78 Intestinal obstruction

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ADYNAMIC OBSTRUCTION

Paralytic ileus

ADYNAMIC OBSTRUCTION Paralytic ileus

This may be defined as a state in which there is failure of trans mission of peristaltic waves secondary to neuromuscular failure (i.e. in the myenteric [Auerbach’s] and submucous [Meissner’s] plexuses). The resultant stasis leads to accumulation of fluid and gas within the bowel, with associated distension, vomiting, absence of bowel sounds and absolute constipation. Varieties The following varieties are recognised: /uni25CF Postoperative : a degree of ileus usually occurs after any abdominal procedure and is self-limiting, with a variable Leopold Auerbach , 1828–1897, Professor of Neuropathology , Breslau, Germany (now Wroc ł aw , Poland), described the myenteric plexus in 1862. Georg Meissner , 1829–1905, Professor of Physiology , Göttingen, Germany , described the submucous plexus of the alimentary tract in 1852. - - - - duration of 24–72 hours. Postoperative ileus may be pro - longed in the presence of hypoproteinaemia or metabolic - abnormality .) and /uni25CF Infection : intra-abdominal sepsis may give rise to local - ised or generalised ileus. /uni25CF Reflex ileus : this may occur following fractures of the spine or ribs, retroperitoneal haemorrhage or even the ap - plication of a plaster jacket. /uni25CF Metabolic : uraemia and hypokalaemia are the most common contributory factors. Clinical features - Paralytic ileus takes on a clinical significance if, 72 hours after laparotomy: /uni25CF there has been no return of bowel sounds on auscultation; /uni25CF there has been no passage of flatus. Abdominal distension becomes more marked and tym - panitic. Colicky pain is not a feature. Distension increases pain from the abdominal wound. In the absence of gastric aspiration, e ff ortless vomiting may occur. Radiologically , the abdomen shows gas-filled loops of intestine with multiple fluid levels (if an erect film is felt necessary). Management Nasogastric tubes are not required routinely after elective - intra-abdominal surgery . Paralytic ileus is managed with the use of nasogastric suction and restriction of oral intake until bowel sounds and the passage of flatus return. Electrolyte balance must be maintained. The use of an enhanced recov - ery programme with early introduction of fluids and solids is, however, becoming increasingly popular (see Chapter 73). Specific treatment is directed towards the cause, but the follo wing general principles apply: /uni25CF If a primary cause is identified this must be treated. /uni25CF Gastrointestinal distension must be relieved by decompres - sion.

Figure 78.21 Gross functional colonic distension.

/uni25CF There is no convincing evidence for the use of prokinetic drugs to treat postoperative adynamic ileus. /uni25CF If paralytic ileus is prolonged CT scanning will demon strate any intra-abdominal sepsis or mechanical obstruc tion and therefore guide any requirement for laparotomy . The decision to take a patient back to theatre in these circumstances is always di ffi cult. The need for a laparotomy becomes increasingly likely the longer the bowel inactivity per sists, particularly if

it lasts for more than 7 days or if bowel activity recommences following surgery and then ceases.

Acute intestinal obstruction of the newborn

Acute intestinal obstruction of the newborn

Neonatal intestinal obstruction has many potential causes. Congenital atresia and stenosis are the most common. Intestinal malrotation with midgut volvulus, meconium ileus, Hirschsprung's disease, imperforate anus, necrotising enterocolitis and an incarcerated inguinal hernia may also be responsible. Many of these conditions are discussed in Chapters 17 and 18 . Intestinal atresia Duodenal atresia and stenosis are the most common forms of intestinal obstruction in the newborn (see Chapter 18). Jejunal or ileal atresias are next in frequency whereas colonic atresia is rare. The possibility of multiple atresias makes intraoperative assessment of the whole small and large bowel mandatory . As with all congenital anomalies, associated malformations are common and should be excluded. There are four main types of jejunal/ileal atresia, ranging from an obstructing membrane with continuity of the bowel wall through blind-ended segments of bowel separated by Harald Hirschsprung , 1830–1916, physician, The Queen Louise Hospital for Children, Copenhagen, Denmark, described congenital megacolon in 1887. - - a fibrous cord or V-shaped mesenteric defect (including the so-called apple-peel atresia) (Figure 78.17), to multiple atresias ('string of sausages'). The obstructed proximal bowel is at risk of perforation, which may happen prenatally , causing meco - nium peritonitis in the fetus.). Small bowel atresias present with intestinal obstruction soon after birth. Bilious vomiting is the dominant feature in jejunal atresia whereas abdominal distension is more promi - nent with ileal atresia. A small amount of pale meconium may be passed despite the atresia. Plain abdominal radiographs sho w a variable number of dilated loops of bowel and fluid levels according to the level of obstruction. In a stab le infant, a contrast enema may be required to clarify the cause of a distal bowel obstruction.

Figure 78.16 Reducing the terminal part of the intussusception (after RE Gross). Figure 78.17 Apple-peel jejunal bowel atresia with obstructed proximal jejunum and collapsed distal ileum coiled round a remnant ileocolic artery (courtesy of MD Stringer, Leeds, UK).

Duodenal atresia is corrected by a duodenoduodenostomy . In most cases of jejunal/ileal atresia, the distal end of the dilated proximal small bowel is resected and a primary end-to-end anastomosis is possible. If the proximal bowel is extremely dilated it may need to be tapered to the distal bowel before anastomosis. Occasionally , a temporary stoma is required before definitive repair. Meconium ileus Cystic fibrosis is almost always the underlying cause of this condition. Meconium is normally kept fluid by the action of pancreatic enzymes. In meconium ileus the terminal ileum becomes filled with thick viscid meconium, resulting in progres sive intestinal obstruction. A sterile meconium peritonitis may have occurred in utero . Visibly dilated loops of bowel are often palpable in the newborn with meconium ileus. An abdominal radiograph may show a dilated small intestine with mottling. Fluid lev generally not seen. Unlike ileal atresia there is no

abrupt ter mination of the gas-filled intestine. A contrast enema shows an unused microcolon. As the condition is caused by an autosomal recessive genetic defect, a family history may be present. Fur ther assessment includes gene mutation analysis and, beyond the neonatal period, a sweat test, whic h shows elevated sodium and chloride levels (>70 /uni00A0 mmol/L). Uncomplicated meconium ileus may respond to treatment with a h yperosmolar Gastrografin enema; this draws fluid into the gut lumen and also has detergent properties, whic h help to liquefy the meconium. Infants treated in this way need extra intravenous fluids to compensate for fluid shifts. Meconium ileus complicated by intestinal perforation, volvulus or atresia, or unresponsive to enemas, demands surgery . Various surgical procedures are used, including intestinal resection and tem porary stoma formation, resection and primary anastomosis, and, in uncomplicated cases, enterotomy and irrigation of the bowel. T he Bishop–Koop operation (Figure 78.18) with its irrigating stoma is now rarely used.

Acute intussusception

Acute intussusception

This occurs when one portion of the gut invaginates into an immediately adjacent segment; almost invariably , it is the proximal into the distal. The condition is encountered most commonly in children, with a peak incidence between 5 and 10 months of age. About 90% of cases are idiopathic but an associated upper respiratory - tract infection or gastroenteritis may precede the condition. It is believed tha t hyperplasia of Peyer's patches in the terminal - ileum may be the initiating event. Weaning, loss of passively ptoki - acquired maternal immunity and common viral pathogens have all been implicated in the pathogenesis of intussusception in infancy (see Chapter 17). Children with intussusception associated with a patholog - ical lead point such as Meckel's diverticulum, polyp, duplica - tion, Henoch–Schönlein purpura or appendix are usually older than those with idiopathic disease. After the age of 2 years, a pathological lead point is found in at least one-third of a ff ected children. In adults, cases are almost invariably associated with a lead point, which is usually a polyp (e.g. Peutz–Jeghers syn- drome), a submucosal lipoma or other tumour. The phenomenon of transient intussusception in younger patients is now recognised. Imaging of the small bowel (with CT scanning, capsule endoscopy or enteroscopy) is required to exclude intraluminal disease. Pathology An intussusception is composed of three parts (Figure 78.5 /uni25CF the entering or inner tube (intussusceptum); /uni25CF the returning or middle tube; /uni25CF the sheath or outer tube (intussuscipiens). The part that advances is the apex, the mass is the intus- susception and the neck is the junction of the entering layer with the mass. Intussusception may be anatomically defi ned according to the site and extent of invagination (Table 78.2). In most children, the intussusception is ileocolic. In adults, colocolic intussusception is more common. The degree of ischaemia is dependent on the tightness of invagination, which is usually greatest as it passes through the ileocaecal valve. John Law Augustine Peutz , 1886–1968, Chief Specialist for Internal Medicine, St John's Hospital, The Hague, The Netherlands. Harold Joseph Jeghers , 1904–1990, Professor of Internal Medicine, New Jersey College of Medicine and Dentistry , Jersey City , NJ, USA. Robert Edward Gross , 1905–1988, paediatric surgeon, Harvard Medical School, Boston, MA, USA. On CT scanning the target sign may be evident and, if present, is pathognomonic (Figure 78.6). It is worth noting that occasionally an asymptomatic intussusception can be observed on CT scanning in adults. This may be transient or intermittent. Summary box 78.4 Intussusception /uni25CF): /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Intussuscipiens Intussusceptum Intussusception Figure 78.5 Small bowel intussusception showing components: intussusceptum (purple arrow); intussuscipiens; lead point; middle tube (red arrows). TABLE 78.2 Types of intussusception in children (after RE Gross) (n = 702). Percentage of series Ileoileal 5 Ileocolic 77 Ileoileocolic 12 Colocolic 2 Multiple 1 Retrograde 0.2 Others 2.8 Intussusceptum Lead point Neck Apex Intussusception 78.05 Most common in children Adult cases are secondary to intestinal pathology, e.g. polyp, Meckel's diverticulum Ileocolic is the most common variety Can lead to an ischaemic segment Radiological reduction is indicated in most paediatric cases Adults who present acutely require surgery Figure 78.6 Abdominal computed

tomography scan illustrating the ‘target sign’ of the ileocolic intussusception seen in Figure 78.5 .

A volvulus is a twisting or axial rotation of a portion of bowel about its mesentery . The rotation causes obstruction to the lumen (>180° torsion) and if tight enough also causes vascular occlusion in the mesentery (>360° torsion). Bacterial fermentation adds to distension and increasing intraluminal pressure impairs capillary perfusion. Mesenteric veins become obstructed as a result of the mechanical twisting; thrombosis results and contributes to ischaemia. V olvuli may be primary or secondary . The primary form is caused by congenital malrotation of the gut, abnormal mesen teric attachments or congenital bands. Examples include vol vulus neonatorum, caecal v olvulus and sigmoid volvulus (see Chapter 65). A secondary volvulus, which is the more com mon variety , is due to rotation of a segment of bowel around an acquir ed adhesion or stoma. Summary box 78.5 Volvulus /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF This occurs secondary to intestinal malrotation (see Chapters 17 and 65) and is potentially catastrophic. Sigmoid volvulus This is uncommon in Europe and the USA but more common in eastern Europe and Africa. Indeed, it is the most common cause of large bowel obstruction in the indigenous black African population. Rotation nearly always occurs in the anticlockwise direction. The predisposing clinical features are summarised in Figure 78.7 . Other predisposing factors include a high-residue - diet and constipation. In western populations, the condition is - seen most often in elderly patients with chronic constipation; comorbidities are common and chronic psychotropic drug - use is associated with this condition. Y ounger patients present earlier and the prognosis is inversely related to the duration of symptoms. Presentation with volvulus can be classified as: /uni25CF fulminant : sudden onset, severe pain, early vomiting, rapidly deteriorating clinical course; /uni25CF indolent : insidious onset, slow progressive course, less pain, late vomiting. Compound volvulus This is a rare condition that is also known as ileosigmoid knotting. The long pelvic mesocolon allows the ileum to twist around the sigmoid colon, resulting in gangrene of either or both segments of bowel. The patient presents with acute intestinal obstruction, but distension is comparatively mild. Plain radiography reveals distended ileal loops in a distended sigmoid colon. At operation, decompression, resection and anastomosis are required.

May involve the small intestine, caecum or sigmoid colon Neonatal midgut volvulus secondary to midgut malrotation is life-threatening The most common spontaneous type in adults is sigmoid volvulus Sigmoid volvulus can be relieved by decompression per anum Surgery may be required to prevent or relieve ischaemia Band of adhesions (peridiverticulitis) Overloaded pelvic colon Long pelvic mesocolon Narrow attachment of pelvic mesocolon Figure 78.7 Causes predisposing to volvulus of the sigmoid colon. Idiopathic megacolon usually precedes the volvulus in African people.

Bolus obstruction

Bolus obstruction

Bolus obstruction in the small bowel may be caused by gall stones, food, trichobezoar, phytobezoar, stercoliths and worms. Gallstones This type of obstruction tends to occur in the elderly secondary to erosion of a large gallstone directly through the gallbladder Burrill Bernard Crohn , 1884–1983, gastroenterologist, Mount Sinai Hospital, New Y ork, NY , USA, described regional ileitis in 1932. Leo George Rigler , 1896–1979, Professor of Radiology , University of California, Los Angeles, CA, USA. proximal to the ileocaecal valve. The patient may have recur - rent attacks as the obstruction may be incomplete or relapsing as a result of a ball-v alve e ff ect. The characteristic radiological sign of gallstone ileus is Rigler's triad, comprising: small bowel obstruction, pneumobilia and an atypical mineral shadow on radiographs of the abdomen. The presence of two of these radiological signs has been considered pathognomonic of gallstone ileus and is encountered in 40–50% of the cases (note that pneumobilia is a common finding following endoscopic retrograde cholangiopancreatography with sphincterotomy). At laparotomy , the stone should be milked proximally away from the site of impaction. It may be possible to crush the stone within the bowel lumen; if not, the intestine is opened at this point and the gallstone removed. If the gallstone is faceted, a careful check for other enteric stones should be made. The region of the gallbladder should not be explored (see Chapter 71). Food Bolus obstruction may occur after partial or total gastrectomy when unchewed articles can pass directly into the small bowel. Fruit and vegetables are particularly liable to cause obstruc - tion. The management is similar to that for gallstones, with intraluminal crushing usually being successful. Trichobezoars and phytobezoars These are firm masses of undigested hair ball and fruit/ vegetable fibre, respectively . The former is due to persistent hair chewing or sucking and may be associated with an under - lying psychiatric abnormality . Predisposition to phytobezoars results from a high fibre intake, inadequate chewing, previous gastric surgery , hypochlorhydria and loss of the gastric pump mechanism. When possible, the lesion may be kneaded into the caecum; otherwise, open removal is required. A preoper - ative diagnosis is di ffi cult even with high-resolution computed tomography (CT) scanning. Stercoliths - These are usually found in the small bowel in association with a jejunal diverticulum or ileal stricture. Presentation and management are identical to that of gallstones. Worms Ascaris lumbricoides may cause low small bowel obstruction, particularly in children, the institutionalised and those near the tropics. An attack may follow the initiation of anthelmin - thic therapy . Debility is frequently out of proportion to that produced by the obstruction. If worms are not seen in the stool or vomitus the diagnosis may be indicated by eosinophilia or the sight of worms within gas-filled small bowel loops on a - plain radiograph. At lapar otomy it may be possible to knead the tangled mass into the caecum; if not, it should be removed. Occasionally , worms may cause a perforation and peritonitis, especially if the enteric wall is weakened by such conditions as amoebiasis (see Chapter 6).

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Adhesions In western countries adhesions and bands are the most common cause of intestinal obstruction. The lifetime risk of requiring an admission to hospital for adhesional small bowel obstruction subsequent to abdominal surgery is approximately 4% and the risk of requiring a laparotomy around 2%. Adhesions start to form within hours of abdominal surgery . In the early postoperative period, the onset of such a mechanical obstruction may be di ffi cult to di ff erentiate from paralytic ileus. The causes of intraperitoneal adhesions are shown in Table 78.1 . Any source of peritoneal irritation results in local fibrin production, which produces adhesions between apposed surfaces. Early fibrinous adhesions may disappear when the cause is removed or they may become vascularised and be replaced by mature fibrous tissue. There are several factors that may limit adhesion forma tion. Summary box 78.3 Prevention of adhesions /uni25CF /uni25CF /uni25CF /uni25CF Numerous substances have been instilled in the peritoneal cavity to prevent adhesion formation, including hyaluroni dase, hydrocortisone, silicone, dextran, polyvinylpropylene (PVP), chondroitin, streptomycin, anticoagulants, antihista mines, non-steroidal anti-inflammatory drugs and stre nase. Currently , no single agent or combination of agents has been convincingly shown to be e ff ective. It is hoped that with more widespread use of laparoscopic surgery the incidence of intra-abdominal adhesions will reduce. Adhesions may be classified into various types by virtue of whether they are early (fibrinous) or late (fibrous) or by underlying aetiology . From a practical perspective there are Johann Conrad Peyer , 1653–1782, Professor of Logic, Rhetoric and Medicine, Scha ff hausen, Switzerland, described the lymph follicles in the intestine in 1677. Johann Friedrich Meckel (the younger), 1781–1833, Professor of Anatomy and Surgery , Halle, Germany , described the diverticulum in 1809. Eduard Heinrich Henoch , 1820–1910, Professor of Diseases of Children, Berlin, Germany , described this form of purpura in 1868. Johann Lucas Schönlein , 1793–1864, Professor of Medicine, Berlin, Germany , gave his account of this disease in 1837. - only two types: ‘easy’ flimsy ones and ‘di ffi cult’ dense ones (Figure 78.4). Postoperative adhesions giving rise to intestinal obstruction usually involve the lower small bowel and less commonly the large bowel. Bands Usually only one band is culpable. This may be: /uni25CF congenital, e.g. obliterated vitellointestinal duct; /uni25CF a string band following previous abdominal surgery or peritoneal inflammation; /uni25CF a portion of greater omentum, usually adherent to the parietes.

TABLE 78.1 The common causes of intra-abdominal adhesions. Acute in /f_l ammation Sites of anastomoses, reperitonealisation of raw areas, trauma, ischaemia Foreign material Talc, starch, gauze, silk Infection Peritonitis, tuberculosis Chronic in /f_l ammatory Crohn’s disease conditions Radiation enteritis Factors that may limit adhesion formation include: Good surgical technique Washing of the peritoneal cavity with saline to remove clots Minimising contact with gauze Covering anastomoses and raw peritoneal surfaces Figure 78.4 Band adhesion causing a closed-loop obstruction.

CHRONIC LARGE BOWEL OBSTRUCTION

CHRONIC LARGE BOWEL OBSTRUCTION

The symptoms of chronic intestinal obstruction may arise from two sources: the cause and the subsequent obstruction. /uni25CF intraluminal (rare) – faecal impaction; /uni25CF intrinsic intramural – strictures (Crohn’s disease, isch aemia, diverticular), anastomotic stenosis; /uni25CF extrinsic intramural (rare) – metastatic deposits (ovarian), endometriosis, stomal stenosis; or functional: /uni25CF Hirschsprung’s disease, idiopathic megacolon, pseudo- obstruction. The symptoms of chronic obstruction di ﬀ er in their pre dominance, timing and degree from acute obstruction. In functional cases, the symptoms may have been present for months or years. Constipation appears first. It is initially rela tive and may become absolute, associated with distension. In the presence of large bowel disease, the point of greatest dis tension is in the caecum, and this is heralded by the onset of pain. V omiting is a late feature and theref ore dehydration is less severe. Examination is unremarkab le, save for confirma tion of distension, which can be profound (Figure 78.21 the onset of peritonism in late cases. Rectal examination may confirm the presence of faecal impaction or a tumour.

CLASSIFICATION

CLASSIFICATION

Intestinal obstruction may be classified into two types: /uni25CF Dynamic , in which peristalsis is working against a mechanical obstruction. It may occur in an acute or a chronic form (Figure 78.1). /uni25CF Adynamic , in which there is no mechanical obstruction; peristalsis is absent or inadequate (e.g. paralytic ileus or pseudo-obstruction). Summary box 78.1 Causes of intestinal obstruction /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Dynamic Intraluminal Intramural Faecal impaction Stricture Foreign bodies Malignancy Bezoars Intussusception Gallstones Volvulus Extramural Bands/adhesions Hernia Adynamic Paralytic ileus Pseudo-obstruction

CLINICAL FEATURES OF INTESTINAL OBSTRUCTION Dynami

CLINICAL FEATURES OF INTESTINAL OBSTRUCTION Dynamic obstruction

The diagnosis of dynamic intestinal obstruction is based on the classic quartet of pain, distension, vomiting and absolute constipation. Obstruction may be classified clinically into two types: /uni25CF small bowel obstruction – high or low; /uni25CF large bowel obstruction. The nature of the presentation will also be influenced by whether the obstruction is: /uni25CF complete; /uni25CF incomplete. A complete small bowel obstruction has all the cardinal features. In cases of complete large bowel obstruction there is often a surprising lack of preceding symptoms. Both small and large bowel obstruction can present with more chronic symptoms in which the symptoms and signs are intermittent or the obstruction is incomplete. Incomplete obstruction is also referred to as partial or subacute. Features of obstruction /uni25CF /uni25CF /uni25CF Summary box 78.7 Cardinal clinical features of acute obstruction /uni25CF /uni25CF /uni25CF /uni25CF Presentation will be further influenced by whether the obstruction is: /uni25CF simple – in which the blood supply is intact; /uni25CF strangulating/strangulated – in which there is interference to blood flow . The common causes of intestinal obstruction in wes tern countries and their relative frequencies are shown in Figure 78.1 . The underlying mechanisms are shown in Summary box 78.2 . The clinical features vary according to: /uni25CF the location of the obstruction; /uni25CF the duration of the obstruction; /uni25CF the underlying pathology; /uni25CF the presence or absence of intestinal ischaemia. Late manifestations of intestinal obstruction that may be encountered include dehydration, oliguria, hypovolaemic shock, pyrexia, septicaemia, respiratory embarrassment and peritonism. In all cases of suspected intestinal obstruction, the hernial orifices m ust be examined.

In high small bowel obstruction , vomiting occurs early, is profuse and causes rapid dehydration. Distension is minimal with little evidence of dilated small bowel loops on abdominal radiography In low small bowel obstruction , pain is predominant with central distension. Vomiting occurs later. Multiple dilated small bowel loops are seen on radiography In large bowel obstruction , distension is early and pronounced. Pain is less severe and vomiting and dehydration are later features. The colon proximal to the obstruction is distended on abdominal radiography. The small bowel will be dilated if the ileocaecal valve is incompetent (Figure 78.3 Abdominal pain Distension Vomiting Absolute constipation

Clinical features of strangulation

Clinical features of strangulation

It is vital to distinguish strangulating from non-strangulating intestinal obstruction because the former is a surgical emer - gency . The diagnosis is clinical but may be aided by CT scanning as long as this does not delay surgical intervention. Summary box 78.8 Clinical features of strangulation - /uni25CF /uni25CF /uni25CF In addition to the features in Summary box 78.8 , it should be noted that: /uni25CF The presence of shock suggests underlying ischaemia. /uni25CF In impending or established strangulation, pain is never completely absent. /uni25CF The presence and character of any local tenderness are of great significance and, however mild, tenderness requires frequent reassessment. /uni25CF Generalised tenderness and the presence of rigidity indi - cates the need for early laparotomy . /uni25CF When pain persists despite conservative management, even in the absence of the above signs, strangulation should be presumed. /uni25CF When strangulation occurs in an external hernia, the lump is tense, tender and irreducible and there is no expansile cough impulse. Skin changes with erythema or purplish discoloration are associated with underlying ischaemia (Figures 78.9 and 78.10) .

Constant pain, severe pain Tenderness with rigidity and peritonism Shock

The classic presentation of intussusception is with episodes of screaming and drawing up of the legs in a previously well male infant. The attacks last for a few minutes and recur repeatedly . During attacks the child appears pale and between episodes may be listless. V omiting may or may not occur at the outset but becomes conspicuous and bile-stained with time. Initially , the passage of stool may be normal, whereas, later, blood and mucus are evacuated – the ‘redcurrant jelly’ stool. Whenever possible, examination should be undertaken between episodes of colic, without disturbing the child. Clas sically , the abdomen is not initially distended; a lump hardens on palpation may be discerned but this is present in only 60% of cases (Figure 78.11). There may be an associated feeling of emptiness in the right iliac fossa (the sign of Dance). On r ectal examination, blood-stained mucus may be found on the finger. Occasionally , in extensive ileocolic or colocolic intussusception, the apex may be palpable or even protrude from the anus. Unrelieved, progressive dehydration and abdominal dis tension from small bowel obstruction will occur, followed by peritonitis secondary to gangrene. Rarely , natural cure may occur as a result of sloughing of the intussusception. Differential diagnosis Acute gastroenteritis Although abdominal pain and vomiting are common in acute gastroenteritis, with occasional blood and mucus in the stool, diarrhoea is a leading symptom and faecal matter or bile is always present in the stool. Henoch–Schönlein purpura Henoch–Schönlein purpura is associated with a characteristic rash and abdominal pain; intussusception may occur.

Sausage-shaped lump. Concavity towards the umbilicus Figure 78.11 The physical signs as recorded by Hamilton Bailey in a typical case of intussusception in an infant.

Clinical features of volvulus

Clinical features of volvulus

Volvulus of the small intestine This may be primary or secondary and usually occurs in the lower ileum. It may occur spontaneously in African people, particularly following the consumption of a large volume of Henry Hamilton Bailey , 1894–1961, surgeon, The Royal Northern Hospital, London, UK. Jean Baptiste Hippolyte Dance , 1797–1832, physician, Hôpital Cochin, Paris, France. secondary to adhesions passing to the parietes or female pelvic organs. Caecal volvulus This may occur as part of volvulus neonatorum or de novo and is usually a clockwise twist. It is more common in females in the fourth and fifth decades and usually presents acutely with the classic features of obstruction. Ischaemia is common. At first the obstruction may be partial, with the passage of flatus and faeces. In 25% of cases, examination may reveal a - palpable tympanic swelling in the midline or left side of the that abdomen. The volvulus typically results in the caecum lying in the left upper quadrant. The diagnosis is not usually made preoperatively . Sigmoid volvulus The symptoms are of large bowel obstruction. Presentation varies in severity and acuteness, with younger patients appear - ing to develop the more acute form. Abdominal distension is an early and progressive sign, which may be associated with hiccough and retching. Constipation is absolute. In the elderly , a more c hronic form may be seen. In some patients the grossly distended torted left colon is visible through the abdominal wall.

Closed-loop obstruction

Closed-loop obstruction

This occurs when the bowel is obstructed at both the proximal and distal points (Figure 78.2). The distension is principally confined to the closed loop; distension proximal to the obstructed segment is not typically marked. A classic form of closed-loop obstruction is seen in the presence of a malignant stricture of the colon with a compe tent ileocaecal valve (present in up to one-third of individuals). This can occur with lesions as far distally as the rectum. The inability of the distended colon to decompress itself into the small bo wel results in an increase in luminal pressure, which is August Gottlieb Richter , 1742–1812, lecturer in surgery , Göttingen, Germany , described this form of hernia in 1777. Jacob Benignus Winslow , 1669–1760, Professor of Anatomy , Physic and Surgery , Paris, France. greatest at the caecum, with subsequent impairment of blood flow in the wall. Unrelieved, this results in necrosis and perfo - ration (Figure 78.3).

(a) (b) Figure 78.2 Distension. Closed-loop obstruction around a constrict

ing band (arrow) with impending strangulation, mild distension of the proximal limb (a) and collapse of the distal limb (b) of small bowel.

Constipation

Constipation

This may be classified as absolute (i.e. neither faeces nor flatus is passed) or relative (where only flatus is passed). Absolute consti - pation is a cardinal feature of complete intestinal obstruction. Some patients may pass flatus or faeces after the onset of obstruction as a result of the evacuation of the distal bowel contents. The administration of enemas should be avoided in cases of suspected obstruction. This merely stimulates evacu - - ation of bowel contents distal to the obstruction and confuses the clinical picture.

Figure 78.8 Visible peristalsis. Intestinal obstruction due to a strangu

lated right femoral hernia (arrow).

obstruction does not apply in: /uni25CF Richter’s hernia; /uni25CF gallstone ileus; /uni25CF mesenteric vascular occlusion; /uni25CF functional obstruction associated with pelvic abscess; /uni25CF all cases of partial obstruction (in which diarrhoea may occur).

Distension

Distension

In the small bowel the degree of distension is dependent on the site of the obstruction and is greater the more distal the lesion. Visible peristalsis may be present in thin patients (Figure 78.8). This can sometimes be provoked by â€˜ï¬,ickingâ€™ the abdominal wall. Distension is a later feature in colonic obstruction and may be minimal or absent in the presence of mesenteric vascular occlusion.

IMAGING

IMAGING

Erect abdominal films are no longer routinely obtained and the radiological diagnosis is based on a supine abdominal film (Figure 78.12). An erect film may subsequently be requested when further doubt exists. -

Figure 78.12 Gas- /f_i lled small bowel loops illustrating valvulae con

niventes; patient supine.

and remaining colon have a characteristic appearance in adults and older children that allows them to be distinguished radiologically . Summary box 78.9 Radiological features of obstruction (on plain radio graph) /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Fluid levels seen radiologically appear later than gas shad ows as it takes time for gas and fluid to separate (Figure 78.13 These are most prominent on an erect abdominal radiograph or cross-sectional imaging. In adults, two inconstant fluid le – one at the duodenal cap and the other in the terminal ileum – may be regarded as normal. In infants (less than 1 year old), a few fluid levels in the small bowel may be physiological. In this age group it is di ffi cult to distinguish large from small bowel in the presence of obstruction because the characteristic fea seen in adults are not present or are unreliable. During the obstructive process, fluid levels become more conspicuous and more numerous when paralysis has occurred. When fluid levels are pronounced, the obstruction is advanced. In the small bowel, the number of fluid levels is dir ectly propor tional to the degree of obstruction and to its site, the number increasing the more distal the lesion. In patients without evidence of strangulation there is a role for other imaging modalities. The appearance of contrast in the colon 4–24 hours after administration of 50–100 /uni00A0 mL of wa ter-soluble contrast agent had a sensitivity of 96% and a specificity of 98% in predicting resolution of small bowel obstruction. If contrast does not reach the colon, surgery is required in approximately 90% of patients. Administration of a water-soluble agent was also e ff ective in reducing the need for surgery and shortening the duration of hospital stay . Low colonic obstruction does not commonly give rise to small bowel fluid levels unless advanced, whereas high colonic obstruction may do so in the presence of an incompetent ileo caecal valv e. Colonic obstruction is usually associated with a large amount of gas in the caecum. A limited water-soluble enema can be undertaken to di ff

erentiate large bowel obstruc tion from pseudo-obstruction. A barium f ollow-through is contraindicated in the presence of acute obstruction and may be life-threatening. - - CT scanning is now used very widely to investigate all). forms of intestinal obstruction. It is highly accura te and its only limitations are in diagnosing ischaemia. Two features vels may be helpful when looking for intestinal ischaemia: reduced enhancement of the bo wel wall and absence of mesenteric oedema. It is important to remember that, even with the best imaging techniques, the diagnosis of strangulation remains primarily clinical. tures Summary box 78.10 CT features of strangulation /uni25CF - /uni25CF /uni25CF Impacted foreign bodies may be seen on abdominal radio - graphs. It is noteworthy that gas-filled loops and fluid levels in the small and large bowel can also be seen in established paralytic ileus and pseudo-obstruction (see Chapter 73). The former can, however, normally be distinguished on clinical grounds whereas the latter can be confirmed radiologically . Fluid levels may also be seen in non-obstructing conditions - such as gastroenteritis, acute pancreatitis and intra-abdominal sepsis. -

The obstructed small bowel is characterised by straight segments that are generally central and lie transversely. No/ minimal gas is seen in the colon The jejunum is characterised by its valvulae conniventes, which completely pass across the width of the bowel and are regularly spaced, giving a ‘concertina’ or ladder effect Ileum – the distal ileum is featureless A distended caecum appears as a rounded gas shadow in the right iliac fossa Large bowel, except for the caecum, shows haustral folds, which, unlike valvulae conniventes, are spaced irregularly, do not cross the whole diameter of the bowel and do not have indentations placed opposite one another Small bowel /f_l uid levels may be seen on an erect abdominal radiograph Figure 78.13 Fluid levels with gas above; ‘stepladder pattern’. Ileal obstruction caused by adhesions (erect abdominal radiograph). Reduced bowel wall enhancement on CT increases the probability of strangulation Absence of mesenteric /f_l uid on CT decreases the probability of strangulation The clinical reliability of other CT signs is doubtful for predicting strangulation

Imaging in intussusception

Imaging in intussusception

A plain abdominal field usually reveals evidence of small or large bowel obstruction with an absent caecal gas shadow in A barium enema may be used to diagnose the presence of an ileocolic intussusception but does not demonstrate small bowel intussusception. Abdominal ultrasonography has a high diagnostic sensitivity in children, demonstrating the typical doughnut appearance of concentric rings in transverse section. CT scanning is currently considered the most sensitive radio logical method to confirm intussusception, with a reported diagnostic accuracy of 58–100%. The characteristic features of CT scan include a ‘target’- or ‘sausage’-shaped soft-tissue mass with a layering e ff ect (Figure 78.6); mesenteric vessels within the bowel lumen are also typical.

Imaging in volvulus

Imaging in volvulus

/uni25CF In caecal volvulus, radiological abnormalities are iden tifiable in nearly all patients but are often non-specific, with caecal dilatation (98–100%), a single air–fluid level (72–88%), small bowel dilatation (42–55%) and absence of gas in distal colon (82–91%) reported as the most common abnormalities. A barium enema may be used to confirm the diagnosis if there are no concerns about ischaemia, with an absence of barium in the caecum and a bird's beak deformity . CT scanning is now the imaging of choice. /uni25CF In sigmoid volvulus, a plain radiograph shows massive colonic distension. The classic appearance is of a dilated loop of bowel; the two limbs are seen running diagonally across the abdomen from right to left (Figure 78.14 two fluid levels seen, one within each loop of bowel (if an erect film is taken). /uni25CF In volvulus neonatorum, the abdominal radiograph shows a variable appearance. Initially , it may appear normal or show evidence of duodenal obstruction but, as the intestinal strangulation progresses, the abdomen becomes relatively gasless.

Introduction

Introduction

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Investigation

Investigation

Plain abdominal radiography confirms the presence of large bowel distension. All such cases should be investigated by a subsequent single-contrast water-soluble enema study , CT scan or endoscopic assessment to rule out functional disease. Organic disease requires decompression with either a lapa rotomy or stent. Stomal stenosis can usually be managed at the abdominal wall level. Surgical management after resuscitation depends on the underlying cause and the relevant c hapters in this book should be consulted. Functional disease requires colonoscopic decompression in the first instance and conservative management. Intestinal perforation can occur in patients with functional obstruction (see Chapter 73).

Learning objectives

Learning objectives

To understand: The pathophysiology of dynamic and adynamic intestinal • obstruction The cardinal features on history and examination •

Obstruction from enteric strictures

Obstruction from enteric strictures

Small bowel strictures usually occur secondary to tubercu losis or Crohn’s disease. Malignant strictures associated with lymphoma are uncommon; carcinoma and sarcoma are rare. Presentation is usually subacute or chronic. Standard surgical management consists of resection and anastomosis. Resection is important to establish a histological diagnosis as this can be uncertain clinically . In Crohn’s disease, strictureplasty may be considered in the presence of short multiple strictures without active sepsis (see Chapter 75).

Other manifestations

Other manifestations

Dehydration Dehydration is seen most commonly in small bowel obstruc tion because of repeated vomiting and fluid sequestration. It results in dry skin and tongue, poor venous filling and sunken eyes with oliguria. The blood urea level and haematocrit rise, giving a secondary polycythaemia. Hypokalaemia Hypokalaemia is not a common feature in simple mechanical obstruction. An increase in serum potassium, amylase or lactate dehydrogenase may be associated with the presence of strangulation, as may leukocytosis or leukopenia. Pyrexia Pyrexia in the presence of obstruction may indicate: /uni25CF the onset of ischaemia; /uni25CF intestinal perforation; /uni25CF inflammation or abscess associated with the obstructing disease. Hypothermia indicates septicaemic shock or neglected cases of long duration. Abdominal tenderness Localised tenderness indicates impending or established isch aemia. The development of peritonism or peritonitis indicates impending or established infarction and/or perforation. In cases of large bowel obstruction, it is important to elicit these findings in the right iliac fossa as the caecum is most vulnerable to ischaemia. - Bowel sounds High-pitched bowel sounds are present in the vast majority of patients with intestinal obstruction. Normal bowel sounds are of negative predictive value. Bowel sounds may be scanty or absent if the obstruction is longstanding and the small bowel has become inactive.

Figure 78.9 Skin discoloration over a strangulated incisional hernia. Figure 78.10 Ischaemic small and large bowel in a strangulated incisional hernia.

PATHOPHYSIOLOGY

PATHOPHYSIOLOGY

Irrespective of aetiology or acuteness of onset, in dynamic (mechanical) obstruction the bowel proximal to the obstruction dilates and the bowel below the obstruction exhibits normal peristalsis and absorption until it becomes empty and collapses. Initially , proximal peristalsis is increased in an attempt to overcome the obstruction. If the obstruction is not relieved, the bowel continues to dilate; ultimately there is a reduction in peristaltic strength, resulting in flaccidity and paralysis. The distension proximal to an obstruction is caused by two factors: /uni25CF Gas : there is a significant overgrowth of both aerobic and anaerobic organisms, resulting in considerable gas produc - tion. Following the reabsorption of oxygen and carbon dioxide, the majority is made up of nitrogen (90%) and hydrogen sulphide. /uni25CF Fluid : this is made up of the various digestive juices (saliva, 500 /uni00A0 mL; bile, 500 /uni00A0 mL; pancreatic secretions, 500 /uni00A0 mL; gas - tric secretions, 1 litre; all per 24 hours). This accumulates in the gut lumen as absorption by the obstructed gut is retarded. Dehydration and electrolyte loss are therefore due to: /uni25CF reduced oral intake; /uni25CF defective intestinal absorption; /uni25CF losses as a result of vomiting; /uni25CF sequestration in the bowel lumen; /uni25CF transudation of fluid into the peritoneal cavity .

The causes of small and large bowel obstruction • The indications for surgery and other treatment options in • bowel obstruction Adhesions 40% Miscellaneous 5% Obstructed Pseudo- hernia obstruction 12% 5% Faecal impaction 8% In /f_l ammatory 15% Carcinoma 15% Figure 78.1 Pie chart showing the common causes of intestinal obstruction and relative frequencies.

It is important to appreciate that the consequences of intestinal obstruction are not immediately life-threatening unless there is superimposed strangulation. When strangulation occurs, the blood supply is compromised and the bowel becomes ischaemic. Summary box 78.2 Causes of strangulation /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Ischaemia from direct pressure on the bowel wall from a constricting band such as a hernial orifice is easy to understand. Distension of the obstructed segment of bowel results in high pressure within the bowel wall. This can happen when only part of the bowel wall is obstructed, as seen in a Richter’s hernia (see Chapter 64). V enous return is compr omised before the arterial supply . The resultant increase in capillary pressure leads to impaired local perfusion and, once the arterial supply is impaired, haemorrhagic infarction occurs. As the viability of the bowel is compromised, translocation and systemic expo sure to anaerobic organisms and endotoxin occurs. The morbidity and mortality associated with strangulation are largely dependent on the duration of the ischaemia and its extent. Elderly patients and those with comorbidities are more vulnerable to its e ff ects. Although in strangulated exter nal hernias the segment involved is often short, any length of ischaemic bowel can cause significant systemic e ff ects second ary to sepsis. Bowel distension and fluid sequestration proximal to the obstruction can result in significant dehydration. When bow el involvement is extensive circulatory failure is common.

Direct pressure on the bowel wall Hernial ori /f_i ces Adhesions/bands Interrupted mesenteric blood /f_l ow Volvulus Intussusception Increased intraluminal pressure Closed-loop obstruction

Pain

Pain

Pain is the first symptom encountered; it occurs suddenly and is usually severe. It is colicky in nature and usually centred on the umbilicus (small bowel) or lower abdomen (large bowel) (see Chapter 63). The pain coincides with increased peristaltic activity . With increasing distension, the colicky pain is replaced by a more constant di ff use pain. If there is no ischaemia and the obstruction persists over several days, pain reduces and can disappear. lation, especially if the pain is continuous. Beware the patient whose pain is not controlled with intravenous opiates. Colicky pain may not be a significant feature in postoperative simple mechanical obstruction and colicky pain does not usually occur in paralytic ileus.

Postoperative intestinal obstruction

Postoperative intestinal obstruction

Di ﬀ erentiation between persistent paralytic ileus and early mechanical obstruction may be di ﬃ cult in the early postopera - tive period. Mechanical obstruction is more likely if the patient has regained bowel function postoperatively that subsequently stops. Obstruction is usually incomplete and the majority settle with continued conservative management. Postopera tive obstruction; CT scanning with oral contrast is of particular value in the assessment of the postoperative abdomen.

Pseudo-obstruction

Pseudo-obstruction

This condition describes an obstruction, usually of the colon, that occurs in the absence of a mechanical cause or acute intra-abdominal disease. It is associated with a variety of syndromes in which there is an underlying neuropathy and/or myopathy and a range of other factors. Small intestinal pseudo-obstruction This condition may be primary (i.e. idiopathic or associated with familial visceral myopathy) or secondary . The clinical picture consists of recurrent subacute obstruction. The diag nosis is made by the exclusion of a mechanical cause. Treat ment consists of initial correction of any underlying disorder. Metoclopramide and erythromycin may be of use. Colonic pseudo-obstruction This may occur in an acute or a chronic form. The former, also known as Ogilvie’s syndrome, presents as acute large bowel obstruction. Abdominal radiographs show evidence of colonic obstruction, with marked caecal distension being a common feature. Indeed, caecal perforation is a well-recognised complication. The absence of a mechanical cause requires urgent confirmation by colonoscopy or a single-contrast water- soluble barium enema or CT . The aetiology , investigation and management are covered in detail in Chapter 73 . Sir William Heneage Ogilvie , 1887–1978, surgeon, Guy’s Hospital, London, UK. Alavi K, Poylin V , Davids JS et al . American Society of Colon and Rectal Surgeons clinical practice guidelines for the management of - colonic volvulus and acute colonic pseudo-obstruction. Dis Colon - Rectum 2021; 64 : 1046–57. Bickell NA, Federman AD, Aufses AH. Influence of time on risk of bowel resection in complete small bowel obstruction. J Am Coll Surg 2005; 201 : 847–54. Ceresoli M, Coccolini F , Catena F et al . Water-soluble contrast agent - in adhesive small bowel obstruction: a systematic review and meta-analysis of diagnostic and therapeutic value. Am J Surg 2016; 211 (6): 1114–25. Fevang BT , Fevang J, Lie S et al . Long-term prognosis after operation for adhesive small bowel obstruction. Ann Surg 2004; 240 : 193–201. Finan PJ, Campbell S, V erma R et al . The management of malignant large bowel obstruction: ACPGBI position statement. Colorectal Dis 2007; 9 (Suppl 4): 1–17. Ha GW , Lee MR, Kim JH. Adhesive small bowel obstruction after laparoscopic and open colorectal surgery: a systematic review and meta-analysis. Am J Surg 2016; 212 (3): 527–36. Miller AS, Boyce K, Box B et al . The Association of Coloproctology of Great Britain and Ireland consensus guidelines in emergency colorectal surgery . Colorectal Dis 2021; 23 : 476–547. ten Broek RP , Stommel MW , Strik C et al . Benefits and harms of adhesion barriers for abdominal surgery: a systematic review and meta-analysis. Lancet 2014; 383 (9911): 48–59. - van Hooft JE, V eld J, Arnold D et al . Self-expandable metal stents for - obstructing colonic and extracolonic cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline – Update 2020. Endoscopy 2020; 52 : 389–407. V ogel JD, Feingold DL, Stewart DB et al . Clinical practice guidelines for colonic volvulus and acute colonic pseudo-obstruction. Dis Colon Rectum 2016; 59 : 589–600. Williams SB, Greenspon J, Y oung HA, Orkin BA. Small bowel obstruction: conservative vs. surgical management. Dis Colon Rectum 2005; 48 : 1140–6. Wolthuis AM, Bislenghi G, Fieuws S et al . Incidence of prolonged postoperative ileus after colorectal surgery: a systematic review and meta-analysis. Colorectal Dis 2016; 18 : O1–9.

SPECIAL TYPES OF MECHANICAL INTESTINAL OBSTRUCTION

SPECIAL TYPES OF MECHANICAL INTESTINAL OBSTRUCTION Internal hernia

- Internal herniation occurs when a portion of the small intes - tine becomes entrapped in one of the retroperitoneal fossae or in a congenital mesenteric defect. The following are potential sites of internal herniation (all are very rare): - /uni25CF the foramen of Winslow; - /uni25CF a defect in the mesentery; /uni25CF a defect in the transverse mesocolon; /uni25CF defects in the broad ligament; /uni25CF congenital or acquired diaphragmatic hernia; /uni25CF duodenal retroperitoneal fossae; /uni25CF caecal/appendiceal retroperitoneal fossae; /uni25CF intersigmoid fossa. Internal herniation in the absence of adhesions is rare and a preoperative diagnosis is unusual. The standard treatment of an obstructed hernia is to release the constricting agent by division. This should not be undertaken in cases of hernia - tion inv olving the foramen of Winslow , mesenteric defects and - paraduodenal/duodenojejunal fossae as major blood vessels run in the edge of the constriction ring. The distended loop in such circumstances must first be decompressed (minimising contamination) and then reduced.

(b) Figure 78.3 Obstructing stricture of the distal descending colon in the presence of (a) a competent ileocaecal valve, resulting in gross caecal distension, and (b) an incompetent ileocaecal valve, allowing decom pression into the distal small bowel without gross caecal distension.

Supportive management

Supportive management

Nasogastric decompression is achieved by the passage of a non-vented (Ryle) or vented (Salem) tube. The tubes are normally placed on free drainage with 4-hourly aspiration but may be placed on continuous or intermittent suction. As well as facilitating decompression proximal to the obstruction, they are essential to reducing the risk of subsequent aspiration during induction of anaesthesia and after extubation. The basic biochemical abnormality in intestinal obstruc - tion is sodium and water loss, and therefore the appropriate replacement is Hartmann's solution or normal saline. The volume requir ed varies and should be determined by clinical haematological and biochemical criteria. The timing of surgical intervention is dependent on the clinical picture. There are several indications for early surgical inter vention. Summary box 78.13 Indications for early surgical intervention /uni25CF /uni25CF /uni25CF The classic clinical advice that 'the Sun should not both rise and set' on a case of unrelieved acute intestinal obstruction was based on the concern that intestinal ischaemia would develop while the patient was waiting for surgery . If there is complete obstruction, but no evidence of intestinal ischaemia, it is rea sonable to defer surgery until the patient has been adequately resuscitated. Where obstruction is likely to be secondary to adhesions, conservative management may be continued for up to 72 hours in the hope of spontaneous resolution. If the site of obstruction is unknown, adequa te exposure is best achieved by a midline laparotomy incision. Assessment is directed to: /uni25CF the site of the obstruction; /uni25CF the nature of the obstruction; /uni25CF the viability of the gut. In cases of small bowel obstruction, the first manoeuvre is to deliver the distended small bowel into the wound. This per mits access to the site of obstruction. The small bowel should be covered with moist swabs and the weight of the fluid-filled bowel supported such tha t the blood supply to the mesentery is not impaired. Operative decompression should be performed whenever possible. The simplest and safest method is to insert a large-bore orogastric tube and to milk the small bowel con tents in a retrograde manner to the stomach for aspiration. Great care must be taken not to tear the mesentery or injure the small bowel, which will be distended and oedematous. It is important to ensure that the stomach is empty at the end of the procedure to reduce the incidence of postoperative aspi ration. Decompression using Savage's decompressor within a seromuscular purse-string suture may be required. Its benefits should be balanced against the potential risk of septic compli cations from spillage and the risk of leakage from the suture line postoperativ ely . The type of surgical procedure required will depend upon the cause of obstruction: division of adhesions (enterolysis), excision, bypass or pr oximal decompr ession. If resection is performed, Savage's decompressor can be inserted into this segment to obviate the risk of a suture line. Following relief of obstruction, the viability of the involved bowel should be carefully assessed (Table 78.3). Although Paul Thwaites Savage , 1916–2013, surgeon, Whittington Hospital, London, UK. may be di ffi cult to discern. If in doubt, the bowel should be wrapped in hot packs f or 10 minutes and then reassessed. - T he state of the mesenteric vessels and pulsation in adjacent arcades should be sought. Viability is also confirmed by colour, sheen and peristalsis. If, at the end of this period, there is still uncertainty about bowel viability , it should be resected unless there is

concern that the extent of resection may lead to short bowel syndrome (see Chapter 74). In which case, or in the case of a critically unwell patient, consideration should be given to resecting necrotic bowel and raising both residual ends as sto - mas. This avoids anastomosis in unfavourable circumstances. When no resection has been undertaken or there are multiple ischaemic areas (mesenteric vascular occlusion), a second-look laparotomy at 24–48 hour s may be required. Intestinal ischaemia/reperfusion injury has been described following reperfusion of ischaemic bowel with remote lung injury resulting from the release of inflammatory mediator s. This should be borne in mind when dealing with ischaemic - bowel. For example, if there is a volvulus with established infarc - tion, detorsion should be avoided until the a ff ected mesentery has been clamped and thus reperfusion injury prevented. - Special attention should always be paid to the sites of con - - striction at each end of an obstructed segment. If of doubtful viability , they should be infolded using a seromuscular suture (Figure 78.15). The surgical management of massive infar ction is depen - dent on the patient's overall prognostic criteria. In the elderly , - infarction of the small bowel from the duodenojejunal flexure to the right colon may be considered incurable , whereas in the young, with the potential for long-term intravenous alimenta - - tion and small bowel transplantation, a policy of excision may be justified. Whenever the small bowel is resected, the exact site of resection, the length of the resected segment and that of the residual bowel should be recorded. As laparoscopic surgery is now so common, it is import - ant to note that small bow el obstruction and strangulation occur in relation to port-site hernias. The risk of port-site herniation is related to older age, higher body mass, trocar diameter and extension of the port site for tissue e xtraction.

Obstructed external hernia Clinical features of intestinal strangulation Obstruction in a previously unoperated abdomen TABLE 78.3 Differentiation between viable and non-viable intestine. Viable Non-viable Dark colour remains Circulation Dark colour No detectable becomes lighter pulsation Visible pulsation in mesenteric arteries General appearance Shiny Dull and lustreless Intestinal Firm Flabby, thin and musculature friable Peristalsis may be No peristalsis observed

to be around 2%. Obstruction and strangulation have even been reported through 5-mm port sites. Complications from these hernias may present in the early postoperative period and as a Richter's hernia. They can be easily overlooked and careful examination of port sites in patients with small bowel obstruction is essential.

TREATMENT OF ACUTE INTESTINAL OBSTRUCTION

TREATMENT OF ACUTE INTESTINAL OBSTRUCTION

There are three main measures used to treat acute intestinal obstruction. Summary box 78.11 Treatment of acute intestinal obstruction /uni25CF /uni25CF /uni25CF /uni25CF John Alfred Ryle , 1889–1950, Regius Professor of Physic, University of Cambridge, and later Professor of Social Medicine, University of Oxford, UK, introduced the Ryle’s tube in 1921. Henri Albert Charles Antoine Hartmann , 1860–1952, Professor of Clinical Surgery , University of Paris, Paris, France. - - The first two steps are always necessary before attempting surgical relief of obstruction and are the mainstay of post-) with operative management. Summary box 78.12 Principles of surgical intervention for obstruction /uni25CF /uni25CF /uni25CF

Gastrointestinal drainage via a nasogastric tube Fluid and electrolyte replacement Relief of obstruction Surgical treatment is necessary for most cases of intestinal obstruction but should be delayed until resuscitation is complete, provided there is no sign of strangulation or evidence of closed-loop obstruction Figure 78.14 Supine abdominal radiograph showing sigmoid volvulus. Management of: The segment at the site of obstruction The distended proximal bowel The underlying cause of obstruction

TREATMENT OF ACUTE LARGE BOWEL OBSTRUCTION

TREATMENT OF ACUTE LARGE BOWEL OBSTRUCTION

Large bowel obstruction is caused by an underlying carcinoma or less commonly diverticular disease and presents in an acute or chronic form. The condition of pseudo-obstruction should always be considered and excluded by a limited contrast study or CT scan to confirm mechanical obstruction. After full resuscitation, the abdomen should be opened through a midline incision. Care should be taken to ensure that the loss of tamponade of the abdominal wall does not lead to increased caecal distension and rupture (this starts with splitting along the line of the taenia coli on the antimesenteric border). Distension of the caecum will confirm large bowel involvement. Identification of a collapsed distal segment of the Harry C Bishop , 1921–2009, Professor of Surgery , University of Philadelphia, Philadelphia, PA, USA. Charles Everett Koop , 1916–2013, paediatric surgeon and public health administrator, served as the 13th Surgeon General of the USA (1982–1989). Frank Thomas Paul , 1851–1941, surgeon, The Royal Infirmary , Liverpool, UK. Johann von Mikulicz-Radecki , 1850–1905, Professor of Surgery , Breslau, Germany (now Wroc ł aw , Poland). - els are - - large bowel and its sequential proximal assessment will readily lead to identification of the cause. As surgery for malignant bowel cancer is technically challenging, wherever possible a suitably trained surgeon should perform the procedure. When - a removable lesion is found in the caecum, ascending colon, hepatic flexure or proximal transverse colon, an emergency right hemicolectomy should be performed. A primary anasto - mosis is safe if the patient’s general condition is reasonable (see Chapter 77). If the lesion is not resectable a proximal stoma (colostomy or ileostomy if the ileocaecal valve is incompetent) or ileotransverse bypass should be considered. Obstructing lesions at the splenic flexure should be treated by an extended right hemicolectomy with ileo-descending colonic anastomosis. For obstructing lesions of the left colon or rectosigmoid junction, immediate resection should be considered unless there are clear contraindications. In rare instances or when caecal perforation is imminent, additional time to improve the patient’s clinical condition can be bought by performing an emergency caecostomy or loop transverse colostomy (loop ileostomy in the presence of an incompetent ileocaecal valve). In the absence of senior clinical sta ff , it is safest to bring the proximal colon to the surface as a colostomy . When pos - sible the distal bowel should be brought out at the same time (Paul–Mikulicz procedure) to facilitate subsequent closure. In the majority of cases , the distal bowel will not reach and is

Ileostomy End-to-side ileoileostomy Figure 78.18 Bishop–Koop operation. This shows the completed pro

cedure after a grossly distended ileum has been resected. Because intestinal continuity is preserved, early closure of the ileostomy is not essential.

A second-stage colorectal anastomosis can be planned when the patient is fit. If an anastomosis is to be considered using the proximal colon, it may be decompressed and cleaned by an on-table colonic lavage. In a palliative situation or if a patient is unfit for major surgery insertion of a self-expanding metal stent may be pref erable as it o ff ers reduced mortality and morbidity and stoma formation (see Chapter 77). Technical and clinical success ra tes for stenting are of the order of 80–90% (Figure 78.19 For patients with potentially curative disease, stenting as a bridge to surgery (usually performed 1–4 weeks post stent ing) has been shown to reduce stoma forma tion but not to reduce postoperative mortality . Recent guidelines from the European Society of Gastrointestinal Endoscopy recommend stenting as a bridge to surgery to be discussed, within a shared decision-making process, as a treatment option in patients with potentially curable left-sided obstructing colon cancer as an alternative to emergency resection. This is a strong recom mendation based on high-quality evidence. Colonic stenting should be performed or directly supervised by an operator who can demonstrate competence in both colonoscopy and fluoroscopic techniques and who performs colonic stenting on a regular basis. A time interval of 2–4 w eeks is generally employed prior to definitive surgery . This period allows treat ment of comorbidities and completion of staging investiga tions. A decompressing stoma as a bridge to elective surgery is a valid option if the patient is not a candidate for colonic stenting or when stenting expertise is not available.

Treatment of adhesions

Treatment of adhesions

Initial management is based on intravenous rehydration and nasogastric decompression; occasionally , this treatment is cura tive. Although an initial conservative regimen is considered appropriate, regular assessment is mandatory to ensure that strangulation does not occur. Conservative treatment should not usually be prolonged bey ond 72 hours. When laparotomy is required, although multiple adhesions may be found, only one may be causative. If there is absolute certainty that this is the cause of the obstruction, this should be divided and the remaining adhesions can be left in situ severe angulation is present. Division of these adhesions will only cause further adhesion formation. When obstruction is caused by multiple adhesions, the adhesions should be freed by sharp dissection from the duo denojejunal junction to the caecum. Following the release of band obstruction, the constriction sites that hav e su ff ered direct compression should be carefully assessed and, if they sho w residual colour changes, invaginated with a seromuscular suture (Figure 78.15). Laparoscopic adhesiolysis may be considered in highly selected cases of small bowel obstruction. This is classed as an advanced laparoscopic procedure and should only be under taken by surgeons with advanced laparoscopic skills. Summary box 78.14 Treatment of adhesive obstruction /uni25CF /uni25CF /uni25CF /uni25CF

Initially treat conservatively provided there are no signs of strangulation; should rarely continue conservative treatment for longer than 72 hours At operation, divide only the causative adhesion(s) and limit dissection Repair serosal tears; invaginate (or resect) areas of doubtful viability Laparoscopic adhesiolysis should only be performed by surgeons with advanced laparoscopic skills

Treatment of caecal volvulus

Treatment of caecal volvulus

At operation the volvulus is frequently found to be ischaemic and needs resection. If viable, the volvulus should be reduced. Sometimes, this can only be achieved after decompression of the caecum using a needle. Further management consists of either resection or fixation of the caecum to the right iliac fossa (caecopexy) and/or a caecostomy in those considered unfit for resection. Recurrence of volvulus after caecopexy has been reported in up to 40% of cases. -). - - - -

Figure 78.19 Radiograph of a stent inserted for malignant colonic obstruction. Figure 78.20 The Paul–Mikulicz operation applied to volvulus of the pelvic colon.

Treatment of intussusception

Treatment of intussusception

In the infant with ileocolic intussusception, after resuscitation with intravenous fluids, broad-spectrum antibiotics and naso gastric drainage, non-operative reduction can be attempted using an air or barium enema. Successful reduction can only be accepted if there is free reflux of air or barium into the small bowel, together with resolution of symptoms and signs in the patient. Non-operative reduction is contraindicated if there ar e signs of peritonitis or perforation, there is a known pathological lead point or in the presence of profound shock. In experienced units, more than 70% of intussusceptions can be reduced non-operatively . Strangulated bowel and patholog ical lead points are unlikely to reduce. Perforation of the colon during pneumatic or hydrostatic reduction is a recognised hazard but is rare. Recurrent intussusception occurs in up to 10% of pa tients after non-operative reduction. Surgery is required when radiological reduction has failed or is contraindicated. After resuscitation, a transverse right- sided abdominal incision provides good access. Reduction is achieved by gently compressing the most distal part of the intussusception towar ds its origin, making sure not to pull. The last part of the reduction is the most di ffi cult (Figure 78.16 After reduction, the terminal part of the small bowel and the appendix will be seen to be bruised and oedematous. The viability of the whole bowel should be checked carefully . An irreducible intussusception or one complicated by infarction or a pathological lead point requires resection and primary anastomosis.

Treatment of recurrent intestinal obstruction caus

Treatment of recurrent intestinal obstruction caused by adhesions

Several procedures may be considered in the presence of recurrent obstruction including: /uni25CF repeat adhesiolysis (enterolysis) alone; /uni25CF Noble’s plication operation; Thomas Benjamin Noble , 1895–1965, surgeon, The Community Hospital, Indianapolis, IN, USA. Wesley A Childs , 1915–2005, surgeon, University of Colorado, Denver, CO, USA. Richard B Phillips , surgeon, Albuquerque, NM, USA. - unless - - /uni25CF Childs–Phillips transmesenteric plication; /uni25CF intestinal intubation. The last three operations are now very rarely performed and can probably be consigned to the history books (they have never been required by the author).

(b) Figure 78.15 (a, b) Wall injury resulting from band compression, oversewn with an absorbable seromuscular suture.

Treatment of sigmoid volvulus

Treatment of sigmoid volvulus

Flexible sigmoidoscopy or rigid sigmoidoscopy and insertion of a flatus tube should be carried out to allow deflation of the gut. The tube should be secured in place with tape for 24 hours and a repeat radiograph taken to ensure that decompression has occurred. Success, as long as ischaemic bowel is excluded, will resolve the acute problem. In fit patients, an elective sigmoid colectomy is required. It may not be reasonable to o ff er any further treatment fol - lowing successful endoscopic decompression in elderly or unfit patients; however, if there are recurrent episodes of volvulus, the options are resection or two-point fixation with combined endoscopic/percutaneous tube insertion (gastrostomy tubes are frequently used for this purpose). When the bowel is viable, fixation of the sigmoid colon to the posterior abdominal wall may be a safer manoeuvre in inex - perienced hands. Resection is preferable if it can be achieved safely . A Paul–Mikulicz procedure is useful, particularly if ther e is suspicion of impending gangrene (Figure 78.20); an alternative pr ocedure is a sigmoid colectomy and, when anas - tomosis is considered unwise, a Hartmann’s procedure with subsequent reanastomosis can be carried out.

Vomiting

Vomiting

The more distal the obstruction, the longer the interval between the onset of symptoms and the appearance of nausea and vomiting. As obstruction progresses the character of the vomitus alters from digested food to faeculent material, as a result of enteric bacterial overgrowth.

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