Introduction

A hernia is the abnormal exit of tissue or an organ, such as the bowel, through the wall of the cavity in which it normally resides.

Risk factors for the development of a hernia include: smoking, chronic obstructive pulmonary disease, obesity, pregnancy, peritoneal dialysis, collagen vascular disease, and previous open appendectomy, among others.

TYPES OF VENTRAL ABDOMINAL WALL HERNIAS; figure no 1

Inguinal hernias;

The most common hernias (up to 75% of all abdominal hernias) are the inguinal hernias. Inguinal hernias are further divided into the more common indirect inguinal hernia (2/3), in which the inguinal canal is entered via a congenital weakness the internal inguinal ring, being lateral to the inferior epigastric vessels, and the direct inguinal hernia type (1/3), where the hernia contents push through a weak point at the back wall of the inguinal canal, being medial to the epigastric vessels. Inguinal hernias are the most common type of hernia in both men and women. There are cases in which the hernia may contain both direct and indirect hernia simultaneously pantaloon hernia, or, though very rare, may contain simultaneous indirect hernias. Jones, Riley (2013).

Pantaloon hernia (Saddle Bag hernia) is a combined direct and indirect hernia, when the hernial sac protrudes on either side of the inferior epigastric vessels.

Femoral hernias

Femoral hernias occur just below the inguinal ligament, when abdominal contents pass through the weak area at the posterior wall of the femoral canal. They can be hard to distinguish from the inguinal type especially when ascending cephalad, however, they generally appear more rounded, and, in contrast to inguinal hernias, there is a strong female preponderance in femoral hernias. The incidence of strangulation in femoral hernias is high.

A Cooper's hernia is a femoral hernia with two sacs, the first being in the femoral canal, and the second passing through a defect in the superficial fascia and appearing almost immediately beneath the skin. Jones, Riley (2013).

Umbilical and para-umbilical hernias

They involve protrusion of intra-abdominal contents through a weakness at the site of passage of the umbilical cord through the abdominal wall. Umbilical hernias in adults are largely acquired, and are more frequent in obese or pregnant women. Abnormal decussation of fibers at the linea alba may contribute. Jones, Riley (2013).

Incisional hernias;

An incisional hernia occurs when the defect is the result of an incompletely healed surgical wound. When these occur in median laparotomy incisions in the linea alba, they are termed ventral hernias. These can be the most frustrating and difficult to treat, as the repair utilizes already attenuated tissue. Jones, Riley (2013).
Other hernias

- **Epigastric hernia:** a hernia through the linea Alba above the umbilicus.
- **Spigelian hernia,** also known as spontaneous lateral ventral hernia, occurs through the lateral border of rectus abdominis muscle.
- **Amyand's hernia:** containing the appendix vermiformis within the hernia sac.
- **Littre's hernia:** a hernia involving a *Meckel's diverticulum.*
- **Lumbar hernia:** a hernia in the lumbar region.
- **Parastomal hernias,** which is when tissue protrudes adjacent to a stoma tract.
- **Paraumbilical hernia:** in adults.

**COMPLICATIONS OF ABDOMINAL WALL HERNIAS**

The most common complications of abdominal wall hernias are bowel obstruction secondary to the hernia, incarceration, and strangulation. These complications can often be detected at clinical evaluation. Presenting symptoms may include abdominal pain, vomiting, and distention. Physical examination may reveal a firm, tender abdominal wall mass. Abdominal distention, dehydration, or peritoneal signs eventually become manifest. (NeblettWW3rd).

Imaging studies are required when the clinical manifestation is misleading or inconclusive or preoperative assessment of the hernia or secondary obstruction is required. Moreover, early diagnosis of hernia complications is feasible using ultrasound examination, potentially improving patient outcome by preserving bowel viability.

**Bowel Obstruction**

After adhesions, abdominal wall hernias are the second leading cause of small bowel obstruction (10%–15% of cases) (Macari M, Megibow A., 2001). Colonic obstruction caused by abdominal wall hernia is uncommon. Most cases of bowel obstruction secondary to abdominal wall hernia occur after incarceration and strangulation. In these cases, bowel obstruction occurs with the transition point at the level of the hernia.

**Incarceration**

Incarceration refers to an irreducible hernia and is diagnosed clinically when a hernia cannot be reduced or pushed back manually. The diagnosis of incarceration cannot be made with imaging alone but can be suggested when herniation occurs through a small defect and the hernia sac has a
narrow neck. Detection is important because incarceration predisposes to complications such as obstruction, inflammation, or ischemia.
If fatty tissue or fluid but no bowel is present in an incarcerated hernia, time is not a limiting factor in preparing the patient for surgery. In contrast, incarcerated bowel requires immediate surgery to prevent bowel necrosis and subsequent resection of the affected bowel loop (Rettenbacher T, Hollerweger A, 2001).

**Strangulation**
Strangulation refers to ischemia caused by a compromised blood supply. It usually occurs when the hernia defect obstructs the afferent and efferent bowel loops, creating a closed loop within the herniated bowel (Yu CY, et al 2004).
Anatomy
The abdominal wall encloses the abdominal cavity, and can be divided into anterolateral and posterior sections. Its key functions include:
- Forms a firm, flexible wall which;
- Keeps the Abdominal viscera in the abdominal cavity.
- Protects the abdominal viscera from injury.
- Maintains the anatomical position of abdominal viscera against gravity.
- Assists in forceful expiration by pushing the abdominal viscera upwards.
- Involved in any action (coughing, vomiting) that increases intra-abdominal pressure.

The anterolateral abdominal wall consists of four main layers (external to internal); skin, superficial fascia, muscles and associated fascia, and parietal peritoneum.

Superficial Fascia

The superficial fascia consists of fatty connective tissue (figure no.2). The composition of this layer depends on its location:
- **Above the umbilicus** – a single sheet of connective tissue. It is continuous with the superficial fascia in other regions of the body.
- **Below the umbilicus** – divided into two layers; the fatty superficial layer (Camper’s fascia) and the membranous deep layer (Scarpa’s fascia).
  - The superficial vessels and nerves run between these two layers of fascia.

![Figure no.2](image-url)
**Surface landmarks**

The xiphisternal joint is at the apex of the infra-sternal angle, which is formed by costal cartilage on each side. The xiphoid process extends into the angle, and the slight depression of the anterior abdominal wall in front of it is the epigastric fossa. The costal margin is formed by costal cartilages 7 to 10.

The whole of the iliac crest is usually palpable. Its most superior part is situated somewhat posteriorly. The anterior superior iliac spine is frequently visible, and the posterior superior iliac spine is usually marked by a dimple. The pubic tubercle is about 2 to 3 cm lateral to the median plane.

The linea alba and the linea semilunaris (lateral border of the rectus muscle) are usually evident in lean, muscular individuals on contraction of the abdominal wall. The umbilicus is usually between the L3 and L5 vertebral level, but its position is highly variable.

The inguinal ligament is in the groin and extends from the anterior superior iliac spine to the pubic tubercle. The skin crease at the junction of the abdomen and thigh lies immediately inferior and parallel to the inguinal ligament. The deep inguinal ring is immediately superior to the midinguinal point, and the superficial inguinal ring is about 1 cm superior and lateral to the pubic tubercle.

**Planes and regions**;

For descriptive purposes the abdomen can be divided into quadrants (left and right, upper and lower) by using the median plane and the umbilicus. Other nomenclature for abdominal planes and regions has been used in the past (fig.3) and may still be encountered from time-to-time.

**Antero-lateral abdominal wall**

**Muscles (figs. 25-3, 25-4, 25-5, 25-6 and 25-7)**

The anterior part of the abdominal wall contains the rectus abdominis and pyramidalis muscles. The external and internal oblique muscles and the transversus abdominis muscle are lateral (table 2).
The fibers of the rectus run vertically. In general, those of the external oblique muscle (cf. the external inter-costal muscles) run inferior and anterior (as in inserting a hand in a pocket), those of the internal oblique muscle (cf. the internal inter-costal muscles) go mostly superior and anterior, and those of the transversus pass transversely. *Mosby's Medical Dictionary, 9th edition*

### External Oblique Aponeurosis.

The aponeurosis of the external oblique muscle passes anterior to the rectus abdominis. Its inferior edge extends from the anterior superior iliac spine to the pubic tubercle and is known as the inguinal ligament. A part that continues posterior (toward the superior pubic ramus) is termed the lacunar ligament. A further extension laterally (along the pectin pubis of the superior pubic ramus) is called the pectineal ligament (fig. 25-7). *Mosby's Medical Dictionary, 9th edition.*

Lateral to the pubic tubercle, the aponeurosis of the external oblique muscle divides into medial and lateral crura, which diverge to form the superficial inguinal ring. The superficial inguinal ring may be found by pushing the scrotal skin upward along the spermatic cord to a point immediately above the pubic tubercle, and then passing the finger backward. The ring normally admits the tip of the little finger.

### Internal Oblique Aponeurosis.

The aponeurosis of the internal oblique muscle divides into anterior and posterior layers, which pass, respectively, in front of and behind the rectus muscle to reach the linea alba. The linea alba is the median, fibrous intersection of the aponeuroses, extending vertically from the xiphoid process to the pubic symphysis. The division into anterior and posterior layers is absent inferiorly, where the aponeuroses of all three muscles pass anterior to the rectus muscles to reach the linea alba. Inferiorly, the medial portion of the fused internal oblique and transversus aponeuroses is termed the conjoined tendon.


### Transversalis fascia.

The fascia on the internal surface of the transversus abdominis serves as epimysium and is known as the transversalis fascia. It passes posterior to the rectus sheath and crosses the median plane. It is continuous with the general fascia of the abdomen to the extent that it is regarded by some as a part of the extraperitoneal connective tissue.
Rectus Sheath.

The rectus sheath (fig. 25-6) is described as consisting of anterior and posterior layers (lamella) formed by the aponeuroses of the external and internal oblique and transversus abdominis muscles. These aponeuroses meet at the lateral edge of the rectus along a curved line termed the linea semilunaris, which extends from the 9th costal cartilage to the pubic tubercle and is often visible in thin, muscular people. Through most of the abdomen, the aponeuroses divide to pass around either side of the rectus muscle creating an anterior and posterior sheath. The anterior sheath is comprised of the aponeurosis of the external oblique and an anterior layer of the aponeurosis of internal oblique; the posterior sheath of the posterior layer of the internal oblique and the aponeurosis of the transversus abdominis muscle. Inferior to the plane that is located approximately halfway between the umbilicus and the symphysis pubis, all three aponeuroses pass anterior to the rectus muscle. This anterior displacement of the aponeuroses creates a crescentic line of demarcation in the posterior lamella of the rectus sheath called the arcuate line, below which only the transversalis fascia separates the rectus abdominis muscle from the parietal peritoneum.

Actions.

The muscles of the abdominal wall protect the viscera and help to maintain or to increase intra-abdominal pressure. They also move the trunk and help to maintain posture. The recti flex the trunk against resistance, and they can be tested by having a supine subject flex the trunk without using the arms. The obliqui and transversi increase intra-abdominal pressure and hence are important in respiration, defecation, micturition, parturition, and vomiting. The obliqui also aid in movements of the trunk.

Inguinal Canal.

The inguinal canal is an oblique passage through the abdominal wall. It is occupied by the spermatic cord or by the round ligament of the uterus, and it contains the ilioinguinal nerve. It is about 3 to 5 cm long (figs. 25-7, 25-8, 25-9 and 25-10 and table 25-2). The canal is potentially a weak area through which an inguinal hernia may occur. Many divergent viewpoints exist concerning the canal and its surgery, largely because of variations and a confusing terminology.

The ductus (vas) deferens curves around the lateral side of the inferior epigastric artery and is joined by nerves and vessels embedded in extraperitoneal connective tissue to form the spermatic cord. Superior to the midinguinal point, the cord traverses the deep inguinal ring.

The deep inguinal ring is a slit-like opening in the transversalis fascia. The cord then runs medially and inferiorly in the inguinal canal and emerges through the superficial inguinal ring. As the spermatic cord traverses the muscular part of the internal oblique muscle, it acquires a covering of cremaster muscle and cremasteric fascia.

The superficial inguinal ring is a triangular opening in the aponeurosis of the external oblique muscle (fig. 25-10A). In its course through the canal, the spermatic cord acquires sheaths from each of the layers of the abdominal wall through which it passes. The posterior wall of the inguinal canal is formed by the transversalis fascia and the aponeurosis of the transversus abdominis muscle. The anterior wall is formed by the aponeurosis of the external oblique muscle and, laterally, by internal oblique muscular fibers. Superior to the canal are the arching fibers of the internal oblique muscle and the transversus abdominis muscle, which come together to attach to the conjointed tendon (falx inguinales). The floor (inferior aspect) of the inguinal canal is formed by the inguinal and lacunar ligaments. The inferior epigastric vessels lie posterior to the canal, immediately medial to the deep ring. The inguinal triangle is formed by the inferior
epigastric vessels (superolaterally), the lateral border of the rectus (medially), and the inguinal ligament (inferolaterally) (fig. 25-9).

The chief protection of the inguinal canal is muscular. The muscles that increase intra-abdominal pressure and tend to force abdominal contents into the canal at the same time tend to narrow the canal and close the rings. For example, the deep ring moves laterally and upward, closing like a shutter and making the canal longer and more oblique.

**Blood vessels and lymphatic drainage (see figs. 13-5, 24-2, and 32-1)**

The cutaneous veins and lymphatic vessels drain in two directions from approximately the level of the umbilicus: (1) upward to the thoraco-epigastric and lateral thoracic veins (thereby providing collateral circulation in caval obstruction) and to the axillary nodes, respectively, and (2) downward to the great saphenous vein and superficial inguinal nodes, respectively. Subcutaneous veins near the umbilicus anastomose with the portal vein by way of branches along the ligamentum teres of the liver.

Apart from branches (the superficial epigastric and superficial circumflex iliac) of the femoral artery, the chief arteries of the abdominal wall are two above (the superior epigastric and musculophrenic) from the internal thoracic artery and two below (the inferior epigastric and deep circumflex iliac) from the external iliac artery. The superior epigastric artery enters the rectus sheath and descends behind that muscle. The musculophrenic artery courses along the costal margin. The inferior epigastric artery (see fig. 25-9), arising near the midinguinal point, ascends past the medial margin of the deep ring, where the ductus deferens hooks around its lateral side. As it proceeds toward the lateral edge of the rectus abdominis, it forms the superolateral boundary of the inguinal triangle. Finally the artery ascends behind the rectus in a compartment of the rectus sheath. The anastomoses between the superior and inferior epigastric arteries provide collateral circulation between the subclavian and external iliac arteries. The deep circumflex iliac artery (see fig. 32-1) proceeds laterally between the transversus and the internal oblique muscles and reaches the anterior superior iliac spine.

**Nerves (see figs. 25-12 and 30-7)**

The abdominal wall is supplied by intercostal nerves 7 to 11 (the thoraco-abdominal nerves) and by the subcostal, iliohypogastric, and ilio-inguinal nerves, A band of skin is supplied by the lateral and anterior cutaneous branches of each of these nerves (except the ilio-inguinal, which is a branch of the first lumbar nerve). The overlap in distribution is such that section of a single nerve results in only diminished sensation in its area of supply. The lower intercostal nerves travel basically between the internal oblique muscle and the transversus abdominis [innermost intercostal] layers.)

**Umbilicus**
The umbilicus (omphalos in Greek), or navel, is a median depression some distance above the pubis. It indicates the site of attachment of the umbilical cord before birth, and, even in the adult, some constituents of the cord are recognizable on the inner aspect of the abdominal wall. All layers of the abdominal wall are fused at the umbilicus, and subcutaneous fat that accumulates around the margins causes the umbilicus to appear depressed.