**Microscopic Anatomy**

- Basic unit of small bowel mucosa is the villus, which is a finger-like projection. Each villus is covered with tall columnar epithelium.
- Goblet cells, Paneth cells and endocrine cells are seen in the crypts.

Goblet cells are mature mucous cells. Endocrine cells (enterochromaffin cells) have cytoplasmic granules which secrete 5-hydroxytryptamine, neurotensin, glucagon and motilin. Importantly, mucosal cell mediated immunity is brought by mucosal T lymphocytes.

**FUNCTIONS – PHYSIOLOGY**

- **Motility:** Two types of muscle contractions occur—one which does not propagate—it exposes the food contents to the absorptive surface for a longer time by causing segmentation thus better absorption of the food. Another type is peristaltic which propagates the food contents. Control of peristalsis is done by myenteric plexus. Time taken by the solid food contents to reach from mouth to colon is about 4 hours (Key Box 28.2).

- **Absorption and digestion:** Except calcium and iron almost everything is absorbed in the small intestines. To give a few examples: out of 6–10 litres of water, almost 80% water is absorbed in the small intestine and only 10–20% is discharged into colon. Thus in cases of terminal ileal obstruction, about 8–10 litres of fluid accumulate resulting in gross distension of the abdomen and dehydration. Carbohydrates and fat are mainly absorbed in duodenum and proximal jejunum. Proteins require pancreatic enzymes. Hence, they are broken down in the jejunum into amino acids and peptides. Conjugated bile acids are absorbed in the terminal ileum whereas enterohpetic circulation takes place and again they are secreted in the bile. Thus in ileal resections or diseases like Crohn’s disease, more amount of bile acids enter colon resulting in diarrhoea due to increased secretion of water and electrolytes.

**KEY BOX 28.2**

**FUNCTIONS OF THE SMALL INTESTINE**

- Digestion and absorption
- Synthesis of lipoproteins
- Secretion of regulatory peptides
  - Secretin
  - Cholecytokinin
  - Somatostatin
  - VIP
- Immune function; Production of immunoglobulins (IgA). The B cells and T cells help in phagocytosis and secretion of cytokines.
Fig. 28.3: Abdominal tuberculosis—pathology and pathogenesis

5. Mantoux test is nonspecific but a strong ulcerated Mantoux test result suggests tuberculosis.
6. Ultrasound, being a noninvasive investigation is an imaging of choice.
   - Ascites can be demonstrated and the aspirated fluid is sent for analysis
   - Focal ascites between loops of bowel—Club sandwich sign may be seen
   - Enlargement of mesenteric lymph nodes (common) and retroperitoneal nodes (uncommon) can be detected
   - Dilated loops and sometimes peritoneal tubercles are seen as echo-poor shadows
   - Thickening of omentum, mesentery, peritoneum can be found out. (However ultrasound is not the best investigation to detect these findings).
   - Pseudokidney sign: Pulled caecum identified in the right hypochondrium
   - Hepatosplenomegaly may be present

7. Ascitic fluid analysis:
   - Ultrasound guided fluid is aspirated and about 20–40 ml is sent for analysis (Key Box 28.4).
   - CECT: Contrast enhanced CT scan of the abdomen: CT scan is objective. All the findings which can be detected by ultrasound can be confirmed by CT scan. Addition of the contrast is definitely more superior in detecting strictures, dilatations, perforations, and more importantly loculated ascites and intra-abdominal collections. CT guided biopsy can be done. If dissection or matting of loops and adhesions are present, it is not safe.
   - Barium studies: These are not done routinely. If diagnosis is possible by the various investigations mentioned above, there is no necessity to do them. In fact it can harm the patient by precipitating obstruction and barium peritonitis if there is a perforation.

**KEY BOX 28.4**

ASCITIC FLUID ANALYSIS (STRAW-COLOURED FLUID)
- Specific gravity is increased—2020 or more
- Glucose < 30 mg%
- AFB is rarely demonstrated <3% of cases
- Increased white cell count (> 500/cells/cumm), predominantly lymphocyte
- Increased total protein (> 2.5 g/dl)
- Serum/ascitic fluid albumin gradient (SAAG) < 1.1 g%
- LDH > 90 units/L
- Decreased pH
- Increased sodium in ascites
- Bacterial isolation and culture is possible in 20–45% of patients.

SAAG = Serum albumin level—ascitic fluid albumin level
Enteroclysis: Dilatation and narrowed segments in partial obstruction.
- Narrowing of terminal ileum (Fleischer's sign), Fibrotic terminal ileum opening into the contracted caecum (Sterlin's sign)
- Barium enema: Pulled up caecum, normal acute ileocaecal angle becomes obtuse or sometimes straightening of the ileocaecal angle.

10. Endoscopy:
- Upper gastroduodenoscopy may detect tubercles in the stomach or duodenum – rare
- Push enteroscopy: Ulcers in the proximal jejunum can be detected and biopsy can be taken—chances of perforation are high.
- Colonoscopy can detect nodular lesions, ulcerations in the colon—caecum and terminal ileum (last 10 cm of ileum should be entered and biopsy should be taken).

11. Laparoscopy: This is a diagnostic investigation as it gives the tissue diagnosis (Figs 28.4 and 28.5). One can also evaluate all possible viscera, peritoneum, omentum and pelvic organs. Biopsy is possible under direct vision. Findings may include the following (Key Box 28.5):
- Peritoneal cavity: Fluid collection—clear or straw-coloured or abscess secondary to perforation
- Omentum: Tubercles, rolled up omentum
- Peritoneum: Tubercles, nature of the tubercles, caseation.
- Intestines: Matting of the loops of bowel, adhesions, bands, strictures, dilatations, perforations of bowel
- Root of the mesentery: Short mesentery, caseation of lymph nodes—cold abscess
- Lymph nodes: Mesenteric lymph nodes enlargement, caseation
- Caecum: Pulled up caecum
- Hepatosplenomegaly, tubercles on the surface of the liver.

Laparoscopy can also be therapeutic, if a stricture is identified, the diseased loop is isolated, brought out and a resection and anastomosis/stricturoplasty done.

**KEY BOX 28.5**

**LAPAROSCOPY—IMPORTANT FINDINGS**
- Lymph nodes
- Adhesions, matting
- Peritoneal nodules
- Ascites—aspiration—AFB staining
- Rolled up omentum
- Obstruction, stricture

**When to use what investigations?**

In the diagnosis of the abdominal tuberculosis, investigations can be classified as follows.

### Routine in all cases:
- CBP including ESR, chest X-ray and sputum for AFB. Lymph node biopsy—If lymph nodes are palpable (peripheral—cervical, axillary preferable—
inguinal last choice). Advantage being lymph node biopsy can be done under local anaesthesia. If it is positive, all other invasive and costly investigations can be avoided (see clinical notes below). Imaging: Ultrasound examination followed by guided ascitic fluid analysis has become a routine imaging test. It may not be diagnostic but since it has more advantages than any side-effects, it can be done.

2. Selected cases: PCR, CT scan, small bowel enteroscopy, barium studies, colonoscopy. If any one of these gives a diagnosis, treatment is started. In the presence of obstruction, avoid barium studies, enteroscopy and colonoscopy. The decision is made on clinical grounds to proceed with laparotomy.

3. Finally: Diagnostic laparoscopy/tissue diagnosis — this is the investigation of choice — often done as a last choice when all investigations are equivocal or have failed to give a diagnosis.

Antituberculous Treatment
- Details are given in medicine textbooks. However, 4 drug regimen for 2 months followed by 2 drug regimen for 4 months is recommended as a first line of treatment.
- First line of drugs include INH, rifampicin, ethambutol and pyrazinamide given for 2 months. This is followed by rifampicin and INH for 4 months. Refractory cases are treated by kanamycin, ofloxacin, ciprofloxacin, amikacin, etc. see clinical notes.

TUBERCULOUS PERITONITIS

It can be of two types: Acute and chronic. Basically, it produces the following pathological changes:

1. Intense exudation which causes ascitic form

2. Exudation with minimal fibroblastic reaction — loculated form

3. Extensive fibroblastic reaction — plastic form

4. Fibroblastic with secondary infection — purulent form

   - In most of the cases, tuberculous peritonitis results from reactivation of latent primary peritoneal focus.

Types

1. Ascitic form (Fig. 28.6) (generalised variety)
   - It is common in children and young adults. The child is brought to the hospital with abdominal distension.
   - Omentum can be felt as a rolled up transverse mass, which is nodular due to extensive fibrosis. Abdomen has a doughy feel with fluid giving rise to shifting dullness.
   - Aspiration of peritoneal fluid reveals exudate, which is rich in lymphocytes (Key Box 28.6).
   - Peritoneal cavity contains pale-straw-coloured fluid and the peritoneal surface is studded with tubercles.
   - Umbilical hernia or congenital hydrocele appears in children due to increased intra-abdominal pressure.

2. Loculated or encysted form (Fig. 28.7)
   - In this variety, ascitic fluid is present in one quadrant of the abdomen which is sealed off by matted intestinal coils surrounded by omentum. It gives rise to localised swelling. These patients have no shifting dullness.
   - It commonly presents in adults.
   - Differential diagnosis: Other cystic swellings in the abdomen such as pseudocyst of the pancreas, mesenteric cyst, retroperitoneal cyst.

KEY BOX 28.6

CAUSES OF EXUDATIVE ASCITES — INCREASE IN PROTEIN

Pancreatic ascites

Rare causes: Melt’s syndrome

Obstruction: Budd-Chiari syndrome

Tubercular peritonitis

Excess of chylomicrons

Infective: Peritonitis

Neoplasm of peritoneum (parietal peritoneal)

Remember:

Fig. 28.6: Ascitic form

Fig. 28.7: Encysted ascitic form
3. Fibrous peritonitis (plastic) (Fig. 28.8)
- In this variety, there is no ascites but there is extensive fibrosis which results in dense adhesions between the coils of intestines. Intestines are matted, distended and not able to empty properly due to adhesions and bands. It is associated with strictures.
- This gives rise to blind loop with steatorrhoea and emaciation.
- Usually, it presents with intestinal obstruction at a later date due to fibrous band which needs to be divided to relieve the obstruction. In some occasions, it is not possible to enter the peritoneal cavity, due to dense adhesions.
- It is not uncommon to create openings in the bowel at laparotomy and end with a helpless situation wherein one will not be able to close the perforation. The net result is fistula formation.

4. Purulent variety (Fig. 28.9)
- Seen in females as a complication of genitourinary tuberculosis (tuberculous salpingitis).
- The spread occurs through the female genital tract and there is always secondary infection.
- It presents with acute peritonitis at laparotomy, the peritoneal cavity is seen studded with tubercles, cold abscesses and pus.
- Laparotomy, drainage of pus, followed by antituberculous treatment is the choice of therapy.
- It carries poor prognosis because of complications such as toxemia and faecal fistula formation.
- Tuberculous peritonitis can be associated with infections of pleural space and pericardial space (effusion). It is called polyserositis syndrome.
- See also Figs 28.10 to 28.13

Fig. 28.8: Fibrous peritonitis  Fig. 28.9: Purulent type

Fig. 28.10: Fibrous bands

**TUBERCULOUS PERITONITIS (Figs. 28.10, 28.11, 28.12, 28.13)
Clinical presentation**

1. As a calcified lesion (Fig. 28.14) along the line of mesentery, which extends from L2 vertebra, at the left of vertebral column to the right sacroiliac joint. In 50% of cases, there is no active infection but in the remaining, there is infection. If the symptoms are that of tuberculosis, antituberculous treatment should be given. The shadow caused by lymph nodes are round to oval, mottled and may be regular or irregular.
ACUTE INTESTINAL OBSTRUCTION

1. Ans. b. Usually venous blood flow affected first (Ref: Sabiston 19/e p1236-1244; Schwartz 9/e p988-992; Bailey 26/e p1186; 1191; Shackelford 7/e p864-872)
   - Venous return is compromised before arterial supply in strangulated intestinal obstruction.

   SMALL BOWEL OBSTRUCTION

   - Adhesions secondary to previous surgery are the MC cause of SBO.
   - Causes: Adhesions (60%) > Malignant tumors (20%) > Hernia (10%) > Crohn's disease (5%)³
     - Metastatic or peritoneal carcinomatosis are the MC malignancies leading to SBO.
   - Primary colonic cancers (particularly those arising from the cecum and ascending colon) may present as a SBO.

   Pathophysiology:
   - Early in the course of an obstruction, intestinal motility and contractile activity increase in an effort to propel luminal contents past the obstructing point.
   - Increase in peristalsis early in the course of bowel obstruction is present both above and below the point of obstruction (diarrhea in partial or even complete small bowel obstruction in the early period).
   - Later in the course of obstruction, the intestine becomes fatigued and dilates, with contractions becoming less frequent and less intense.
   - As the bowel dilates, water and electrolytes accumulate both intraluminally and in the bowel wall itself.
   - This massive third-space fluid loss accounts for the dehydration and hypovolemia.
   - The metabolic effects of fluid loss depend on the site and duration of the obstruction.

   - As the intraluminal pressure increases in the bowel, a decrease in mucosal blood flow can occur.

   Clinical Features:
   - In most patients, a meticulous history and physical examination complemented by plain abdominal radiographs are all that is required to establish the diagnosis and to devise a treatment plan.
   - Cardinal symptoms of intestinal obstruction: Colicky abdominal pain (1st symptom), nausea, vomiting, abdominal distension, and a failure to pass flatus and feces (i.e., obstipation).
   - Typical crampy abdominal pain occurs in paroxysms at 4- to 5-minute intervals and occurs less frequently with distal obstruction.

   - Nausea and vomiting are more common with proximal obstruction.
   - Cramping abdominal pain is the initial and most prominent symptom in distal obstruction.
   - Abdominal distension is more common in distal obstruction.

   - Abdominal distension occurs as the obstruction progresses, and the proximal intestine becomes increasingly dilated.

   - As the obstruction becomes more complete with bacterial overgrowth, the vomitus becomes more feculent, indicating a late and established intestinal obstruction.

   - Patient may present with tachycardia and hypotension, demonstrating the severe dehydration that is present.
   - Fever suggests the possibility of strangulation.
   - Abdominal distension is dependent on the level of obstruction.

   - Early in the course of bowel obstruction, peristaltic waves can be observed, particularly in thin patients, and auscultation of the abdomen may demonstrate hyperactive bowel sounds with audible rushes associated with vigorous peristalsis (i.e., borborygmi).

   - Late in the obstructive course, minimal or no bowel sounds are noted.

   - Localized tenderness, rebound, and guarding suggest peritonitis and the likelihood of strangulation.
   - Rectal examination: To assess for intraluminal masses and to examine the stool for occult blood (an indication of malignancy, intussusception, or infarction).
Diagnosis

- **X-ray Abdomen**: Confirm the clinical suspicion and define more accurately the site of obstruction (60% diagnostic accuracy). 
  - Supine radiographs: Dilated loops of small intestine without evidence of colonic distention, diagnose site and level of obstruction.
  - Erect radiographs: Multiple air-fluid levels, which often layer in a stepwise pattern.
  - Supine films are better than erect for diagnosis of intestinal obstruction.

  **CT Scan**
  - Used in complex patients, in whom the diagnosis is not readily apparent.
  - Highly sensitive for diagnosing complete or high-grade obstruction of the small bowel and for determining the location and cause of obstruction.
  - Less sensitive for partial small bowel obstruction.
  - Useful for extrinsic cause of bowel obstruction (e.g., abdominal tumors, inflammatory disease, or abscess) and determining bowel strangulation.

- **Enterolysis**: Is investigation of choice in low-grade, intermittent SBO.
- **Barium studies**: Precisely demonstrate the level of the obstruction and cause in certain cases.
- **Ultrasound**: Useful in pregnant patients.
  - Leukocytosis may be found in patients with strangulation, but does not necessarily denote strangulation.
  - Absence of leukocytosis does not eliminate strangulation as a possibility.

2. Ans. a. Small intestinal obstruction (Ref: Bailey 21/e p58)

<table>
<thead>
<tr>
<th>Simple Obstruction</th>
<th>Strangulating Obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually involves a closed-loop obstruction.</td>
<td>Vascular supply to a segment of intestine is compromised, can lead to intestinal infarction.</td>
</tr>
<tr>
<td>Associated with an increased morbidity and mortality risk.</td>
<td>Classic signs: Tachycardia, fever, leukocytosis, and a constant, noncramping abdominal pain.</td>
</tr>
<tr>
<td>CT scan: Useful only in detecting the late stages of irreversible ischemia (e.g., pneumatosis intestinalis, portal venous gas)</td>
<td></td>
</tr>
</tbody>
</table>

5. Ans. b. Malignancy (Ref: Sabiston 19/e p1238; Schwartz 9/e p988; Bailey 26/e p1181, 25/e p1188; Shackelford 7/e p865)

<table>
<thead>
<tr>
<th>Causes of Small Bowel Obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesions secondary to previous surgery are the MC cause of SBO.</td>
</tr>
<tr>
<td>Causes: Adhesions (60%) &gt; Malignant tumors (20%) &gt; Hernia (10%) &gt; Crohn’s disease (5%)</td>
</tr>
</tbody>
</table>

7. Ans. a. Adhesions
8. Ans. c. Post-operative adhesions
9. Ans. a. Vomiting is common in duodenal obstruction, c. In colonic obstruction distension is common than vomiting, d. X-ray erect posture is diagnostic. e. Colicky pain to steady pain indicates strangulation (Ref: Sabiston 19/e p1242-1243; Schwartz 9/e p990-991; Bailey 26/e p1190-1194, 25/e p1196-1198; Shackelford 7/e p870-872)

**TREATMENT OF ACUTE INTESTINAL OBSTRUCTION**

- Fluid Resuscitation and Antibiotics\(^9\): Aggressive intravenous (IV) replacement with an isotonic saline solution such as lactated Ringer’s.
- Urine output should be monitored by the placement of a Foley catheter.
- Elderly patients may require central venous assessment\(^9\).
- Tube Decompression\(^9\): Nasogastric suction reduces the risk of pulmonary aspiration of vomitus and minimizing further intestinal distention from preoperatively swallowed air.
  - Patients with a partial intestinal obstruction may be treated conservatively with resuscitation and tube decompression alone\(^9\).
  - Resolution of symptoms and discharge without the need for surgery has been reported in 60-85% of patients with a partial obstruction\(^9\).
- Clinical deterioration of the patient or increasing small bowel distention on abdominal radiographs during tube decompression warrants prompt operative intervention\(^9\).

**Operative Management**

- Complete SBO requires operative intervention\(^9\).
- Adhesiolysis: In cases of intestinal obstruction secondary to an adhesive band\(^9\).
- Incarcerated hernias can be managed by manual reduction of the herniated segment of bowel and closure of the defect\(^9\).

**Consideration of laparoscopic management in patients with**

- Mild-abdominal distention\(^9\) allowing adequate visualization
- Proximal obstruction\(^9\)
- Partial obstruction\(^9\)
- Anticipated single-band obstruction

10. Ans. a. Abdominal distension, b. Vomiting


12. Ans. a. X-ray abdomen erect posture

13. Ans. b. Duodenal obstruction (Ref: Sabiston 19/e p1236; Schwartz 9/e p988; Bailey 26/e p1186, 25/e p1192-1194; Shackelford 7/e p866)

- Abdominal pain, bilious vomiting without abdominal distention is suggestive of proximal small intestinal obstruction, distal to ampulla of Vater (Duodenal obstruction).
  - Nausea and vomiting are more common with proximal obstruction\(^9\)
  - Abdominal distention is more common in distal obstruction\(^9\)

14. Ans. c. Atresia of the 3rd part of the duodenum

15. Ans. d. Swallowed air (Ref: Sabiston 19/e p1238-1239; Schwartz 9/e p988; Bailey 26/e p1186, 25/e p1189; Shackelford 7/e p866)

<table>
<thead>
<tr>
<th>Cause of Abdominal Distention</th>
<th>Gas</th>
<th>Fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swallowed air(^9) is the major source (Nitrogen(^9) is not well absorbed by intestinal mucosa)</td>
<td>Enormous quantities of fluid from the extracellular space are lost into gut (third space loss)</td>
<td></td>
</tr>
<tr>
<td>Gases produced by bacterial fermentation (H(_2), CO(_2), CH(_3))</td>
<td>Net GI secretion is enhanced in obstruction</td>
<td></td>
</tr>
</tbody>
</table>

16. Ans. b. Duodenal atresia (Ref: Bailey 26/e p120, 1193, 25/e p1199)

- MC site of intestinal atresia: Duodenum\(^9\)
- MC cause of neonatal intestinal obstruction: Duodenal atresia\(^9\)
17. Ans. a. Avoid surgery for initial 48-72 hours (Ref: Sabiston 19/e p1243; Schwartz 9/e p990-991, Bailey 20/e p1192, 25/e p1198, Shackelford 7/e p872)

**TREATMENT OF ADHESIVE OBSTRUCTION**
- Initial management is based on intravenous rehydration and nasogastric decompression; occasionally, this treatment is curative.
- Although an initial conservative regimen is considered appropriate, regular assessment is mandatory to ensure that strangulation does not occur.
  - **Conservative treatment should not be prolonged beyond 72 hours.**
- When, as is usual, laparotomy is required, although multiple adhesions may be found, only one may be causative. This should be divided and the remaining adhesions left in situ unless severe angulation is present. Division of these adhesions will only cause further adhesion formation.
- When obstruction is caused by an area of multiple adhesions, the adhesions should be freed by sharp dissection.
- To prevent recurrence, the bare area should be covered with Omental grafts.
- Laparoscopic adhesiolysis may be considered in highly selected cases of chronic subacute obstruction.

18. Ans. a. First part of duodenum

**SYMPTOMS OF INTESTINAL OBSTRUCTION**
- Symptoms of intestinal obstruction: Pain, vomiting, distention and constipation
- Pain is the first symptom encountered; it occurs suddenly and is usually severe.

<table>
<thead>
<tr>
<th>Pain in Intestinal Obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is colicky in nature and is usually centred on the umbilicus (small bowel) or lower abdomen (large bowel)</td>
</tr>
<tr>
<td>The pain coincides with increased peristaltic activity</td>
</tr>
<tr>
<td>With increasing distention, the colicky pain is replaced by a mild constant diffuse pain</td>
</tr>
<tr>
<td>The development of severe pain is indicative of the presence of strangulation</td>
</tr>
<tr>
<td>Pain may not be a significant feature in postoperative simple mechanical obstruction and does not usually occur in paralytic ileus</td>
</tr>
</tbody>
</table>

20. Ans. b. High peristalsis with colic
21. Ans. d. Multiple air gas shadows on X-ray
22. Ans. a. Post-op adhesion
23. Ans. c. Biliary vomiting

**INTUSSUSCEPTION**

24. Ans. c. Intussusception (Ref: Sabiston 19/e p1851; Schwartz 9/e p1433-1434; Bailey 26/e p1184, 1187, 1183, 25/e p1191, 1196, 1198; Shackelford 7/e p1059-1061)

**INTUSSUSCEPTION**
- Telescoping of one portion of the intestine into the other.
- Middle layer is isolated between two sharp bends and first to become gangrenous.
  - Highest incidence between 4 and 10 months of age
  - Approx 80-90% of cases occur between 3 and 36 months
- Mostly idiopathic in infants and toddlers (no clear etiology).
- MC type: Ileocolic
76. Ans. c. Parasympathomimetics (Ref: Bailey 25/e p1202)
- Rarely, in resistant cases, medical therapy with an adrenergic blocking agent in association with cholinergic stimulation, e.g. neostigmine (the Catchpole regimen), may be used, provided that an intraperitoneal cause has been excluded.

77. Ans. a. No intestinal sounds heard

**LARGE BOWEL OBSTRUCTION**

78. Ans. d. Defunctioning colostomy (Ref: Sabiston 19/e p1317-1319; Bailey 26/e p1194-1196; 25/e p1202; Shackelford 3rd ed 554; Mangi 11/e p501)
- Most common site of colorectal cancer is rectum, in obstructing carcinoma rectum loop colostomy or defunctioning colostomy should be done to relieve obstruction followed by neoadjuvant chemoradiation, with the plan to resect the primary lesion at a later time.

**LARGE BOWEL OBSTRUCTION**

- Classified as *dynamic* (mechanical) or *non-dynamic* (pseudo-obstruction).
- Mechanical obstruction is characterized by blockage of the large bowel (luminal, mural, or extramural), resulting in increased intestinal contractility.
- Pseudo-obstruction is characterized by the absence of intestinal contractility, often associated with decreased or absent motility of the small bowel and stomach.
- MC cause of LBO: Colorectal cancer (CA Rectum > sigmoid).
- Adhesions (MC cause of small bowel obstruction) are rarely a cause of colonic obstruction.

**Pathophysiology**

- Colonic becomes distended as gas (about two thirds is swallowed air, the rest includes the products of bacterial fermentation), stool, and liquid accumulate proximal to the site of blockage.
- In obstructed hernia or volvulus, the blood supply can become compromised, or strangulated; initially, the venous return is blocked.
- Vascular compromise of the obstructed colon can occur due to excessive distention.
- Closed-loop obstruction: When both the proximal and distal parts of the bowel are occluded (strangulated hernia or volvulus).
  - Closed-loop obstruction is seen when a cancer occludes the lumen of the colon in the presence of a competent ileocecal valve.
  - Increasing colonic distention causes the pressure in the cecum to become so high that the vessels in the bowel wall are occluded, and necrosis and perforation can occur.

**Clinical Features**

- Cancers of rectum or left colon are more likely to obstruct than those arising in the more capacious proximal colon.
- Failure to pass stool and flatus associated with increasing abdominal distention and cramping abdominal pain.

**Diagnosis**

- Abdominal X-ray: Distended colon.
- CT scan: Helpful in revealing an inflammatory process such as diverticulitis.
- Water-soluble contrast enema: For the diagnosis of suspected case of volvulus or distal sigmoid cancer.

**Treatment**

- Virtually all patients with complete acute large bowel obstruction require prompt surgical intervention and should not undergo a trial of non-operative management.
- Acute large bowel obstruction in patients with competent ileocecal valve is a true surgical emergency because of high chances of perforation (MC site: Cecum).
- Once diagnosis has been made, surgical exploration should be undertaken as soon as possible after appropriate resuscitation.

<table>
<thead>
<tr>
<th>Treatment of Large Bowel Obstruction</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-sided colonic obstruction (cancer or volvulus)</td>
<td>Resection with ileo-transverse anastomosis</td>
</tr>
<tr>
<td>Cancer of sigmoid colon</td>
<td>Hartmann's operation (sigmoidectomy with descending colostomy and closure of the rectal stump), Sigmoidectomy with primary colorectal anastomosis, Abdominal colectomy with ileorectal anastomosis</td>
</tr>
<tr>
<td>Cancer of distal or mid rectum</td>
<td>Loop colostomy or defunctioning colostomy (to relieve obstruction) followed by neoadjuvant chemoradiation, (with the plan to resect the primary lesion at a later time)</td>
</tr>
</tbody>
</table>
Intestinal Obstruction

### Paralytic Ileus: Common Etiologies

<table>
<thead>
<tr>
<th>Medical Conditions</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal surgery*</td>
<td>Anticholinergics*</td>
</tr>
<tr>
<td>Uremia*</td>
<td>Opiates*</td>
</tr>
<tr>
<td>Infection:</td>
<td>Phenothiazines*</td>
</tr>
<tr>
<td>- Sepsis</td>
<td>Calcium channel blockers*</td>
</tr>
<tr>
<td>- Intra-abdominal abscess</td>
<td>Tricyclic antidepressants</td>
</tr>
<tr>
<td>Peritonitis*</td>
<td>Hypothyroidism*</td>
</tr>
<tr>
<td>- Pneumonia*</td>
<td>Ureteral colic</td>
</tr>
<tr>
<td>- Hypokalemia*</td>
<td>Retroperitoneal hemorrhage*</td>
</tr>
<tr>
<td>- Hypomagnesemia*</td>
<td>Spinal cord injury*</td>
</tr>
<tr>
<td>- Hypermagnesemia*</td>
<td>Myocardial infarction</td>
</tr>
<tr>
<td>- Hyponatremia*</td>
<td>Mesenteric ischemia*</td>
</tr>
</tbody>
</table>

### Clinical Features
- Paralytic ileus is a state in which there is failure of transmission of peristaltic waves secondary to neuromuscular failure.
- The resultant stasis leads to accumulation of fluid and gas within the bowel with associated distention, vomiting, absent or diminished bowel sounds and absolute constipation*.

#### Pain
- Pain is colicky in mechanical obstruction, pain is **not** a feature of paralytic ileus and if present a steady, diffuse discomfort.

### Diagnosis
- Abdominal X-ray: Dilated bowel loops with multiple air fluid levels*.
- Radiological picture is similar to small bowel obstruction, the only differentiating point is presence of gas in colon and rectum in paralytic ileus*.

#### Paralytic Ileus
- Pain is not a feature of paralytic ileus and if present a steady, diffuse discomfort.
- Bowel sounds are hypoactive or absent*
- Presence of gas in colon and rectum* in paralytic ileus on abdominal X-ray.

#### Mechanical Obstruction
- Pain is colicky* in mechanical obstruction.
- Hyperactive bowel sounds* in mechanical obstruction.
- Absence of gas in colon and rectum in mechanical (complete)* small bowel obstruction.

### Management of Post-operative Ileus
- The essence of treatment is prevention, with the use of nasogastric suction and restriction of oral intake until bowel sounds and the passage of flatus return*.
- Following general principles should be applied:
  - The primary cause must be removed*.
  - Gastrointestinal distension must be relieved by decompression*.
  - Close attention to fluid and electrolyte balance* is essential.
  - There is no place for the routine use of peristaltic stimulants.
- Rarely, in resistant cases, medical therapy with an adrenergic blocking agent in association with cholinergic stimulation, e.g. neostigmine (the Catchpole regimen)*, may be used, provided that an intraperitoneal cause has been excluded.

#### Pain
- If paralytic ileus is prolonged and threatens life, a laparotomy should be considered to exclude a hidden cause and facilitate bowel decompression*.

### Questions
73. Ans. c. Laparotomy and exploration (Ref: Bailey 26/e p1197, 25/e p1202)
   - If paralytic ileus is prolonged and threatens life, a laparotomy should be considered to exclude a hidden cause and facilitate bowel decompression.

74. Ans. a. Small intestine

75. Ans. d. Loops of intestine are not seen due to loss of peristalsis
Intestinal Obstruction

Introduction
- Intestinal obstruction is a challenging surgical emergency encountered by general surgeons. This can affect any age group starting from neonate to an old man. It can affect a school going boy, working woman or a man during their peak of life. Sometimes it can be fatal either due to delay in the diagnosis, delay in the treatment, or complications related to surgery. Abdomen is a Pandora's box. Sometimes, it is difficult to pinpoint the cause of obstruction.
- Adhesions and hernia are the two most common causes of intestinal obstruction. Adhesions are more common than hernias nowadays. Laparoscopic surgery has definitely decreased incidence of adhesions. In Western countries more than 50% cases of intestinal obstruction are due to adhesions and only 10–15% are due to obstructed hernia (Fig. 30.1). However, students should be able to diagnose intestinal obstruction, resuscitate the patients and refer the patient for further surgical treatment. With the availability of sophisticated investigations such as CT scan, diagnosis can be established in majority of cases before surgery. However, in other cases, ‘exploratory laparotomy’ will give the diagnosis.

Definition
When the intestinal contents fail to move distally, it is called intestinal obstruction. It is the most common surgical disorder (emergency) of the intestines.

Few important facts about intestinal obstruction:
- 80% occur in small bowel
- 20% occur in large bowel
- Majority (more than 80%) of small bowel obstructions are benign in nature.
  In the large bowel, more than 70% of colonic obstruction is due to malignancy—others being inflammatory bowel diseases, ileocaecal tuberculosis, volvulus, etc.

CLASSIFICATION
(1. Depending upon the nature of obstruction
(Key Box 30.1)
A. Dynamic obstruction/mechanical obstruction (Fig. 30.1)
B. Dynamic obstruction—paralytic ileus or neurogenic ileus.

Fig. 30.1: Obstructed incisional hernia (Courtesy: Prof. Manjunath Shenoy, JSS Medical College and Hospital, Mysore)