Section

4

Abdomen

- Bones
- Anterior Abdominal Wall
- Male External Genitalia
- Abdominal Cavity and Peritoneum
- Abdominal Part of Stomach and Oesophagus
- Small and Large Intestine
- Large Blood Vessels of Abdomen
- Extrahepatic Biliary Apparatus
- Spleen, Pancreas and Liver
- Kidney and Ureter
- Diaphragm
- Posterior Abdominal Wall
- Perineum
- Urinary Bladder and Urethra
- Female Reproductive Organs
- Male Reproductive Organs
- Rectum and Anal Canal

Case

A 45 years old male visited a doctor for severe back pain after lifting a heavy box of books. The pain was referred to the back of thigh, lateral side of left leg and radiating to the foot. He also complained of restriction of movements of vertebral column. MRI of the back revealed decreased space between L4 and L5 and L5 and S1 due to herniation of the discs on the left side.

BONES

Q. Which nerve is affected in this case?

A. Sciatic nerve.

Q. What is this condition called?

A. Sciatica.

Q. What is herniation of disc?

A. In herniation of disc or slipped disc, the posterior or posterolateral part of the annulus fibrosus ruptures and nucleus pulposus bulges out through the crack in annulus (Fig. 4.1).



Fig. 4.1: Herniation or prolapse of disc

Q. Why there is restriction of movements of the vertebral column?

A. Due to irritation of the affected nerve roots, the back muscle undergoes spasm leading to restriction of movements of the vertebral column.

Q. Which muscle are tested to ascertain the compression of L4 and L5 roots?

A. Compression of L4 root is ascertained by testing the tibialis anterior and tibialis posterior, which is done by asking the patient to invert the foot against resistance. Compression of L5 is ascertained by testing the extensor hallucis longus, which is done by asking the patient to extend the big toe against resistance.

Q. What is straight leg raising test?

A. The patient lies in supine position on the bed. The affected leg is raised up from the bed by holding the foot. As the sciatic nerve is stretched, it causes severe pain.

Q. What is cauda equina syndrome?

A. Compression of cauda equina due to midline posterior herniation of the disc produces certain symptoms collectively known as cauda equina syndrome (Fig. 4.2).



Fig. 4.2: Cauda equina syndrome

ANTERIOR ABDOMINAL WALL

Case

A 26 years old woman who is 7 months pregnant visits the doctor for antenatal checkup. Ultrasound examination reveals herniation of small bowel loops into the amniotic cavity. The condition was diagnosed as omphalocele.

Q. What is omphalocele?

A. It is an anomaly results from failure of coils of small intestine to return into the abdominal cavity after their physiological herniation during 6th to 10th week (Fig. 4.3).





Q. What are the coverings of omphalocele?

A. The loops of intestine are covered with Wharton's jelly and transparent amniotic membrane.

Q. What is congenital umbilical hernia?

A. It is an anomaly in which there is herniation of abdominal viscera through the weak umbilical opening. The contents are covered with peritoneum, subcutaneous tissue and skin. The umbilical hernia usually gets reduced on its own within 2–3 years. Surgery is only considered when hernia stays up to 2–3 years of age (Fig. 4.4).





Q. What is gastroschisis?

A. It is an anomaly in which there is linear defect in the anterior abdominal wall through which abdominal contents herniate out. It occurs lateral to the umbilicus and usually on the right side. This defect occurs when lateral folds of embryo fail to fuse with each other around the connecting stalk (Fig. 4.5).



A 35 years old man came to the doctor with complaints of abdominal pain. For physical examination, the doctor told to patient to lie down on the bed on his back. The doctor made him flex his knee and hip joints. He rubbed his hands with each other before palpating the abdomen. The doctor kept talking about his daily routine as he started palpating. Then he applied more pressure and asked the patient to take deep breaths.

Q. Why the doctor made the patient to flex his knee and hip joints?

A. The doctor made the patient to flex his knee and hip joints to achieve adequate relaxation of the abdominal muscles, otherwise the fasciae latae of thigh would pull the membranous layer of superficial fascia tensing the abdominal wall.

Q. Why did doctor rub his hands before palpating?

A. The doctor rubbed his hands to make them warmer as cold hands make the anterior abdominal wall muscles tense.

Q. Why doctor kept talking with the patient as he started palpating?

A. The doctor kept talking with the patient to divert his attention so the abdominal muscles remain relaxed.

Q. Why did the doctor asked the man to take deep breaths?

A. Upon taking deep breaths, the abdominal viscera move down and so palpation of viscera like liver and spleen is easier.

Q. Which organs are palpable only after they enlarge?

A. Liver and spleen are palpable only after they enlarge. For spleen, it has to enlarge double its normal size to become palpable.

Case

A 50 years old woman is detected with breast cancer. She underwent mastectomy. After removal of the affected breast, breast reconstruction surgery is done where ipsilateral rectus abdominis is separated from the surrounding structures and transposed to the chest wall.

Q. How the rectus abdominis is used for reconstruction of other areas?

A. In case of breast reconstruction, the lower end of the ipsilateral rectus abdominis is freed and is transposed to the chest wall, keeping its blood supply intact. In case of thigh or perineum reconstruction, the upper end of the ipsilateral muscle is freed and is transposed to thigh or perineum, keeping its blood supply intact.

Q. Why rectus abdominis a powerful flexor of the trunk?

A. The tendinous intersections divide the rectus abdominis into smaller parts increasing the number of muscle fibres. This makes the rectus abdominis a powerful flexor of the trunk.

Q. What is tendinous intersections of rectus abdominis?

A. These are 3 transverse fibrous bands on the anterior surface of the rectus abdominis which are adherent to the anterior wall of the rectus sheath. One usually lies opposite

the xiphoid process, one opposite the umbilicus and third midway between the two. On the surface the tendinous intersections are marked by three transverse furrows (Fig. 4.6).



Fig. 4.6: Rectus abdominis muscle

Q. What is linea semilunaris?

A. It is curved groove marking the lateral border of the rectus abdominis muscle. It begins at the pubic tubercle and crosses the costal margin at the tip of the 9th costal cartilage (Fig. 16.1; *BD Chaurasia's Human Anatomy*, Vol 2).

Q. What is divarication of recti?

A. It usually occurs in multiparous women and chronically weak child. The upper part of linea alba becomes weak and stretched out so the recti are widely separated (Fig. 4.7). A finger can be insinuated between the two recti. This condition is known as divarication of recti. Sometimes, a



Divarication of rectus abdominis

Fig. 4.7: Divarication of recti

part of greater omentum may herniate through the defect which is known as epigastric hernia.

Q. What is rectus abdominis hematoma?

A. Collection of blood within the rectus sheath due to rupture of epigastric arteries is called rectus abdominis hematoma. It is usually unilateral and occurs when muscle contracts suddenly and violently as in athletes and during coughing in elderly person where the epigastric arteries may be torn. The blood may gravitate into the extraperitoneal tissues of iliac fossa as posterior wall of the rectus sheath is deficient below the arcuate line.

Q. Which landmark is commonly used to locate the inferior end of the posterior wall of the rectus sheath?

A. Arcuate line which is inferior free end of the posterior wall of the rectus sheath. Below the arcuate line the posterior wall of rectus sheath is deficient and rectus lies directly on the fascia transversalis. This part of fascia transversalis is thickened to form the ilio-public tract that supports the rectus abdominis muscle (Fig. 4.8).



Fig. 4.8: Rectus sheath—sagittal section

Case

A 15 years old boy was brought to the general surgeon for complaints of swelling in his left groin. On further inquiry, he informed that the swelling increases in size on coughing and does not disappear on lying down. The surgeon noticed that the swelling superomedial to the pubic tubercle. The surgeon also noticed that the swelling appears in standing position and increased in size on coughing. The surgeon performed the invagination test and ring occlusion test and diagnosed the condition to be indirect inguinal hernia.

Q. What is inguinal hernia?

A. Inguinal hernia is abnormal protrusion of abdominal viscera into the inguinal canal. Loops of intestine are the most common content of inguinal hernia.

Q. What is indirect inguinal hernia?

A. Indirect inguinal hernia enters the inguinal canal through deep inguinal ring, passes through the inguinal canal and emerges through the superficial inguinal ring.

Q. Why indirect hernia is more common in children and young adults?

A. Due to congenital persistence of processus vaginalis in the inguinal canal, this type of hernia occurs early in age in children or young adults.

Q. What is the significance of swelling being superomedial to the pubic tubercle?

A. Superficial inguinal ring lies above and medial to the pubic tubercle. Inguinal hernia come out through superficial inguinal ring, whereas femoral hernia emerges through the femoral canal which lies below and lateral to the pubic tubercle (Fig. 4.9).



Fig. 4.9: Inguinal and femoral hernia

Q. What is ring invagination test? Mention its significance.

A. This test is performed in recumbent position. A finger is passed upwards from the scrotum towards the superficial inguinal ring. Once the finger reaches the superficial inguinal ring, the patient is asked to cough. In this case, the impulse is felt on the tip of the finger, so it is indirect hernia.

Q. What is the ring occlusion test? Mention its significance.

A. This test is performed in standing position. First the hernia is reduced by pushing it with little finger upwards and laterally. The doctor now puts his thumb just above the midinguinal point and then the patient is asked to cough. As the swelling did not appear on coughing in this case, it is indirect hernia. The test is done to differentiate the indirect hernia from direct hernia.

Q. Which nerve is sometimes compressed by hernia to cause groin pain?

A. As ilioinguinal nerve passes through the inguinal canal by the side of spermatic cord, it is sometimes compressed causing pain in the groin region.

Q. What is Littre's hernia?

A. When Meckel's diverticulum is the content of the inguinal hernia, it is called Littre's hernia.

Case

A 56 years old man with history of chronic constipation visited a surgeon with complaint of swelling in the groin for the last 2 months. He also told that the swelling disappears on lying down in supine position. On physical examination, the surgeon noticed that the swelling superomedial to the pubic tubercle and the swelling appeared in standing position and increased in size on coughing. The surgeon performed the invagination test and ring occlusion test and diagnosed the condition to be direct inguinal hernia.

Q. What is direct inguinal hernia?

A. Direct inguinal hernia enters the inguinal canal by passing through the weakened posterior wall of inguinal canal through Hesselbach's triangle and emerges through the superficial inguinal ring.

Q. What are the boundaries of Hesselbach's triangle?

A. Boundaries of Hesselbach's triangle (Fig. 4.10):

Medially: Lower 5 cm of the lateral border of the rectus abdominis muscle.

Laterally: Inferior epigastric artery.

Inferiorly: Medial half of the inguinal ligament.

Floor of the triangle is formed by the peritoneum, extraperitoneal tissue, and fascia transversalis.



Fig. 4.10: Hesselbach's triangle

Q. What are the types of direct inguinal hernia?

A. They are lateral and medial. The Hesselbach's triangle is divided into lateral and medial parts by obliterated umbilical artery. Hernia occurring through lateral part is called lateral direct hernia and that occurring through medial part is called medial direct hernia.

Q. What is difference in coverings of lateral and medial direct hernia?

A. Lateral direct hernia is covered from inside out by extraperitoneal tissue, fascia transversalis, cremasteric fascia, external spermatic fascia and skin. In medial direct hernia, cremasteric fascia is replaced by conjoint tendon (Fig. 16.35; *BD Chaurasia's Human Anatomy*, Vol 2).

Q. Why direct inguinal hernia is more common in old age?

A. It occurs due to weakening of anterior abdominal muscles in old age due to increased intra-abdominal pressure caused by chronic cough or chronic constipation, etc. The posterior wall of the inguinal canal is mainly formed by conjoint tendon which is formed by aponeurosis of internal oblique and transversus abdominis muscles. In old age, these muscles become lax due to loss of tone and power and yield easily.

Q. What is the significance of swelling being superomedial to the pubic tubercle?

A. Superficial inguinal ring lies above and medial to the pubic tubercle. Inguinal hernia comes out through superficial inguinal ring, whereas femoral hernia emerges through the femoral canal which lies below and lateral to the pubic tubercle (Fig. 16.32; *BD Chaurasia's Human Anatomy*, Vol 2).

Q. What is ring invagination test? Mention its significance.

A. This test is performed in recumbent position. A finger is passed upwards from the scrotum towards the superficial inguinal ring. Once the finger reaches the superficial inguinal ring, the patient is asked to cough. In this case, the impulse is felt on the pulp of the finger, so it is direct hernia.

Q. What is the ring occlusion test? Mention its significance.

A. This test is performed in standing position. First the hernia is reduced by pushing it with little finger upwards and laterally. The doctor now puts his thumb just above the midinguinal point and then the patient is asked to cough. In this case, the swelling appeared medial to the thumb, so it is direct hernia. The test is done to differentiate the direct hernia from indirect hernia.

Q. Which nerve is sometimes compressed by hernia to cause groin pain?

A. As ilioinguinal nerve passes through the inguinal canal by the side of spermatic cord, it is sometimes compressed causing pain in the groin region.

MALE EXTERNAL GENITALIA

Case

A 2 years old child is admitted to the hospital for swelling in the groin. Diagnosis revealed that the intermediate portion of processus vaginalis is patent in which fluid has accumulated and has formed a cyst.

Q. What is this condition called?

A. Encysted hydrocele of spermatic cord.

Q. What is hydrocele?

A. Collection of fluid in processus vaginalis is called hydrocele.

Q. What is processus vaginalis?

A. It is a double-layered diverticulum of peritoneum which extends along with the descending testis from abdomen to the scrotum. Once the testis reaches the scrotum, the proximal part of processus vaginalis is obliterated.

Q. What is the derivative of distal part of processus vaginalis?

A. The distal part of processus vaginalis forms the vaginal sac around the testis.

Q. What are the consequences if entire processus vaginalis remains patent?

A. If the processus vaginalis fails to obliterate, the loops of intestine may descend through it into the scrotum causing congenital indirect inguinal hernia. Sometimes, due to incomplete obliteration of the processus vaginalis, a tiny communication occurs between the peritoneal cavity and vaginal sac. This may permit the escape and consequent accumulation of fluid into the vaginal sac causing congenital hydrocele.

Q. What are the types of hydrocele?

- A. These are as follows (Fig. 4.11):
- 1. Vaginal—hydrocele is confined to the scrotum.
- 2. Infantile—extending upwards to the deep inguinal ring.
- 3. Congenital—communicating with the peritoneal cavity (vide supra).
- 4. Encysted hydrocele of spermatic cord (vide supra).



Fig. 4.11: Types of hydrocele, A: Vaginal, B: Infantile, C: Congenital, D: Encysted

Case

A 1 year old boy is admitted to the hospital for complaint of absence of testicles from scrotum. The paediatrician palpated the testes in the inguinal canal which was confirmed by a CT scan of abdomen.

Q. What is this condition called?

A. Cryptorchism

Q. What are the stages of descent of the testis?

- A. These are as follows: (Fig. 17.17; BD Chaurasia's Human Anatomy, Vol 2).
- 1. At the end of the 3rd month—testes begin to descend from upper lumbar region
- 2. At 4th month—testes lie in iliac fossa
- 3. From 4th to 7th month-testes lie at deep inguinal ring.
- 4. During 7th month—testes travel through the inguinal canal
- 5. At 8th month—testes lie at superficial inguinal ring
- 6. At 9th month—testes enter the scrotum
- 7. At or after birth—testes reach the base of scrotum

Q. What are the types of cryptorchism according to its location?

- A. These are as follows (Fig. 4.12):
- 1. Lumbar—testis in lumbar region of abdomen
- 2. Iliac—testis at deep inguinal ring
- 3. Inguinal—testis in inguinal canal
- 4. Pubic—testis at superficial inguinal ring
- 5. Scrotal-high up in scrotum

Q. What is the clinical significance of cryptorchism?

A. These are as follows:

1. The undescended testes are likely to atrophy.



Fig. 4.12: Cryptorchism

- 2. The undescended testes fail to produce mature spermatozoa due to higher abdominal temperature.
- 3. The undescended testes are susceptible to injury.
- 4. The undescended testes are likely to develop malignancy.

Q. How cryptorchism is treated?

A. The cryptorchism is treated with testicular hormones to promote the descent. If it fails, surgery is done to mobilise the testis to the floor of scrotum which is known as orchidopexy.

Q. What is ectopic testis?

A. It is condition where the testis is present elsewhere away from its normal path of descent. The ectopic testis may be present in superficial fascia of anterior abdominal wall, at saphenous opening, at the root of the penis, in the perineum behind the scrotum or rarely at anterior superior iliac spine (Fig. 4.13).



Fig. 4.13: Ectopic testis; 1—lower part of abdomen, 2—front of thigh, 3—femoral canal, 4—skin of penis, 5—behind the scrotum

Q. What is torsion of testis?

A. It is condition in which rotation of testis (90° to 360°) occurs around the spermatic cord in the scrotum. It causes severe testicular pain. Compression of testicular vessels leads to ischaemic necrosis of the testis and is an emergency (Fig. 4.14).



Fig. 4.14: Torsion of testis

Case

A 24 years old man visited the doctor for dragging pain in the scrotum particularly after prolonged standing. Physical examination of scrotum gave the feel of bag of worms (on palpation) on left side which was confirmed later by radiographic examination. No abnormalities were found on right side of scrotum.

Q. What is probable diagnosis?

A. Varicocele (Fig. 4.15)



Fig. 4.15: Varicocele

Q. Which structure is affected in this case?

A. Dilatation and tortuosity of pampiniform plexus of veins give the feel of bag of worms on palpation.

Q. Why this condition is common on left side?

A. Varicocele commonly occurs on the left side (95%) probably due to the following reasons: Fig. 17.11; *BD Chaurasia's Human Anatomy*, Vol 2.

- 1. The left testicular vein is longer than the right vein.
- 2. The left testicular vein opens into left renal vein at right angle, whereas the right testicular vein opens into inferior vena cava at acute angle.
- 3. The mouth of the left testicular vein lies opposite the opening of the left suprarenal vein. This may cause local vasoconstriction of left testicular vein due to adrenaline rich blood entering into the left renal vein.
- 4. The left testicular vein passes behind the sigmoid colon which may compress the vein when loaded.
- 5. At times, the left testicular artery arches over the left renal vein and compresses it.

(Case

A 7 days old male infant is brought to doctor with complaint that he passes the urine from the undersurface of the penis as its base. Physical examination revealed opening of the urethra on the ventral (undersurface) of the penis at the base of glans and was diagnosed as hypospadias.

Q. What is hypospadias?

A. Opening of the urethra on the ventral aspect of penis or perineum instead of tip of the penis is known as hypospadias. In this case, it is balanic type of hypospadias.

Q. Give anatomical basis for this condition?

A. Hypospadias occurs due to failure of canalization of ectodermal cord and/or fusion of the definitive urethral folds.

Q. Mention the types of hypospadias.

A. According to the location of urethral opening, it is subdivided into the following types (Fig. 4.16):

- 1. *Glandular:* Urethra opens at ventral aspect of the glans penis.
- 2. *Balanic:* Urethra opens at the base of the glans penis.
- 3. *Penile:* Urethra opens in form of longitudinal groove on the body of the penis.
- 4. *Penoscrotal:* Urethra opens at the junction of penis and scrotum.
- 5. *Perineal:* Urethral opens as a sagittal slit along the entire length of penis and scrotum.



Q. What is epispadias?

A. Here, the urethral orifice is located on the dorsal surface of the penis. It is mostly associated with ectopia vesicae (Fig. 4.17).



ABDOMINAL CAVITY AND PERITONEUM

🔘 Case

A 36 years old man working in a multinational company was admitted to the hospital for severe abdominal pain. He is known case of duodenal ulcer and was on antacids for the last 1 year. Physical examination reveals rigidity of anterior abdominal wall and rebound tenderness. X-ray examination of abdomen showed presence of air under the right dome of diaphragm. The doctor made the diagnosis of peritonitis due to perforation of duodenal ulcer.

Q. What is peritonitis?

A. Inflammation of peritoneum is called peritonitis.

Q. Give anatomical basis for rigidity of anterior abdominal wall.

A. The parietal peritoneum is supplied by T7 to T11 somatic nerves of anterior abdominal nerves. An inflamed peritoneum reflexly increases the tone of the abdominal muscles causing rigidity and so minimizing the pain.

Q. What is rebound tenderness?

A. First the pressure is applied with a single finger and then suddenly the finger is removed which causes extreme local pain on rebound. This is called rebound tenderness or Bloomberg's sign. The sign indicates aggravation of the parietal peritoneum by stretching or moving.

Q. Give anatomical basis for presence of gas under the right dome of diaphragm.

A. After the duodenal perforation. Stomach contents and gas escape in the peritoneal cavity. Gas readily passes upwards as being lighter and passes under the right dome of the diaphragm in standing position.

Case

A 40 years old male visited the doctor for severe abdominal pain and fever for 2 days. He is known case of gastric ulcer and has been on antacids for the last 6 months. X-ray of abdomen revealed gas under the right dome of diaphragm. Endoscopy of the stomach revealed a perforating ulcer of posterior wall of stomach.

Q. What is most likely area for peritonitis to develop initially?

A. Stomach lies anterior to the lesser sac. So, a perforating ulcer in the posterior wall of the stomach will spill the gastric contents and blood into the lesser sac causing peritonitis in the lesser sac (omental bursa) (Fig. 4.18).



Fig. 4.18: Lesser sac

Q. What is name of the condition when air is present in peritoneal cavity?

A. Perforation of stomach or intestine may cause leakage of air in the peritoneal cavity. This condition is known as pneumoperitoneum.

Q. What is the importance of gas under the right dome of diaphragm?

A. Normal gas shadow under the left dome of the diaphragm is produced by gas in the fundus of the stomach. Any other gas shadow under diaphragm indicates perforation causing leakage of air which readily passes upwards in the peritoneal cavity to settle under the diaphragm.

Q. How does the leaking fluid from the stomach reach the hepatorenal pouch of Morrison? **A.** The leaking fluid from the stomach may pass out through epiploic foramen to reach the hepatorenal pouch of Morrison which is most dependent part of the abdominal cavity proper in supine position. This is the commonest site for formation of subphrenic abscess from spread of infection from lesser sac, gall bladder, perforated appendix, etc. (Fig. 4.19).



Fig. 4.19: Hepatorenal pouch

Q. Why a drain is placed in the hepatorenal pouch after the abdominal surgery?

A. The hepatorenal pouch is the most dependent part of the abdominal cavity proper. So, the reactionary fluids secreted after the abdominal surgery tend to collect in the hepatorenal pouch. That is why a drain is put in the pouch for few days after the surgery in order to facilitate gravitational drainage of the fluid.

Q. Where will the fluid/pus from hepatorenal pouch drain if the patient takes sitting or standing position?

A. If the patient takes sitting or standing position, the infected fluid/pus will track down into the pelvic cavity. In males, the fluid or pus will collect into the rectovesical pouch (most dependent), whereas in female it will collect into the rectouterine pouch of Douglas (most dependent).

Q. How the fluid/pus collected in the rectouterine pouch is drained?

A. The collection in the rectouterine pouch can be drained by inserting a needle through the rectum or through the posterior fornix of vagina (posterior colpotomy).

Q. What can happen if there are adhesions formed at the epiploic foramen in this case?

A. The leaking fluid will cause distension of the lesser sac. The fluid in the lesser sac can be drained by a tube passed through the lesser omentum.

Case

A 51 years old man who is chronic alcoholic was admitted to the hospital for hematemesis from the oesophageal varices. Ultrasonography of the abdomen revealed ascites and splenomegaly.

Q. What is ascites?

A. Excessive collection of the fluid in peritoneal cavity is known as ascites.

Q Which is most likely location will an ultrasound machine confirm the presence of ascites with patient in supine position?

A. In supine position, hepatorenal pouch is the most dependent part of abdominal cavity above the pelvic brim in supine position. So, the fluid tends to collect here in supine position which can be detected by ultrasound machine. The rectovesical (in males) and rectouterine (in females) are the potential areas for fluid accumulation in erect position, as they are most dependent parts of abdominal cavity in erect position (Fig. 18.30; *BD Chaurasia's Human Anatomy*, Vol 2).

Q. What is paracentesis abdominis?

A. It is a procedure by which extra fluid is aspirated from the peritoneal cavity (greater sac) by inserting a tube through the abdominal wall. The cannula with trocar is usually inserted through flank (lateral to McBurney's point). The cannula with pass through skin, superficial fascia, aponeurosis of three flat muscles of anterior abdominal wall, fascia transversalis, extraperitoneal tissue and parietal peritoneum to enter into the peritoneal cavity (Fig. 4.20).



Case

A 43 years old male was admitted to the surgery department for diagnostic laparotomy for abdominal trauma after an accident. One week after the surgery, he was discharged from the hospital. One year later, the patient came back to the hospital with complaint of abdominal pain and vomiting. A CT scan of abdomen revealed loops of small intestine had herniated into the omental bursa through epiploic foramen.

Q. What is this condition called?

A. Internal hernia refers to the condition where a part of GI tract enters the no-entry zones of the peritoneal cavity. These no-entry zones include lesser sac, duodenal recesses, ileocaecal recesses, etc.

Q. Why the patient complained of abdominal pain and vomiting?

A. The herniated loops of intestine may be compressed at the epiploic foramen causing strangulation and obstruction. This will cause abdominal pain around the umbilical region (midgut derivative) and vomiting.

Q. How is the internal hernia is reduced in this case?

A. The epiploic foramen cannot be enlarged due to important structures forming its boundaries. The hernia is reduced by pushing the herniated loops out from the lesser sac by inserting a finger into the lesser sac through the greater omentum or transverse mesocolon, approaching the lesser sac through the greater omentum (Fig. 18.26; *BD Chaurasia's Human Anatomy*, Vol 2).

Q. Which vein is to be kept in mind while reducing internal hernia in paraduodenal recess?

A. The inferior mesenteric vein passes through the peritoneal fold of paraduodenal recess. If cut during the surgery, it may cause alarming haemorrhage (Fig. 18.32; *BD Chaurasia's Human Anatomy*, Vol 2).

ABDOMINAL PART OF STOMACH AND OESOPHAGUS

🔘 Case

A 34 years old male executive visited his physician for complaint of pain in upper part of abdomen usually 1–2 hours after the meal and occasional vomiting for the last 6 months. Pain was relieved by taking antacids but he has loss some weight in last few months. He also told that he travels a lot and is under constant pressure to meet the sales target. Endoscopic examination revealed gastric ulcer along the lesser curvature of the stomach.

Q. Give anatomical basis for pain in the upper part of abdomen.

A. Stomach is supplied by sympathetic nerves from T6 to T10 segments of the spinal cord via great splanchnic nerve. The skin of epigastrium is also supplied by the T6 to T9 segments of the spinal cord. Due to this reason pain of stomach is referred to the epigastrium, i.e. upper part of abdomen.

Q. Which types of people are usually affected by gastric ulcer?

A. It is described as 'Hurry, Worry and Curry', meaning people who are in hurry, worry too much and eat spicy food are more affected by gastric ulcer.

Q. Why gastric ulcer usually occurs along the lesser curvature of the stomach?

A. This is due to the following reasons:

- 1. The gastric canal along the lesser curvature receives more insult from irritating liquids.
- 2. It is homologous with gastric trough of ruminants which is very acidic.
- 3. Mucosa is not freely movable on muscle coat.
- 4. The epithelium of lesser curvature is comparatively thin.
- 5. Blood supply is less abundant and submucosal plexus is absent along the lesser curvature. Instead, there are long mucosal arteries and occlusion of these long mucosal artery may cause ischaemia on the lesser curvature causing formation of gastric ulcer.
- 6. Parasympathetic supply which stimulate the acid secretion is more along the lesser curvature.

- 7. Compared to greater curvature the lesser curvature is shorter in length and so wave of contraction stays longer at a particular point, viz. the standing wave of incisura angularis.
- 8. *H. pylori* infection is also an important causative factor.

Q. Which type of contrast study can be done to diagnose the gastric ulcer?

A. Barium meal study.

Q. How the ulcer appears on contrast study?

A. On barium meal study, the gastric ulcer is indicated by the presence of an ulcer crater or niche on the lesser curvature and coarseness and irregularity of gastric rugae.

Q. What is hourglass stomach?

A. It occurs due to cicatricial contracture around a saddle-shaped lesser curvature ulcer. In extreme cases, the stomach is divided into two compartments, united by a narrow channel. It almost exclusively occurs in women (Fig. 4.21).



Fig. 4.21: Hourglass stomach

Q. What is tea-pot stomach?

A. Cicatrisation around a long-standing gastric ulcer often causes shortening of the lesser curvature producing the tea-pot deformity of the stomach (Fig. 4.22).



Fig. 4.22: Tea-pot stomach

Abdomen

Q. What is the treatment of gastric ulcer?

A. Gastric ulcers are treated with long lasting proton pump inhibitors. If *H. pylori* infection is suspected, then triple therapy with bismuth citrate, clarithromycin, and metronidazole. In extreme cases, the parasympathetic supply is cut by vagotomy.

Q. Why truncal vagotomy should be accompanied by either pyloroplasty or gastrojejunostomy?

A. When the anterior and posterior vagal trunks are cut the reflex gastric acid secretion is abolished. But these also make stomach atonic so that it is unable to empty its content into duodenum. So, either the pyloric sphincter is rendered incompetent (pyloroplasty) or stomach is connected to the jejunum (gastrojejunostomy) so that the gastric contents pass directly into the small intestine.

Case

A 44 years old man is admitted in emergency department with abdominal discomfort after meal and dyspepsia. He also complained of vomiting large quantities of undigested food and weight loss. Endoscopy revealed a tumour in the pyloric antrum of the stomach. A CT scan was done to evaluate the spread of the carcinoma.

Q. Why gastric carcinoma occurs commonly in the pyloric antrum along the greater curvature?

A. The food is lodged in the stomach for 3–4 hours along the greater curvature mostly in the antral region and therefore, this region is exposed to irritants present in the food. So, gastric carcinoma commonly occurs along the greater curvature mostly in the antral region.

Q. What is leather bottle stomach?

A. The infiltrating carcinoma of the stomach may spread into the muscles of the stomach and so the wall of the stomach is enormously thickened giving it leathery feel. This is called leather bottle stomach.

Q. What is Troisier's sign?

A. The carcinoma of stomach may spread by lymphatics into the left supraclavicular lymph node (Virchow's node). The enlarged palpable left supraclavicular lymph node may be the first sign of gastric malignancy which is called Troisier's sign. The cancer cells reach the left supraclavicular lymph nodes through the thoracic duct.

Q. What is signal node?

A. Enlargement of a left supraclavicular lymph node may signal lymph spread of cancer from a structure within the territory drained by the thoracic duct. It may even be the first (although late) sign of cancer in a thoracic organ (e.g. lung) or abdominal organ (e.g. stomach or testis) since the thoracic and abdominal lymph nodes are all deeply located and none are readily palpable.

(Case

A 16 years girl was brought to the emergency department in unconscious state due to suspected organophosphorus poisoning. The attending doctor ordered insertion of nasogastric tube to do lavage in order to remove poison from the stomach. The nasogastric tube is passed backwards along the floor of nose and passed it up to mark II, about 50 cm from the nostril.

Q. What is gastric lavage?

A. Gastric lavage or gastric irrigation is the procedure of cleaning the contents of the stomach by aspiration after inserting a tube.

Q. Why was the tube directed backwards along the floor of the nose?

A. In upper part of the nose lie three conchae. So, if the tube is inserted in upper part, it may be caught on the conchae.

Q. In which anatomical condition, the passage of tube will impede?

A. Deviated nasal septum. The nose is examined and if the septum is deviated to one side, the opposite nostril is used for insertion of nasogastric tube.

Q. Where does the doctor feel resistance while inserting the tube?

- A. The resistance is felt at three places as described below (Fig. 4.23):
- 1. At the beginning of oesophagus behind cricoid cartilage, at about 15 cm.
- 2. As the aorta crosses in front of oesophagus, at about 22.5 cm.
- 3. As left bronchus crosses in front of oesophagus, at about 27.5 cm.
- 4. At gastro-oesophageal junction, at about 37.5 cm.



