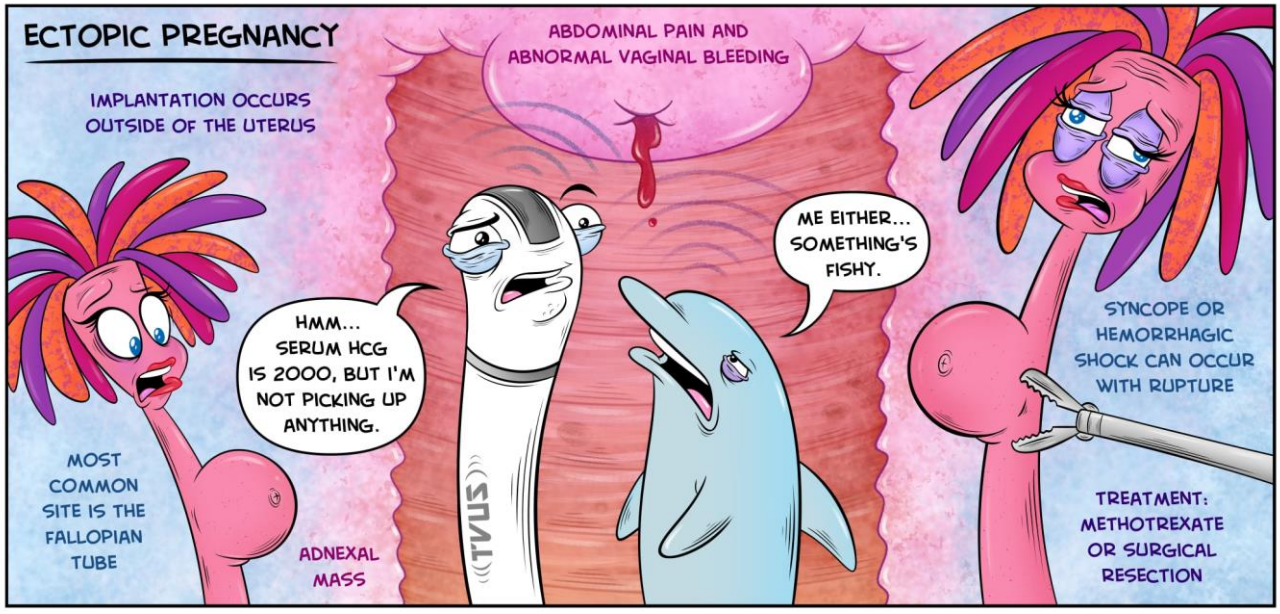
Conditions presenting with acute abdominal pain

Condition	Features	Investigations	Management
Appendicitis	History of migratory pain. Fever. Anorexia. Evidence of right iliac fossa tenderness. Mild pyrexia.	Differential white cell count Pregnancy test C-Reactive protein Amylase Urine dipstick testing	Appendicectomy
Mesenteric adenitis	Usually recent upper respiratory tract infection. High fever. Generalised abdominal discomfort- true localised pain and signs are rare.	FBC - may show slightly raised white cell count Urine dipstick often normal Abdominal USS - usually no free fluid	Conservative management- appendicectomy if diagnostic doubt
Mittelschmerz	Only seen in females Mid cycle pain Usually occurs two weeks after last menstrual period Pain usually has a supra-pubic location Usually subsides over a 24-48h period.	Full blood count- normal Urine dipstick- normal Abdominal and pelvic ultrasound- may show a trace of pelvic free fluid	Manage conservatively if doubt or symptoms fail to settle then laparoscopy
Fitz-Hugh Curtis syndrome	Disseminated infection with Chlamydia. Usually seen in females. Consists of evidence of PID together with peri-hepatic inflammation and subsequent adhesion formation.	Abdominal USS - may show free fluid High vaginal swabs - may show evidence of sexually transmitted infections	Usually medically managed- doxycycline or azithromycin
Abdominal aortic aneurysm *(ruptured)*	Sudden onset of abdominal pain radiating to the back in older adults (look for risk factors). Collapse. May be moribund on arrival in casualty, more stable if contained haematoma. Careful clinical assessment may reveal pulsatile mass.	Patients who are haemodynamically stable should have a CT scan	Unstable patients should undergo immediate surgery (unless it is not in their best interests). Those with evidence of contained leak on CT should undergo immediate surgery Increasing unruptured aneurysmal size is an indication for urgent surgical intervention (that can wait until the next working day)
Perforated peptic ulcer	Sudden onset of pain (usually epigastric). Often preceding history of upper abdominal pain. Soon develop generalised abdominal pain. On examination may have clinical evidence of peritonitis.	Erect CXR may show free air. A CT scan may be indicated where there is diagnostic doubt	Laparotomy (laparoscopic surgery for perforated peptic ulcers is both safe and feasible in experienced hands)
Intestinal obstruction	Colicky abdominal pain and vomiting (the nature of which depends on the level of the obstruction). Abdominal distension and constipation (again depending upon site of obstruction). Features of peritonism may occur where local necrosis of bowel loops is occurring.	A plain abdominal film may help with making the diagnosis. A CT scan may be useful where diagnostic uncertainty exists	In those with a virgin abdomen a lower and earlier threshold for laparotomy should exist than in those who may have adhesional obstruction
Mesenteric infarction	Embolic events present with sudden pain and forceful evacuation. Acute on chronic events usually have a longer history and previous weight loss. On examination the pain is typically greater than the physical signs would suggest.	Arterial pH and lactate Arterial phase CT scanning is the most sensitive test	Immediate laparotomy and resection of affected segments, in acute embolic events SMA embolectomy may be needed.

Gynaecological Causes of Abdominal Pain

In addition to routine diagnostic work up of abdominal pain, all female patients should also undergo a bimanual vaginal examination, urine pregnancy test and consideration given to abdominal and pelvic USS. When diagnostic doubt persists a laparoscopy provides a reliable method of assessing suspected tubulo-ovarian pathology.

Diagnosis	Features	Investigation	Treatment
Mittelschmerz	Usually mid cycle pain. Often sharp onset. Little systemic disturbance. May have recurrent episodes. Usually settles over 24-48 hours.	FBC - usually normal USS - may show small quantity of free fluid	Conservative
Endometriosis	25% asymptomatic, in a further 25% associated with other pelvic organ pathology. Remaining 50% may have menstrual irregularity, infertility, pain and deep dyspareunia. Complex disease may result in pelvic adhesional formation with episodes of intermittent small bowel obstruction. Intra-abdominal bleeding may produce localised peritoneal inflammation. Recurrent episodes are common.	USS - may show free fluid Laparoscopy will usually show lesions	Usually managed medically, complex disease will often require surgery and some patients will even require formal colonic and rectal resections if these areas are involved
Ovarian torsion	Usually sudden onset of deep seated colicky abdominal pain. Associated with vomiting and distress. Vaginal examination may reveal adnexal tenderness.	USS may show free fluid Laparoscopy is usually both diagnostic and therapeutic	Laparoscopy
Ectopic gestation	Symptoms of pregnancy without evidence of intra uterine gestation. Present as an emergency with evidence of rupture or impending rupture. Open tubular ruptures may have sudden onset of abdominal pain and circulatory collapse, in other the symptoms may be more prolonged and less marked. Small amount of vaginal discharge is common. There is usually adnexal tenderness.	Ultrasound showing no intra uterine pregnancy and beta HCG that is elevated May show intra-abdominal free fluid	Laparoscopy or laparotomy is haemodynamically unstable. A salphingectomy is usually performed.
Pelvic inflammatory disease (PID)	Bilateral lower abdominal pain associated with vaginal discharge. Dysuria may also be present. Peri-hepatic inflammation secondary to Chlamydia (Fitz Hugh Curtis Syndrome) may produce right upper quadrant discomfort. Fever >38°	FBC - Leucocytosis Pregnancy test negative (Although infection and pregnancy may co-exist) Amylase - usually normal or slightly raised High vaginal and urethral swabs	Usually medical management



Right Iliac Fossa Pain

Appendicitis	• Pain radiating to right iliac fossa • Anorexia (very common) • Short history • Diarrhoea and profuse vomiting rare
Crohn's disease	• Often long history • Signs of malnutrition • Change in bowel habit, especially diarrhoea
Mesenteric adenitis	• Mainly affects **children** • Causes include *Adenoviruses*, *Epstein Barr Virus*, *Beta-haemolytic Streptococcus*, *Staphylococcus spp.*, *Escherichia coli*, *Streptococcus viridans* and *Yersinia spp.* • Patients have a **higher temperature** than those with appendicitis • If laparotomy is performed, enlarged mesenteric lymph nodes will be present
Diverticulitis	• Both left and right sided disease may present with right iliac fossa pain • Clinical history may be similar, although some change in bowel habit is usual • When suspected, a CT scan may help in refining the diagnosis
Meckel's diverticulitis	• A Meckel's diverticulum is a congenital abnormality that is present in about 2% of the population • Typically 2 feet proximal to the ileocaecal valve • May be **lined by ectopic gastric** mucosal tissue and produce **bleeding** • May be asymptomatic if lined by ileal mucosa
Perforated peptic ulcer	• This usually produces upper quadrant pain but pain may be lower • Perforations typically have a sharp sudden onset of pain in the history
Incarcerated right inguinal / femoral hernia	• Usually only right iliac fossa pain if right sided or bowel obstruction.
Bowel perforation 2ry to caecal or colon carcinoma	• Seldom localised to right iliac fossa, although complete large bowel obstruction with caecal distension may cause pain prior to perforation.
Gynaecological causes	• Pelvic inflammatory disease / Salpingitis / Pelvic abscess / Ectopic pregnancy / Ovarian torsion / Threatened or complete abortion / Mittelschmerz
Urological causes	• Ureteric colic / UTI / Testicular torsion
Other causes	• TB / Typhoid / Herpes Zoster / AAA / Situs inversus

Abdominal Signs

A number of eponymous abdominal signs are noted. These include:

- Rovsing's sign - *appendicitis*
- Boas sign - *cholecystitis*
- Murphy's sign - *cholecystitis*
- Cullen's sign - *pancreatitis* (other intraabdominal haemorrhage)
- Grey-Turners sign - *pancreatitis* (or other retroperitoneal haemorrhage)

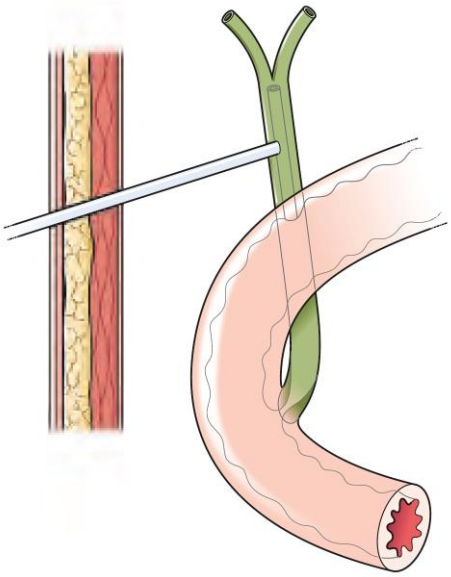
In clinical practice haemorrhagic pancreatitis is thankfully rare. The signs are important and thus shown below:

Cullen's sign

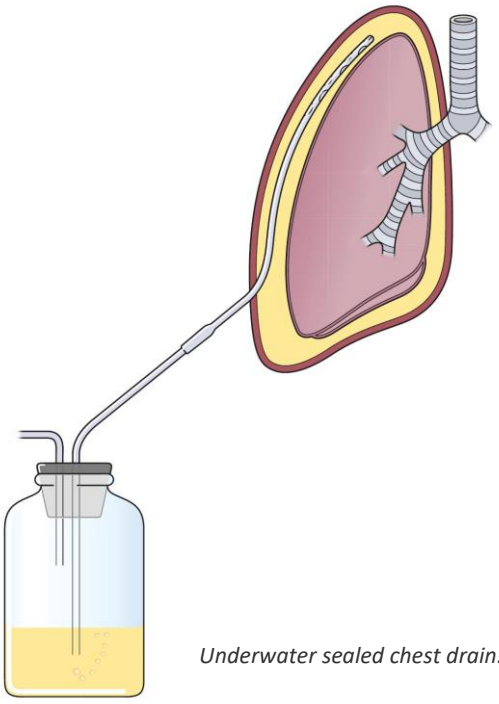
Grey Turner's sign

Drain Types

Type of drain	Features
Redivac	• Suction type of drain • Closed drainage system • High pressure vacuum system
Low pressure drainage systems	• Consist of small systems such as the lantern style drain that may be used for short term drainage of small wounds and cavities • Larger systems are sometimes used following abdominal surgery, they have a lower pressure than the redivac system, which decreases the risks of fistulation • May be emptied and re-pressurised
Latex tube drains	• May be shaped (e.g. T Tube) or straight • Usually used in non pressurised systems and act as sump drains • Most often used when it is desirable to generate fibrosis along the drain track (e.g. following exploration of the CBD)
Chest drains	• May be large or small diameter (depending on the indication) • Connected to underwater seal system to ensure one way flow of air
Corrugated drain	• Thin, wide sheet of plastic, usually soft • Contains corrugations, along which fluids can track



T-tube.



Underwater sealed chest drain.

Splenic Vein Thrombosis

Thrombosis of the splenic vein **may complicate pancreatitis**, pancreatic carcinoma, iatrogenic trauma and hypercoagulable diseases. The condition may predispose to the development of **gastric varices**, oesophageal varices are uncommon in splenic vein thrombosis alone.

Diagnosis is made by **CT angiography**.

Treatment is with **splenectomy**.

Diarrhoea

World Health Organization definitions

- Diarrhoea: > 3 loose or watery stool per day
- Acute diarrhoea < 14 days
- Chronic diarrhoea > 14 days

Acute Diarrhoea	
Gastroenteritis	May be accompanied by abdominal pain or nausea/vomiting
Diverticulitis	Classically causes left lower quadrant pain, diarrhoea and fever
Antibiotic therapy	More common with broad spectrum antibiotics *Clostridium difficile* is also seen with antibiotic use
Constipation causing overflow	A history of alternating diarrhoea and constipation may be given May lead to faecal incontinence in the elderly

Chronic Diarrhoea	
Irritable bowel syndrome	Extremely common. The most consistent features are abdominal pain, bloating and change in bowel habit. Patients may be divided into those with diarrhoea predominant IBS and those with constipation predominant IBS. Features such as lethargy, nausea, backache and bladder symptoms may also be present
Ulcerative colitis	Bloody diarrhoea may be seen. Crampy abdominal pain and weight loss are also common. Faecal urgency and tenesmus may occur
Crohn's disease	Crampy abdominal pains and diarrhoea. Bloody diarrhoea less common than in ulcerative colitis. Other features include malabsorption, mouth ulcers perianal disease and intestinal obstruction
Colorectal cancer	Symptoms depend on the site of the lesion but include diarrhoea, rectal bleeding, anaemia and constitutional symptoms e.g. Weight loss and anorexia
Coeliac disease	• *In children:* may present with failure to thrive, diarrhoea and abdominal distension • *In adults:* lethargy, anaemia, diarrhoea and weight loss are seen. Other autoimmune conditions may coexist

Other conditions associated with diarrhoea include:

- Thyrotoxicosis
- Laxative abuse
- Appendicitis with pelvic abscess or pelvic appendix
- Radiation enteritis

Diagnosis

- Stool culture
- Abdominal and digital rectal examination
- Consider colonoscopy (radiological studies unhelpful)
- Thyroid function tests, serum calcium, anti endomysial antibodies, glucose

Hernia

Hernias occur when a viscus or part of it protrudes from within its normal anatomical cavity. Specific hernias are covered under their designated titles the remainder are addressed here.

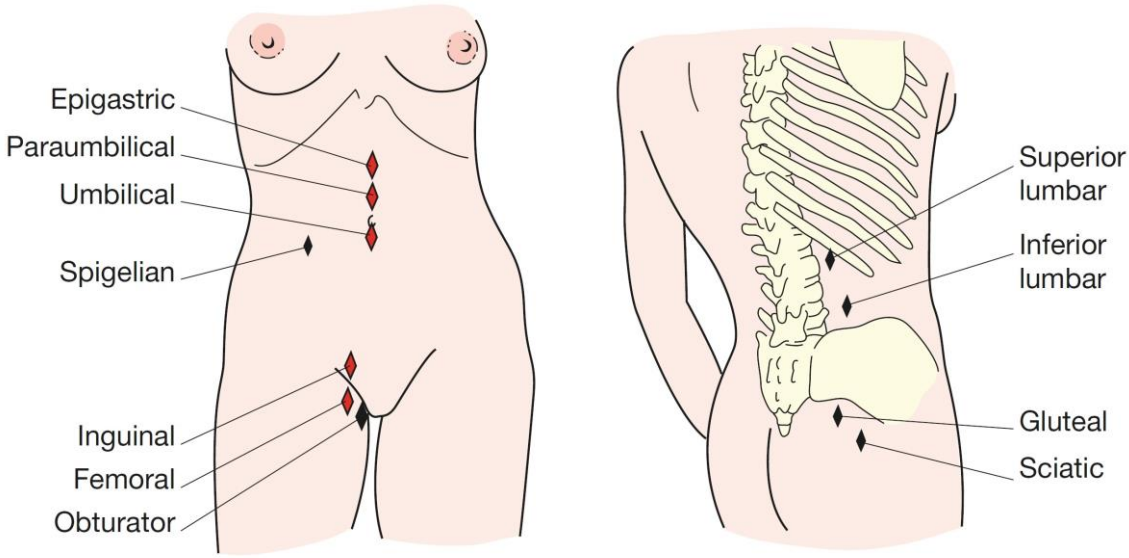


Diagram to show the sites of abdominal wall hernias, common in red and rare in black. Incisional and parastomal hernias can be found at various sites.

Spigelian hernia (lateral ventral hernia)

- Interparietal hernia occurring at the level of the **arcuate line**
- Rare
- May lie beneath internal oblique muscle. Usually between internal and external oblique
- Equal sex distribution
- Position is **lateral to rectus abdominis**
- Young patients usually present with intermittent pain, due to pinching of the fat, similar to an epigastric hernia. A lump may or may not be palpable because the fatty hernia is small and the overlying external oblique is intact.
- Older patients generally present with a reducible swelling at the edge of the rectus sheath and may have symptoms of intermittent obstruction
- Diagnosis should be suspected because of the location of the symptoms and is confirmed by CT. Ultrasonography has the advantage that it can be performed in the upright patient because no defect may be visible with the patient lying down.
- Surgery is recommended because the narrow and fibrous neck predisposes to strangulation
- Both open and laparoscopic repair are possible, the former in cases of strangulation

Spigelian hernia.

Lumbar hernia

- The lumbar triangle (through which these may occur) is bounded by:
  Crest of ilium (inferiorly), External oblique (laterally), Latissimus dorsi (medially)
- Primary lumbar herniae are rare, most are incisional hernias following renal surgery
- Direct anatomical repair with or without mesh re-enforcement is the procedure of choice

Inferior lumbar hernia, which contained caecum, appendix and small bowel. Note the filarial skin rash on the buttocks

Incisional hernia

- Occur through sites of surgical access into the abdominal cavity
- Most common following surgical wound infection
- To minimise following midline laparotomy **Jenkins Rule** should be followed and this necessitates a suture length 4x length of incision with bites taken at 1cm intervals, 1 cm from the wound edge
- Repair may be performed either at open surgery or laparoscopically and a wide variety of techniques are described

A large multilocular incisional hernia.

Umbilical hernia

- Hernia through weak umbilicus
- Usually presents in childhood
- Often symptomatic
- Equal sex incidence
- 95% will resolve by the age of 2 years
- Surgery performed after the third birthday

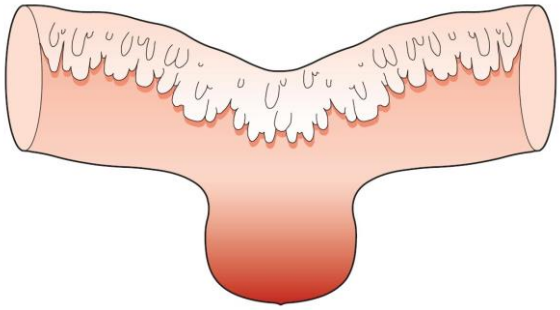
A small paraumbilical hernia.

Paraumbilical hernia

- Usually a condition of adulthood
- Defect is in the linea alba
- More common in females
- Multiparity and obesity are risk factors
- Traditionally repaired using Mayo's technique - overlapping repair, mesh may be used though not if small bowel resection is required owing to acute strangulation

Richter's hernia

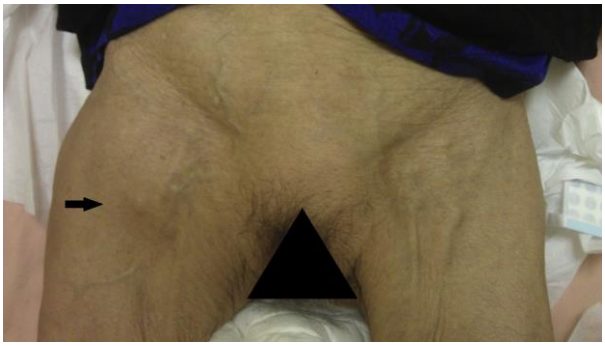
- Condition in which part of the wall of the small bowel (usually the anti-mesenteric border) is strangulated within a hernia (of any type)
- They do not present with typical features of intestinal obstruction as luminal patency is preserved
- Where vomiting is prominent it usually occurs as a result of paralytic ileus from peritonitis (as these hernias may perforate)



Diagrammatic representation of gangrenous Richter's hernia from a case of strangulated femoral hernia.

Obturator hernia

- Herniation through the obturator canal
- Commoner in old females
- Usually lies behind pectineus muscle
- Elective diagnosis is unusual most will present acutely with obstruction
- When presenting acutely most cases with require laparotomy or laparoscopy (and small bowel resection if indicated)



Obturator Hernia. When the patient was lying down, a lump (arrow) was noted over her right inguinal area.

Littre's hernia

- Hernia containing Meckels diverticulum
- Resection of the diverticulum is usually required and this will preclude a mesh repair

A Meckel's diverticulum is a persistent remnant of the vitellointestinal duct and is present in about 2% of the population. It contains all three coats of the bowel wall and has its own blood supply. It may be vulnerable to obstruction and inflammation in the same way as the appendix.

Bochdalek hernia

- Typically congenital diaphragmatic hernia
- 85% cases are located in the left hemi diaphragm
- Associated with lung hypoplasia on the affected side
- More common in males
- Associated with other birth defects
- May contain stomach
- May be treated by direct anatomical apposition or placement of mesh. In infants that have severe respiratory compromise mechanical ventilation may be needed and mortality rate is high

Morgagni Hernia

- Rare type of diaphragmatic hernia (approx. 2% cases)
- Herniation through foramen of Morgagni
- Usually located on the right and tend to be less symptomatic
- More advanced cases may contain transverse colon
- As defects are small pulmonary hypoplasia is less common
- Direct anatomical repair is performed

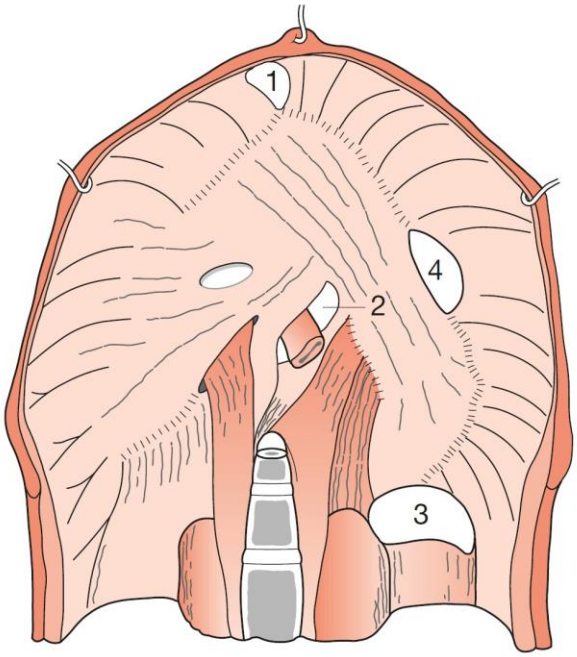


Diagram of sites of hernias. The usual sites of congenital diaphragmatic hernia:
1, foramen of Morgagni;
2, oesophageal hiatus;
3, foramen of Bochdalek (pleuroperitoneal hernia);
4, dome.

Chest x-ray of congenital diaphragmatic hernia. Foramen of Bochdalek hernia on the left side in an infant. The left pleural cavity is occupied by intestine, the mediastinum is displaced to the right and the right lung is aerated very little.

Chest x-ray of congenital diaphragmatic hernia. Colon occupying a Morgagni hernia

Abdominal Wound Dehiscence

- This is a significant problem facing all surgeons who undertake abdominal surgery on a regular basis. Traditionally, it is said to occur when all layers of an abdominal mass closure fail and the viscera protrude externally (associated with 30% mortality).
- It can be subdivided into **superficial**, in which the skin wound alone fails and **complete**, implying failure of all layers.

Risk factors

General • Malnourishment • Diabetes • Obesity • Renal failure • Jaundice • Sepsis • Cancer • Treatment with steroids
Local • Inadequate or poor closure of wound • Poor local wound healing, e.g. because of infection, haematoma or seroma • Increased intra-abdominal pressure, e.g. in postoperative patients suffering from chronic obstructive airway disease, during excessive coughing

When sudden full dehiscence occurs the management is as follows:

- Analgesia
- Intravenous fluids
- Intravenous broad spectrum antibiotics
- Coverage of the wound with saline impregnated gauze (on the ward)
- Arrangements made for a return to theatre

Surgical strategy

- Correct the underlying cause (e.g. TPN or NG feed if malnourished)
- Determine the most appropriate strategy for managing the wound

Options

Resuturing of the wound	This may be an option if the wound edges are healthy and there is enough tissue for sufficient coverage. Deep tension sutures are traditionally used for this purpose.
Application of a wound manager	This is a clear dressing with removable front. Particularly suitable when some granulation tissue is present over the viscera or where there is a high output bowel fistula present in the dehisced wound.
Application of a 'Bogota bag'	This is a clear plastic bag that is cut and sutured to the wound edges and is only a temporary measure to be adopted when the wound cannot be closed and will necessitate a return to theatre for definitive management.
Application of a VAC dressing system	These can be safely used BUT ONLY if the correct layer is interposed between the suction device and the bowel. Failure to adhere to this absolute rule will almost invariably result in the development of multiple bowel fistulae and create an extremely difficult management problem.

Malabsorption

Malabsorption is characterised by diarrhoea, steatorrhoea and weight loss. Causes may be broadly divided into intestinal (e.g. villous atrophy), pancreatic (deficiency of pancreatic enzyme production or secretion) and biliary (deficiency of bile-salts needed for emulsification of fats)

Intestinal causes of malabsorption

- Coeliac disease
- Crohn's disease
- Tropical sprue
- Whipple's disease
- Giardiasis
- Brush border enzyme deficiencies (e.g. Lactase insufficiency)

Pancreatic causes of malabsorption

- Chronic pancreatitis
- Cystic fibrosis
- Pancreatic cancer

Biliary causes of malabsorption

- Biliary obstruction
- Primary biliary cirrhosis

Other causes

- Bacterial overgrowth (e.g. Systemic sclerosis, diverticulae, blind loop)
- Short bowel syndrome
- Lymphoma

Mesenteric Vessel Disease

Mesenteric ischaemia accounts for 1 in 1000 acute surgical admissions. It is primarily caused by arterial embolism resulting in infarction of the colon. It is more likely to occur in areas such as the splenic flexure that are located at the borders of the territory supplied by the superior and inferior mesenteric arteries.

Types

Acute mesenteric embolus (commonest 50%)	• Sudden onset abdominal pain followed by profuse diarrhoea. • May be associated with vomiting. • Rapid clinical deterioration. • Serological tests: WCC, lactate, amylase may all be abnormal particularly in established disease. These can be normal in the early phases.
Acute on chronic mesenteric ischaemia	• Usually longer prodromal history. • Post prandial abdominal discomfort and weight loss are dominant features. Patients will usually present with an acute on chronic event, but otherwise will tend not to present until mesenteric flow is reduced by greater than 80%. • When acute thrombosis occurs presentation may be as above. In the chronic setting the symptoms will often be those of ischaemic colitis (mucosa is the most sensitive area to this insult).
Mesenteric vein thrombosis	• Usually a history over weeks. • Mesenteric vein thrombosis **may complicate severe intra-abdominal sepsis** and when it progresses may impair bowel perfusion. • Overt abdominal signs and symptoms will not occur until venous thrombosis has reached a stage to compromise arterial inflow. • Thrombophilia accounts for 60% of cases.
Low flow mesenteric infarction	• This occurs in patients with multiple co morbidities in whom mesenteric perfusion is significantly compromised by overuse of inotropes or background cardiovascular compromise. • The end result is that the bowel is not adequately perfused and infarcts occur from the mucosa outwards.

Diagnosis

- Serological tests: WCC, lactate, CRP, amylase (can be normal in early disease).
- Cornerstone for diagnosis of arterial AND venous mesenteric disease is **CT angiography** scanning in the arterial phase with thin slices (<5mm). Venous phase contrast is not helpful.
- SMA duplex USS is useful in the evaluation of proximal SMA disease in patients with chronic mesenteric ischaemia.
- MRI is of limited use due to gut peristalsis and movement artefact.

Management

- *Overt signs of peritonism:* **Laparotomy**
- *Mesenteric vein thrombosis:* If no peritonism: Medical management with **IV heparin**
- At operation limited resection of frankly necrotic bowel with view to relook laparotomy at 24-48h. In the interim urgent bowel revascularisation via endovascular (preferred) or surgery.

Prognosis

Overall poor. Best outlook is from an acute ischaemia from an embolic event where surgery occurs within 12h. Survival may be 50%. This falls to 30% with treatment delay. The other conditions carry worse survival figures.

Abdominal Radiology

Plain abdominal x-rays are often used as a first line investigation in patients with acute abdominal pain. A plain abdominal film may demonstrate free air, evidence of bowel obstruction and possibly other causes of pain (e.g. renal or gallbladder stones).
Investigation of potential visceral perforation is usually best performed by obtaining an erect chest x-ray, as this is a more sensitive investigation for suspected visceral perforation than recumbent films.

Features which are usually abnormal

- Large amounts of free air (colonic perforation), smaller volumes seen with more proximal perforations.
- A positive Rigler sign (gas on both sides of the bowel wall).
- Caecal diameter of >8cm
- Fluid levels in the colon
- Ground glass appearance to film (usually due to large amounts of free fluid).
- Sentinel loop in patients with inflammation of other organs (e.g. pancreatitis).

Features which should be expected/ or occur without pathology

- In Chilaiditi's sign, a loop of bowel may be interposed between the liver and diaphragm, giving the mistaken impression that free air is present.
- Following ERCP (and sphincterotomy) air may be identified in the biliary tree.
- Free intra-abdominal air following laparoscopy / laparotomy, although usually dissipates after 48-72 hours.

Irritable Bowel Syndrome (IBS)

The diagnosis of irritable bowel syndrome is made according to the ROME III diagnostic criteria which state:

Recurrent abdominal pain or discomfort at 3 days per month for the past 3 months associated with two or more of the following:

- Improvement with defecation.
- Onset associated with a change in the frequency of stool.
- Onset associated with a change in the form of the stool.

Features such as lethargy, nausea, backache and bladder symptoms may also support the diagnosis

Red flag features should be inquired about:

- Rectal bleeding
- Unexplained/unintentional weight loss
- Family history of bowel or ovarian cancer
- Onset after 60 years of age

Suggested investigations are:

- Full blood count
- ESR/CRP
- Coeliac disease screen (tissue transglutaminase antibodies)
- Colonoscopy (if worrying symptoms, positive family history)
- Thyroid function tests
- Glucose (ensure not diabetic)

The NICE criteria state that blood tests alone will suffice in people fulfilling the diagnostic criteria. We would point out that luminal colonic studies should be considered early in patients with altered bowel habit referred to hospital and a diagnosis of IBS should still be largely one of exclusion.

Treatment

- Usually reduce fibre intake.
- Tailored prescriptions of laxatives or loperamide according to clinical picture.
- Dietary modification (caffeine avoidance, less carbonated drinks).
- Consider low dose tricyclic antidepressants if pain is a dominant symptom.
- Biofeedback may help.

Splenic Trauma

- The spleen is one of the more commonly injured intra-abdominal organs
- In most cases the spleen can be conserved. The management is dictated by the associated injuries, haemodynamic status and extent of direct splenic injury.

Management of splenic trauma

Conservative	Small subcapsular haematoma Minimal intra-abdominal blood No hilar disruption
Laparotomy with conservation	Increased amounts of intraabdominal blood Moderate haemodynamic compromise Tears or lacerations affecting <50%
Resection	Hilar injuries Major haemorrhage Major associated injuries

Splenectomy Technique

Trauma

- GA
- Long midline incision
- If time permits insert a self-retaining retractor (e.g. Balfour/ omnitract)
- Large amount of free blood is usually present. Pack all 4 quadrants of the abdomen. Allow the anaesthetist to 'catch up'
- Remove the packs and assess the viability of the spleen. Hilar injuries and extensive parenchymal lacerations will usually require splenectomy.
- Divide the short gastric vessels and ligate them.
- Clamp the splenic artery and vein. Two clamps on the patient side are better and allow for double ligation and serve as a safety net if your assistant does not release the clamp smoothly.
- Be careful not to damage the tail of the pancreas, if you do then this will need to be formally removed and the pancreatic duct closed.
- Wash out the abdomen and place a tube drain to the splenic bed.
- Some surgeons implant a portion of spleen into the omentum, whether you decide to do this is a matter of personal choice.
- Post operatively the patient will require prophylactic penicillin V and pneumococcal vaccine.

Elective

Elective splenectomy is a very different operation from that performed in the emergency setting. The spleen is often large (sometimes massive). Most cases can be performed laparoscopically. The spleen will often be macerated inside a specimen bag to facilitate extraction.

Complications

- Haemorrhage (may be early and either from short gastrics or splenic hilar vessels
- Pancreatic fistula (from iatrogenic damage to pancreatic tail)
- Thrombocytosis: prophylactic aspirin
- Encapsulated bacteria infection e.g. *Strep. pneumoniae*, *Haemophilus influenzae* and *Neisseria meningitidis*