Systemic Module
GIT

"Anatomy"
The Abdominal Wall and Inguinal Region

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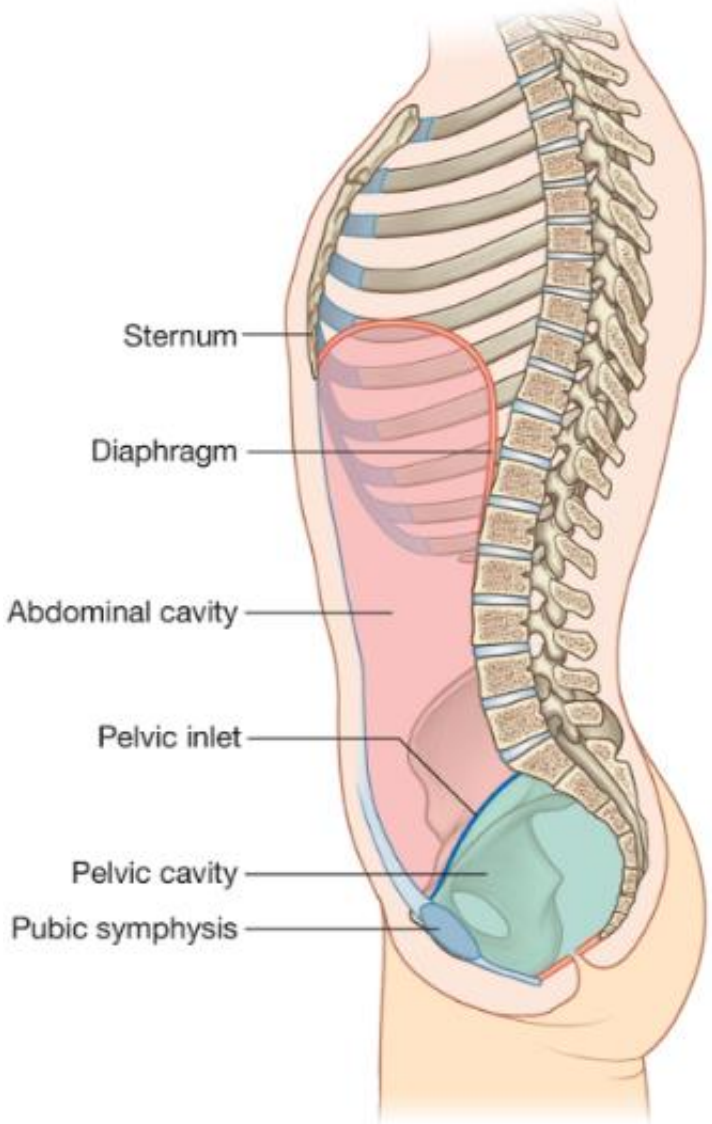
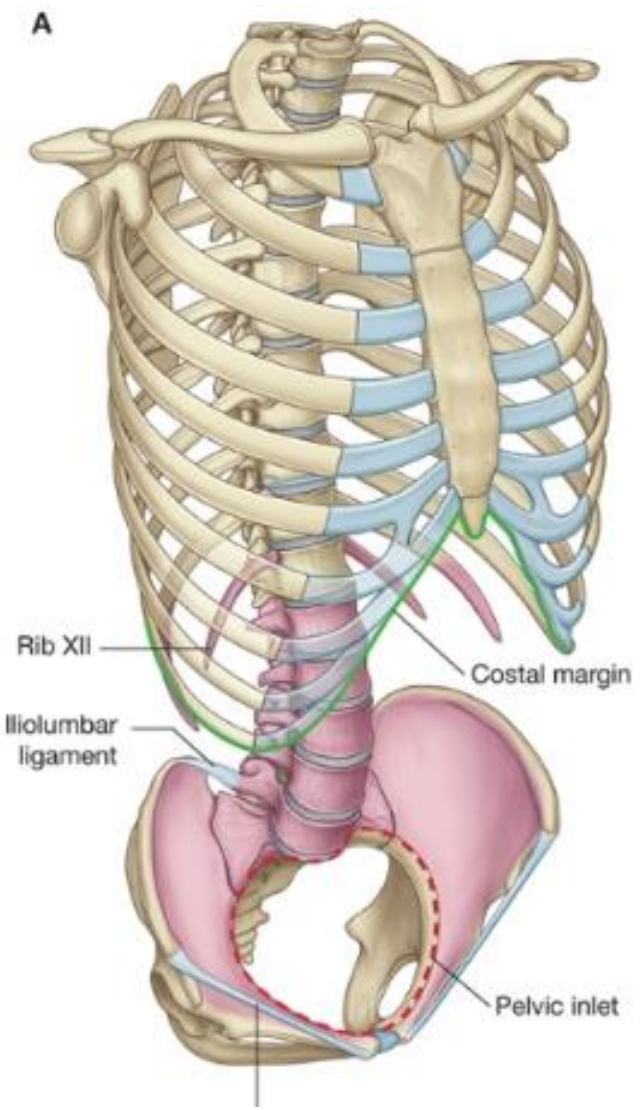
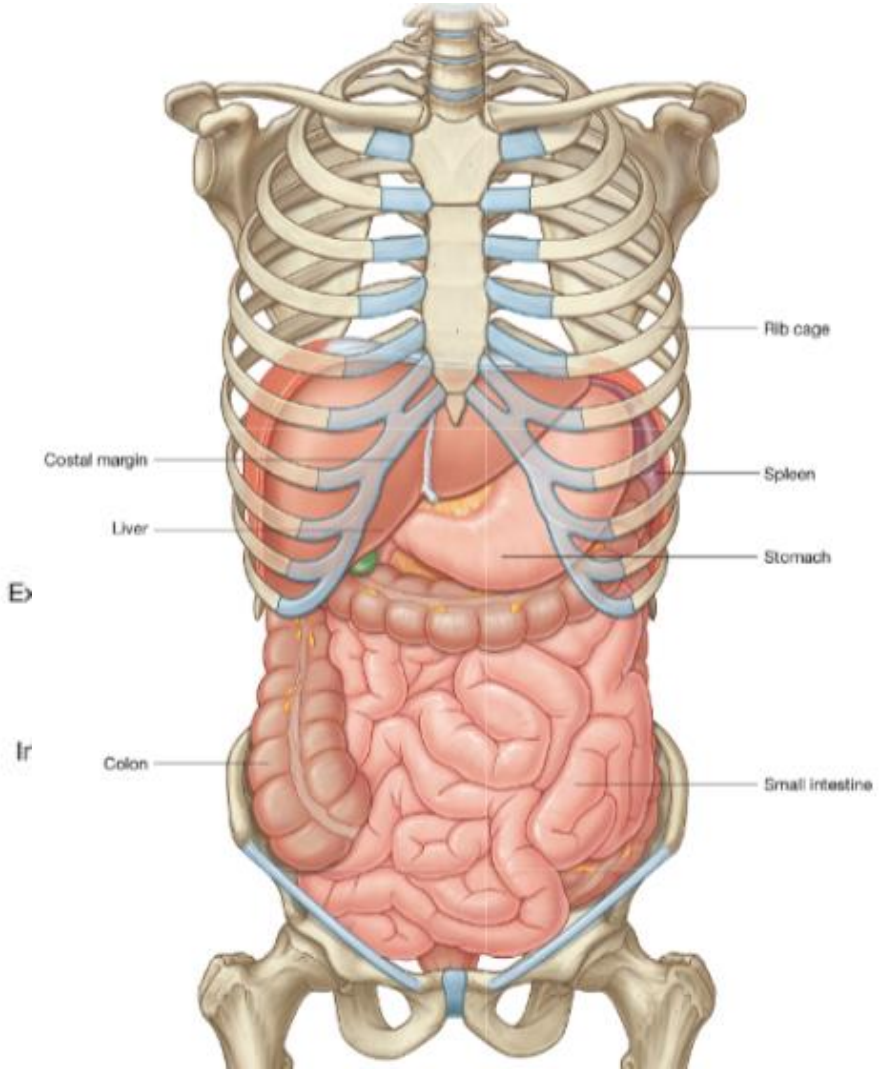
The Abdomen

- The abdomen is the part of the trunk inferior to the thorax.
- Its musculomembranous walls surround a large cavity (the **abdominal cavity**), which is bounded superiorly by the *diaphragm* and inferiorly by the *pelvic inlet*.
- The abdominal cavity may extend superiorly as high as the 4th *intercostal space and* is *continuous inferiorly with the pelvic cavity*.
- **Houses and protects major viscera:** major elements of the gastrointestinal system, the spleen, and parts of the urinary system.

The Abdominal cavity

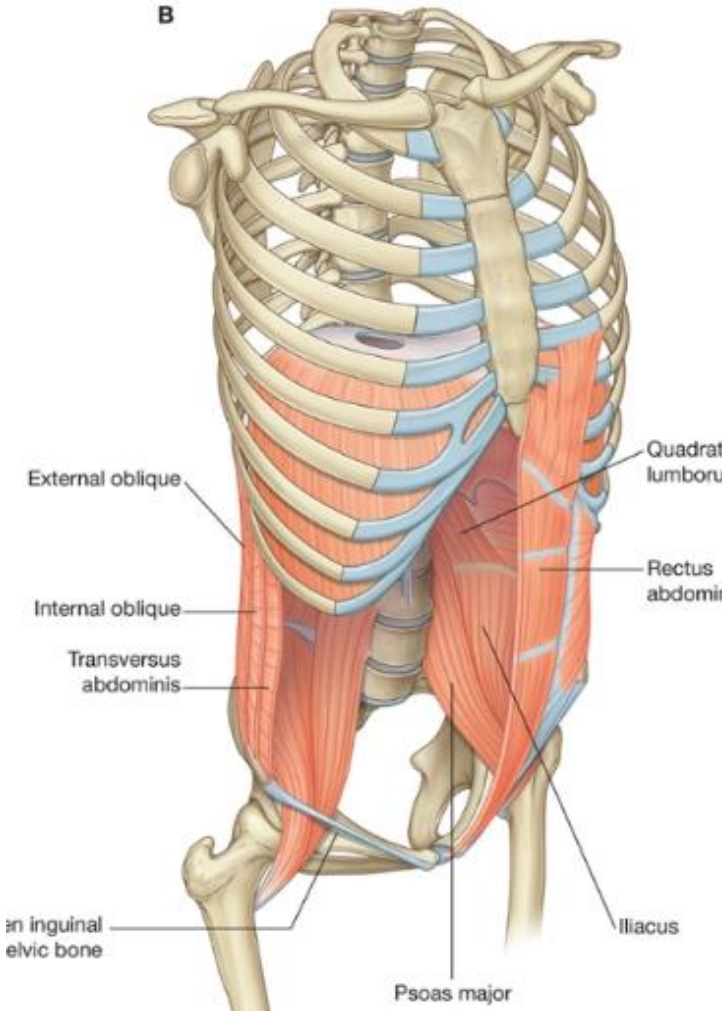


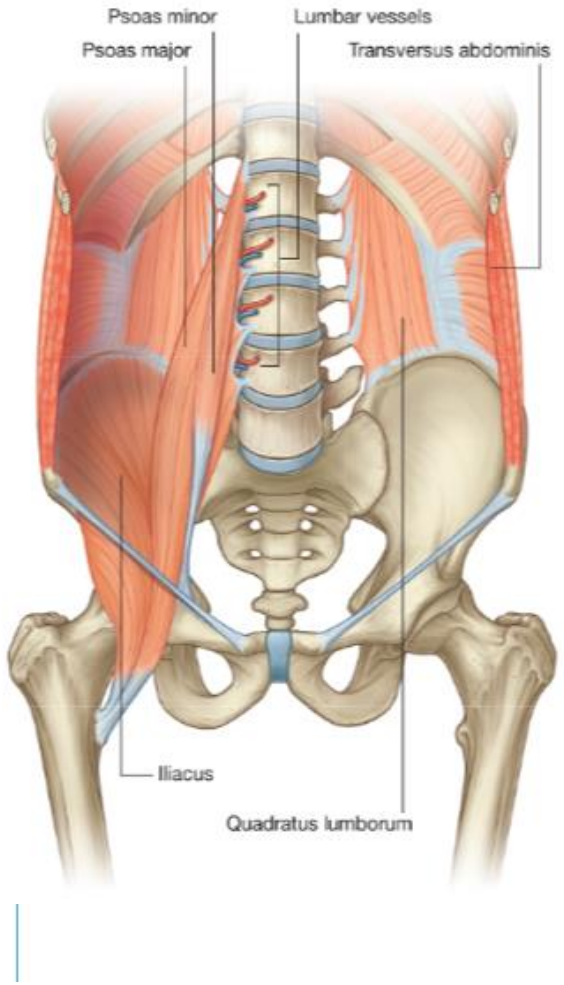




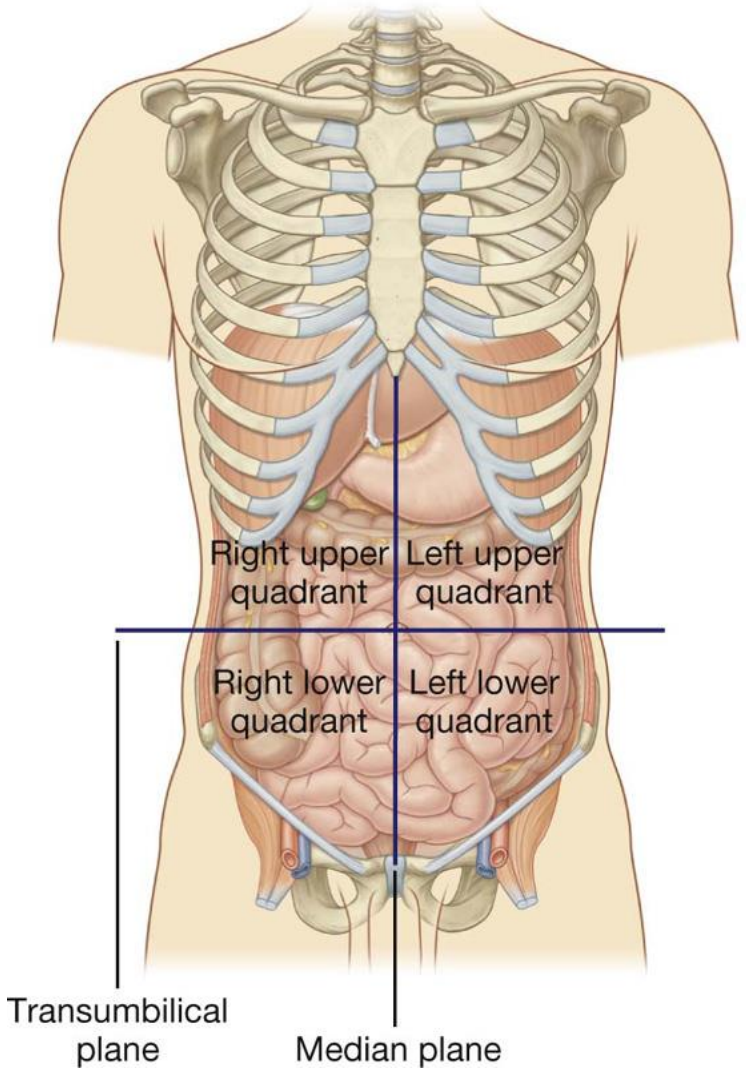
Boundaries of the Abdomen

- **Superiorly**: Diaphragm
- **Inferiorly:** Pelvic inlet
- **Posteriorly:** Vertebral column, and the Psoas, Quadratus lumborum, and Iliacus muscles.
- **Anterolaterally:** Abdominal muscles (External oblique, internal oblique, transversus abdominis, rectus abddominis).

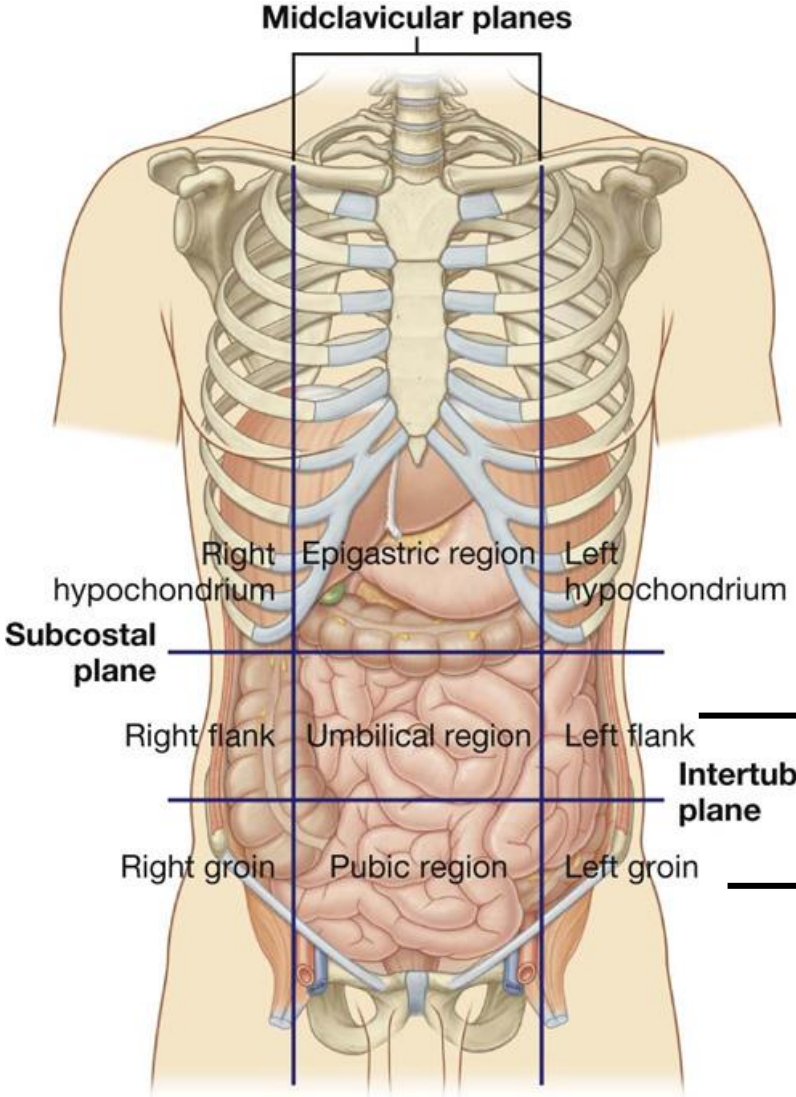




Topographical Divisions of the Abdomen



Four-quadrant pattern



Or Lumber region

Or inguinal region

Or iliac region

Nine-region pattern

The Abdominal Wall

- The abdominal wall encloses the abdominal cavity and can be divided into **anterolateral** and **posterior** sections.

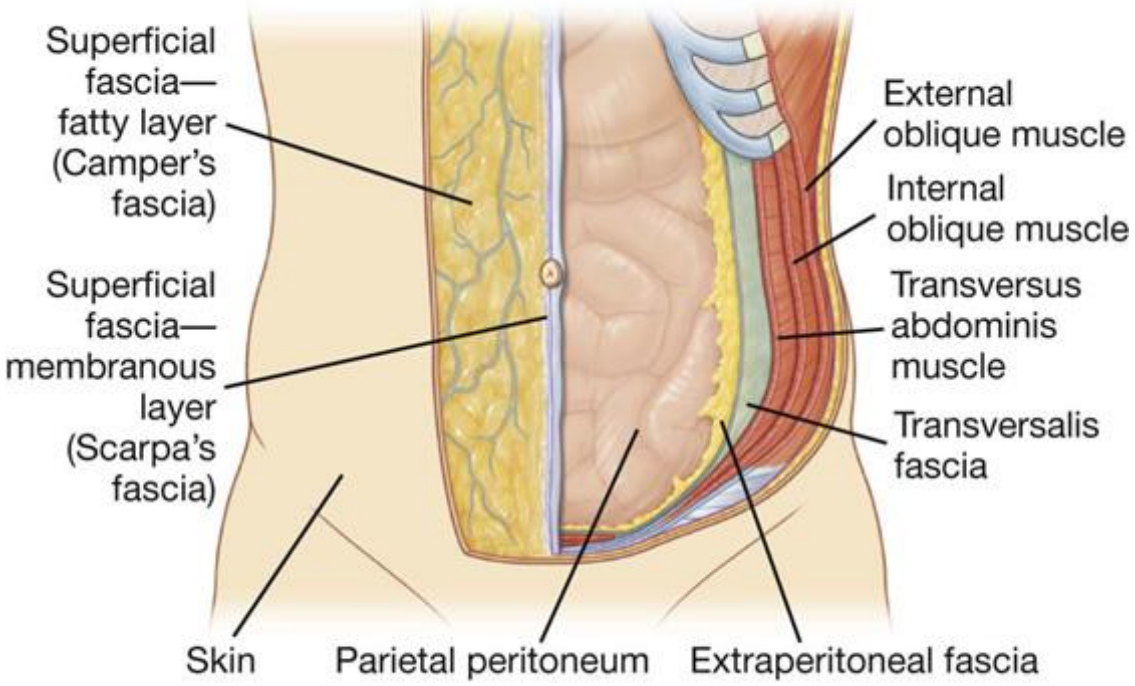
- The major functions of abdominal wall:

1. Provide a firm, flexible boundary which keeps the abdominal viscera in the abdominal cavity.
2. Maintaining the anatomical position of the abdominal organs against gravity.
3. Protects the abdominal organs from injury.
4. Assists expiration by pushing the abdominal organs towards the diaphragm.
5. Assists in coughing, vomiting and defecation by increasing intra-abdominal pressure.

Anterolateral abdominal wall

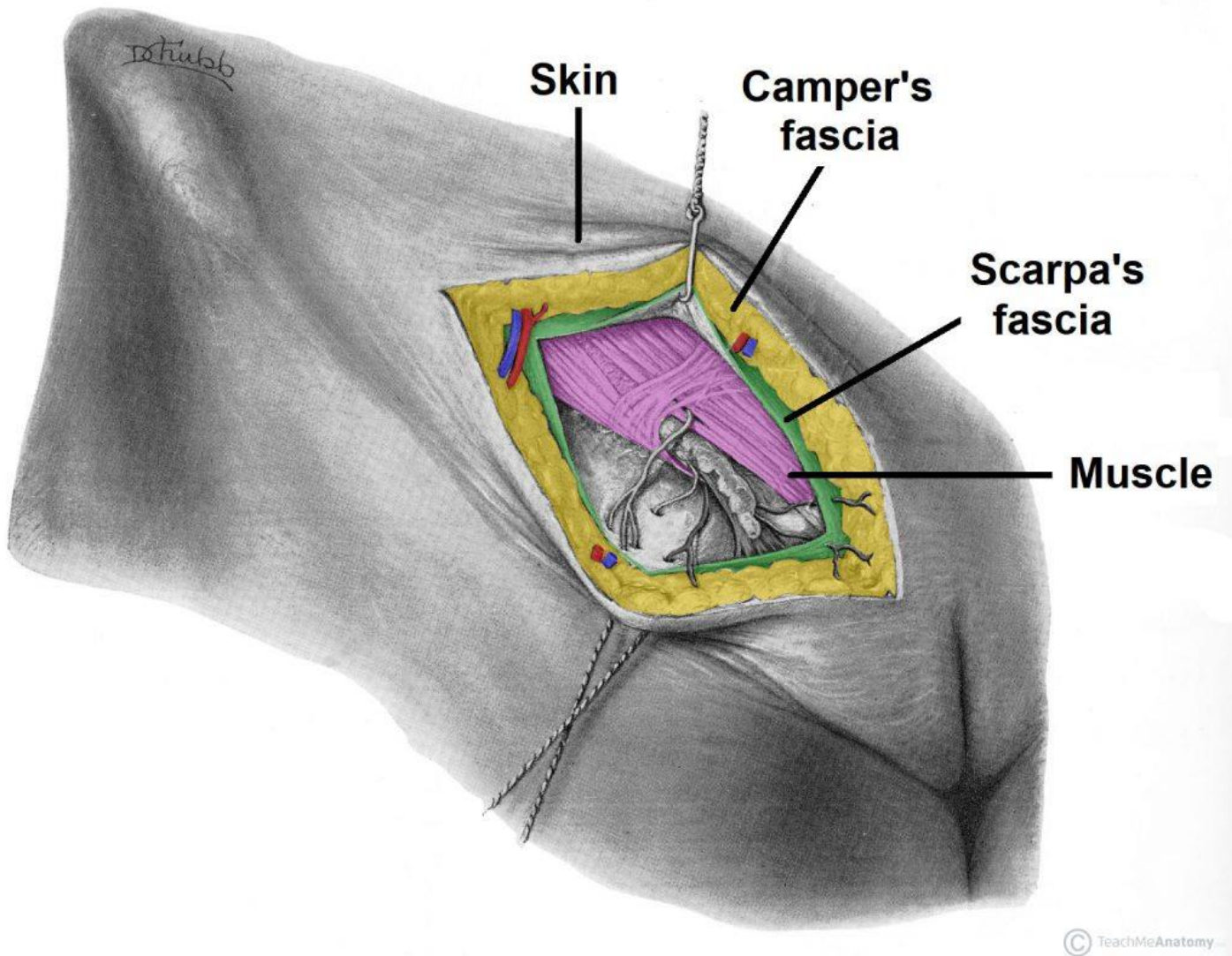
- The anterolateral abdominal wall consists of six main layers (external to internal):

1. **Skin**
2. **Superficial fascia**
3. **Muscles and associated fascia**
4. **Endoabdominal fascia**
5. **Extraperitoneal facia**
6. **Parietal peritoneum**



Superficial fascia

- The superficial fascia is fatty connective tissue. 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:
    1. The fatty superficial layer (**Camper's fascia**)
    2. The membranous deep layer (**Scarpa's fascia**).
    - The superficial vessels and nerves run between these two layers of fascia.


Skin
Camper's fascia
Scarpa's fascia
Muscle
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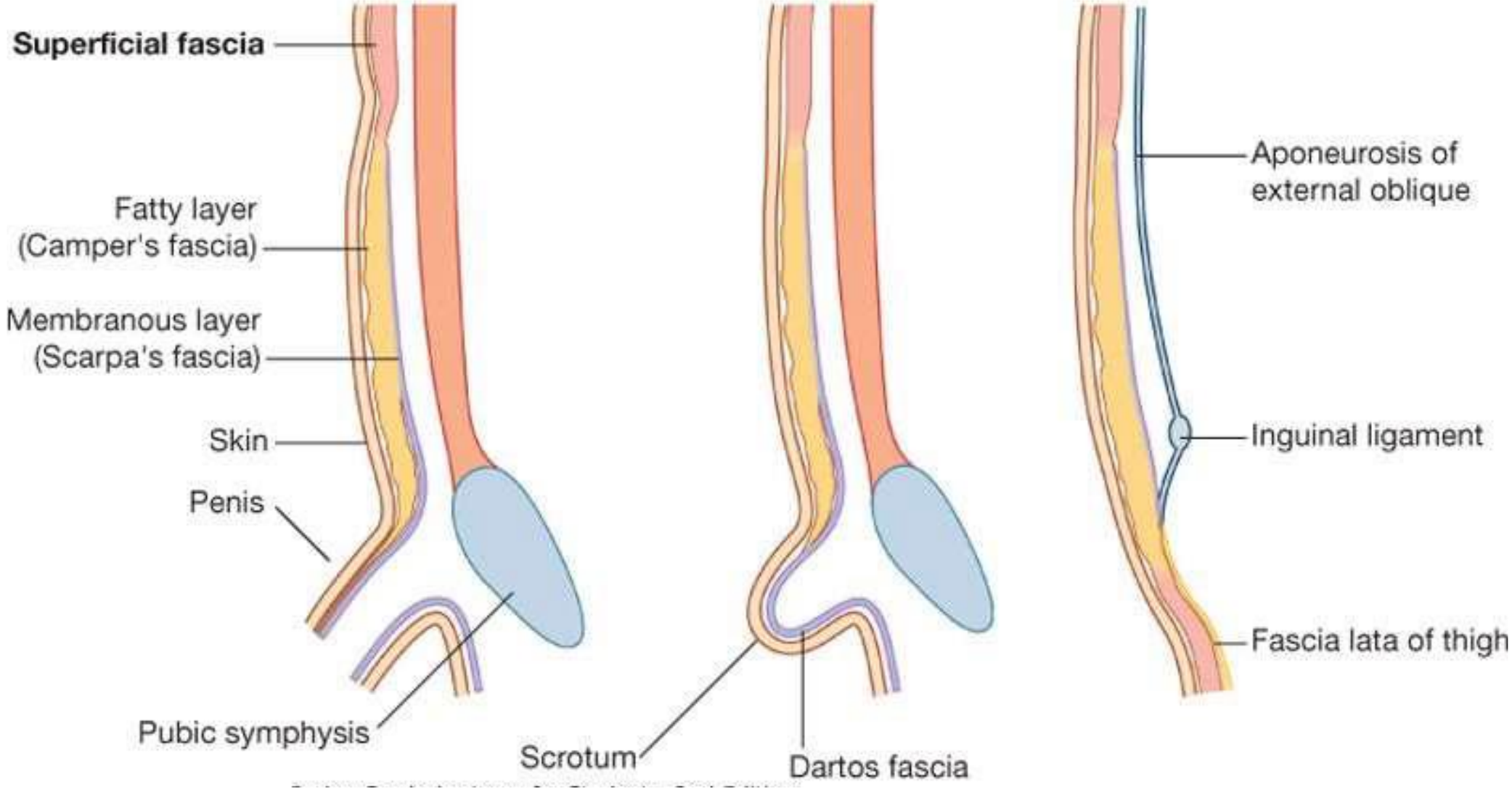
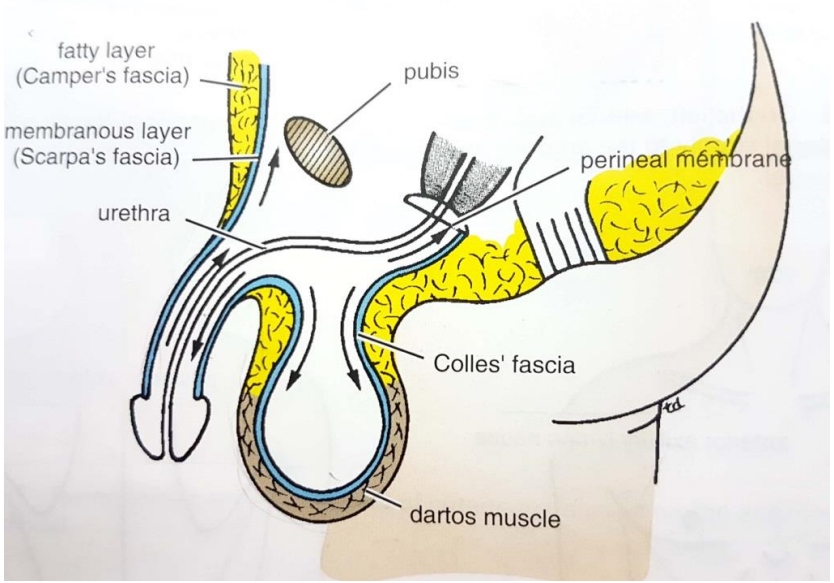

Superficial fascia
Fatty layer
(Camper's fascia)
Membranous layer
(Scarpa's fascia)
Skin
Penis
Pubic symphysis
Scrotum
Dartos fascia
Aponeurosis of
external oblique
Inguinal ligament
Fascia lata of thigh

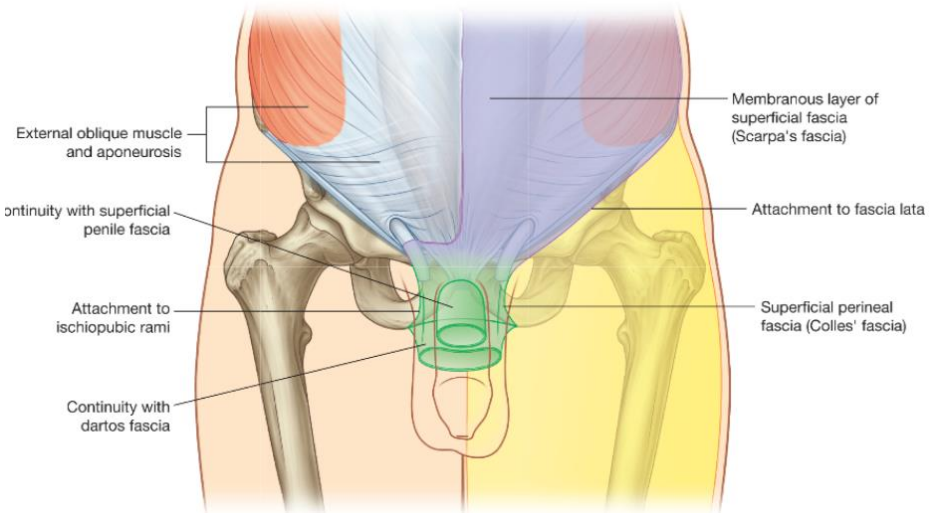
- **The Superficial fatty layer (Camper's fascia):**

- Continuous with the superficial fascia over the rest of the body
- In Men, Continues into the scrotum forming specialized fascial layer containing smooth muscle fibers (**Dartos fascia**).
- In women, retains some fat and is a component of the labia minora.



- **The deep membranous layer (Scarpa's fascia):**

- Only present in the lower part of anterior abdominal wall (below the umbilicus) and fade out laterally and above
- Pass over the inguinal ligament to fuse with the deep fasci of the thigh (Fascia lata)
- Forms tubular sheath for the penis (clitoris)
- In perineum is known as **Colle's fascia**



Muscles of the Anterolateral Abdominal Wall

- **3** flat muscles that are aponeurotic in front. From exterior to interior, these muscles are :

- **External oblique** (1)
- **Internal oblique** (2)
- **Transversus Abdominis** (3)

- **1** Vertical muscle on the either sides of the midline anteriorly called (4) **Rectus abdominis**, which is enclosed within the **rectus sheath** formed by the aponeuroses of the three flat muscles in the front

- In the lower part of the rectus sheath, there may be a small muscle called the **Pyramidalis** (5)

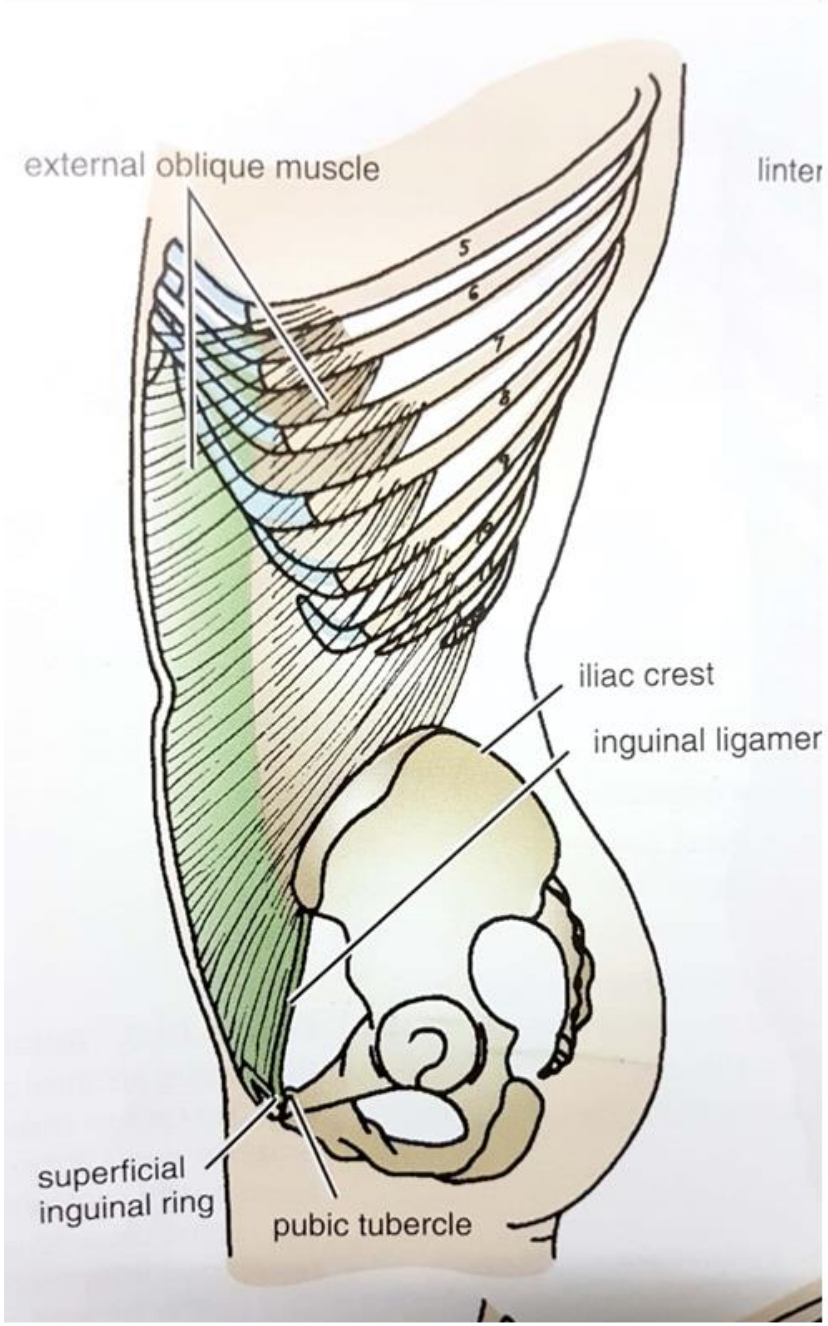
External Oblique

- The external oblique is the largest and most superficial flat muscle in the abdominal wall. Its fibers run ***inferomedially***.

- **Attachments:** Originates from ribs 5-12, and inserts into the iliac crest, pubic tubercle and linea alba.

- **Functions:**
  - Bilateral contraction - Trunk flexion, compresses abdominal viscera, expiration
  - Unilateral contraction - Trunk lateral flexion (ipsilateral), trunk rotation (contralateral)

- **Nerve Supply**: Lower six thoracic nerve

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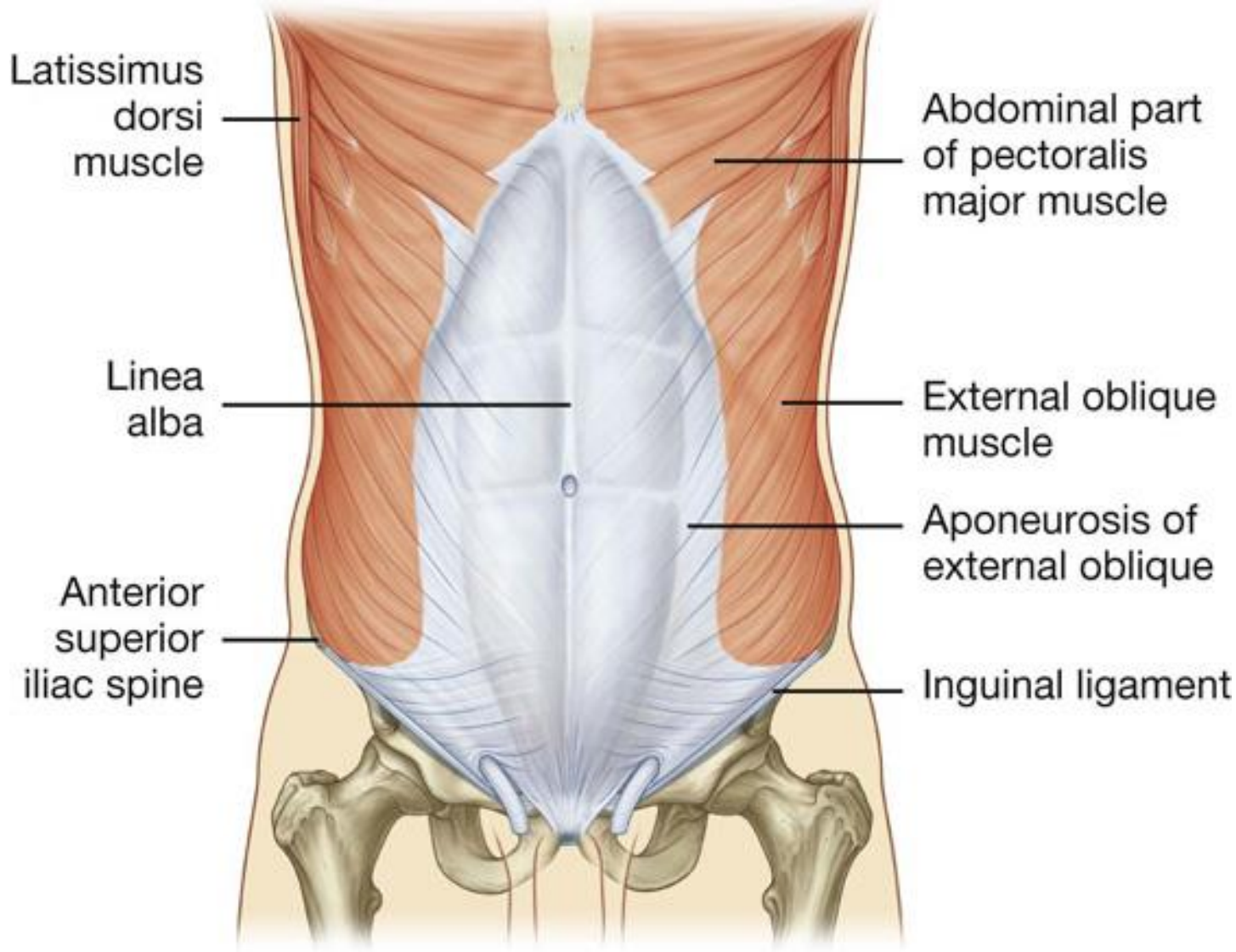
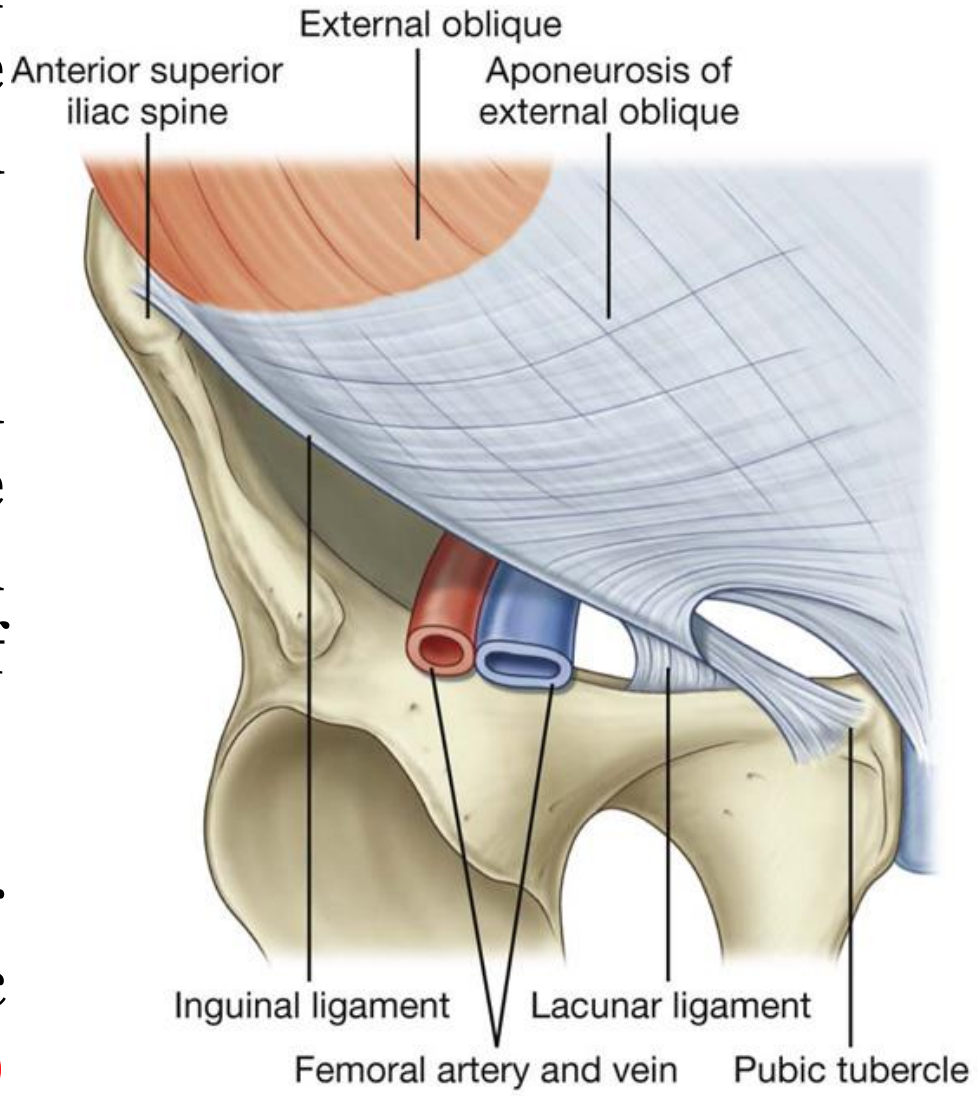

Latissimus dorsi muscle
Linea alba
Anterior superior iliac spine
Abdominal part of pectoralis major muscle
External oblique muscle
Aponeurosis of external oblique
Inguinal ligament

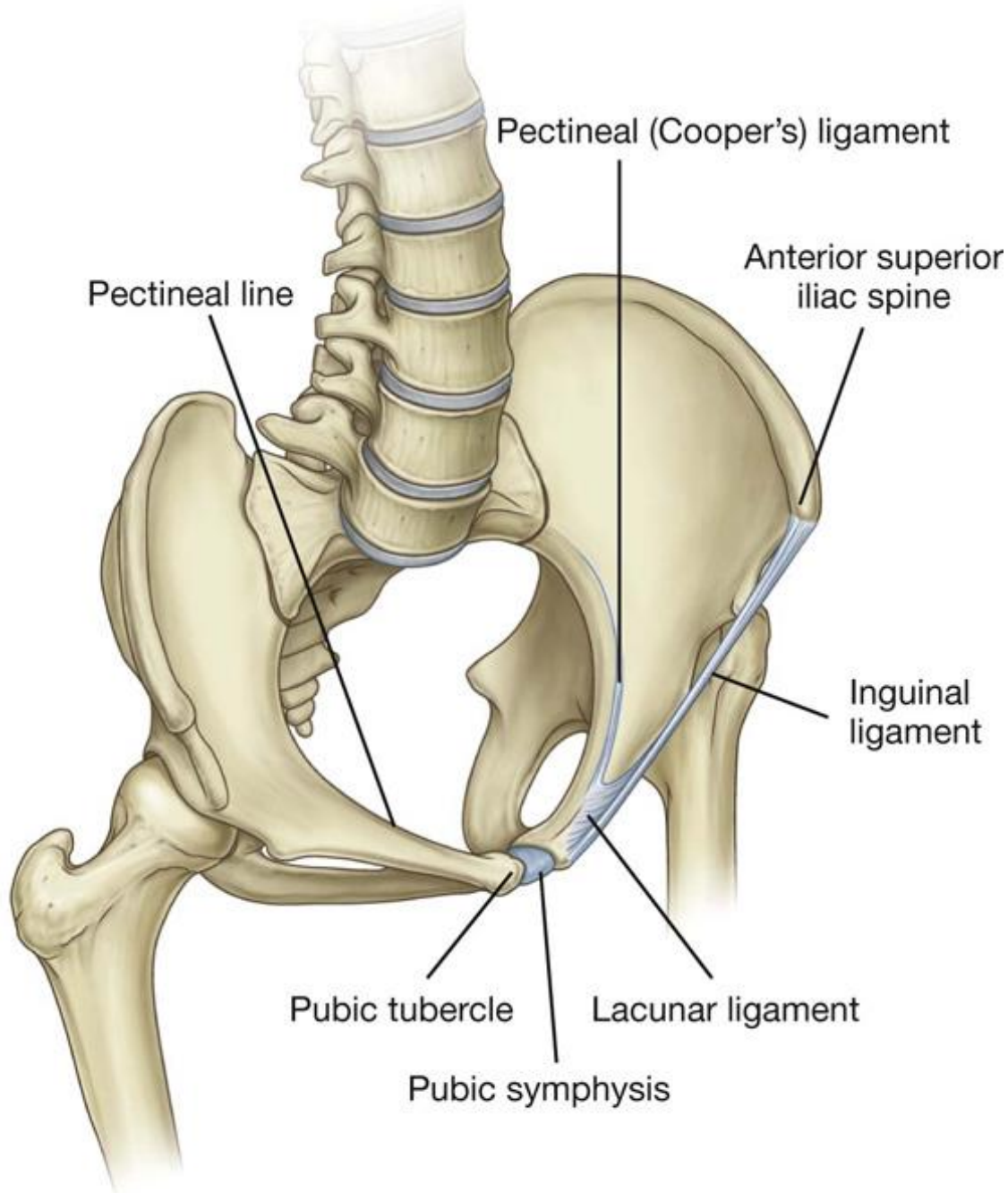
Ligaments associated with external oblique muscle:

- Lower border of the aponeurosis of external oblique muscle fold back on itself forming the **inguinal ligament** connecting the ***ASIS*** and the ***pubic tubercle.***

- The **lacunar ligament** is a crescent-shaped extension of fibers at the medial end of the inguinal ligament that pass backward to attach to the pecten pubis on the superior ramus of the pubic bone.

- Additional fibers extend from the lacunar ligament along the pecten pubis of the pelvic brim to form the **pectineal (Cooper's) ligament**.




Pectineal (Cooper's) ligament
Anterior superior iliac spine
Pectineal line
Inguinal ligament
Pubic tubercle
Lacunar ligament
Pubic symphysis

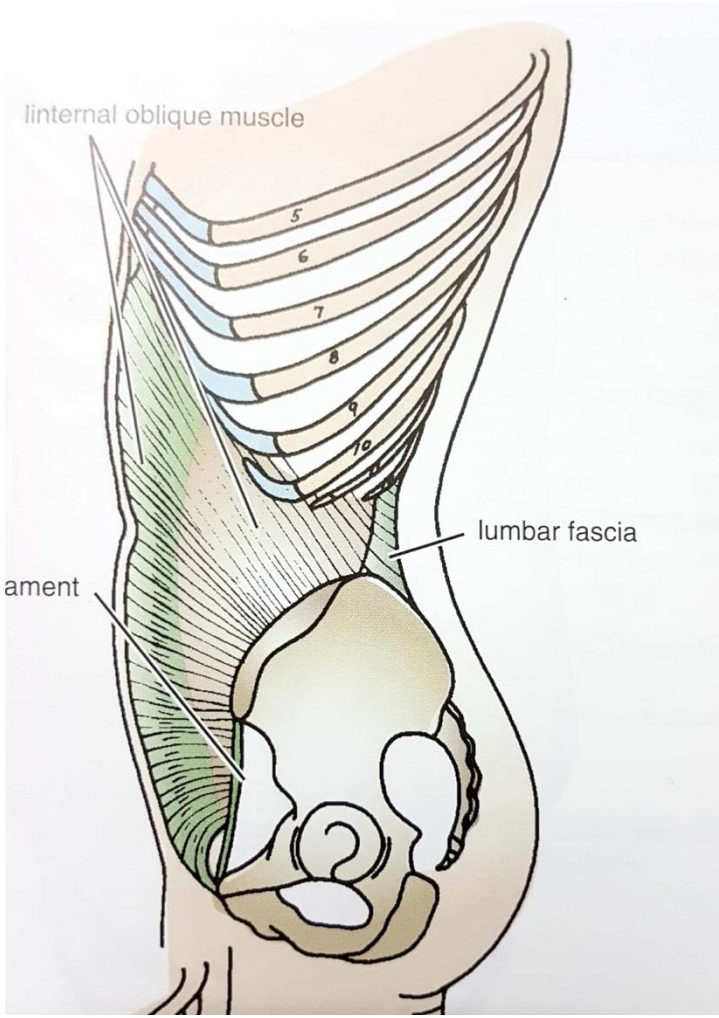
Internal Oblique

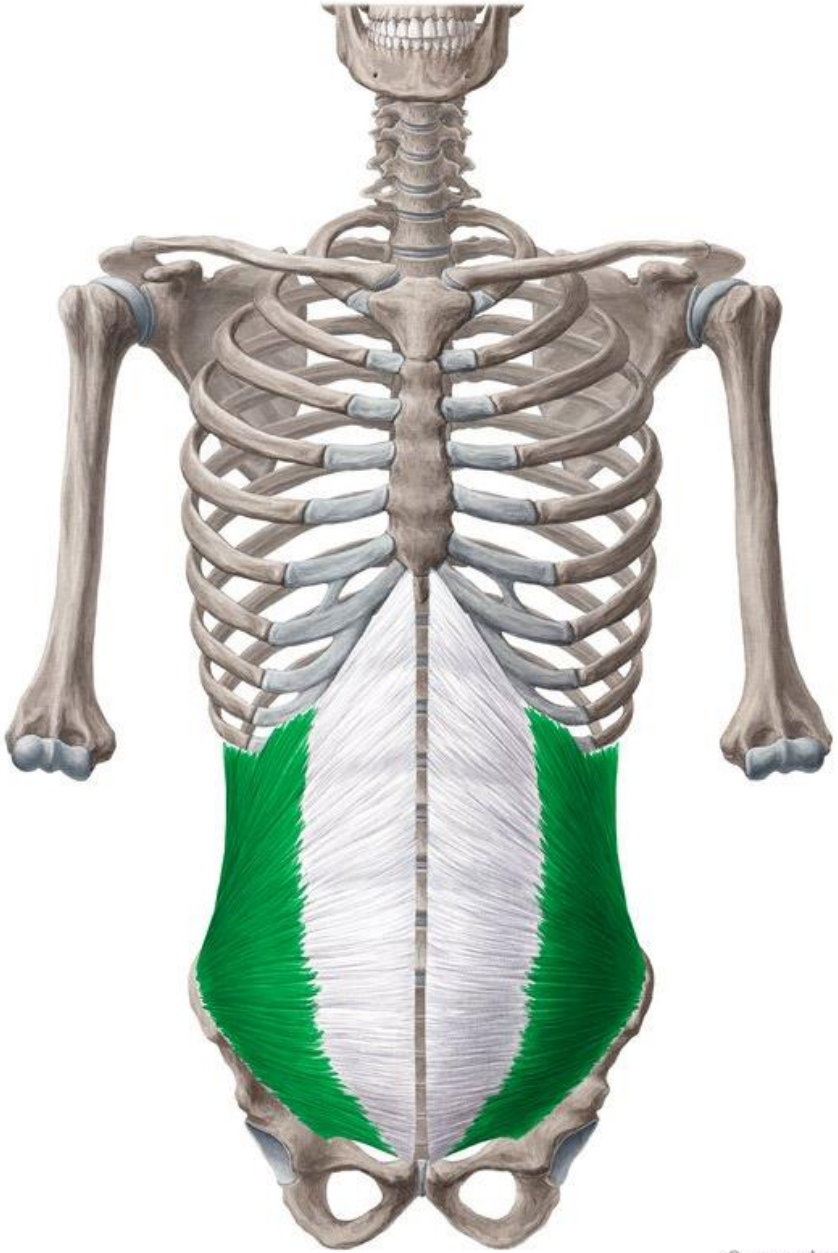
- The internal oblique lies deep to the external oblique. It is smaller and thinner in structure, with its fibers running ***superomedially***.

- **Attachments:** Originates from the inguinal ligament, iliac crest and lumbodorsal fascia, and inserts into ribs 10-12 and linea alba.

- **Functions**: Bilateral contraction compresses the abdomen and flex the trunk while unilateral contraction ipsilaterally rotates the torso.
- **Nerve Supply:** Lower six thoracic nerve and L1

- **Cremaster muscle** is derived from its lower fibers and form the covering of spermatic cord.

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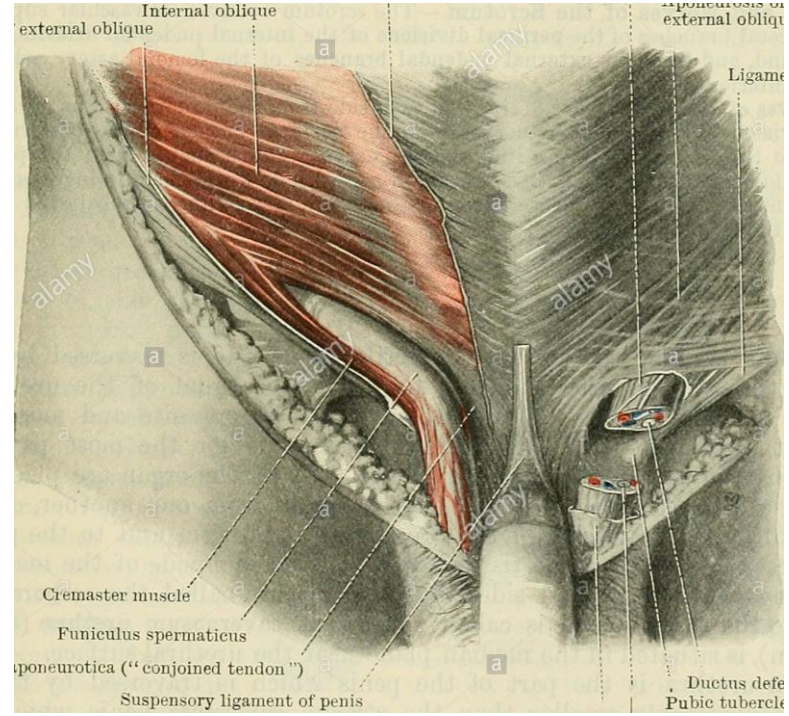
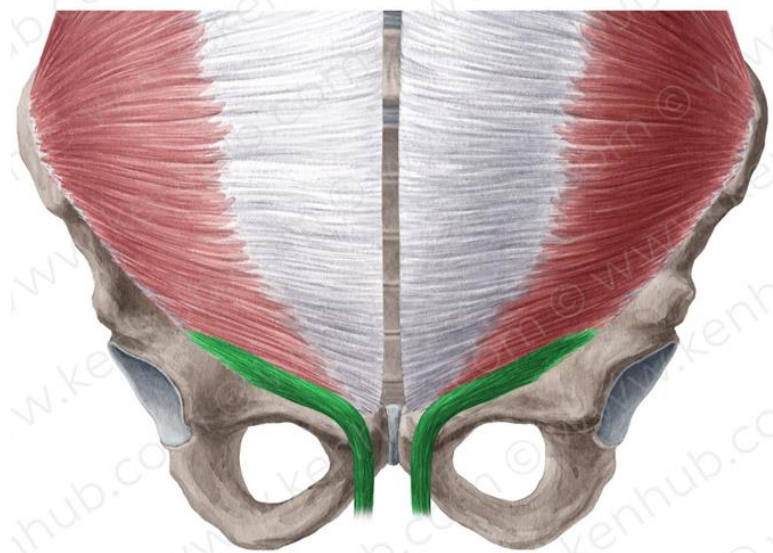
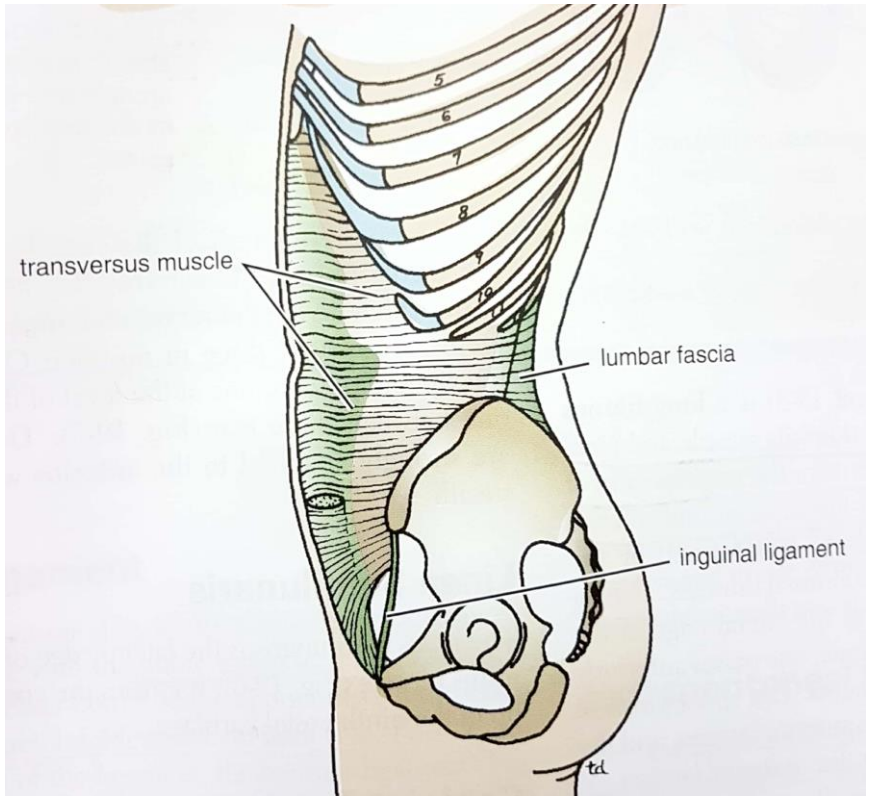
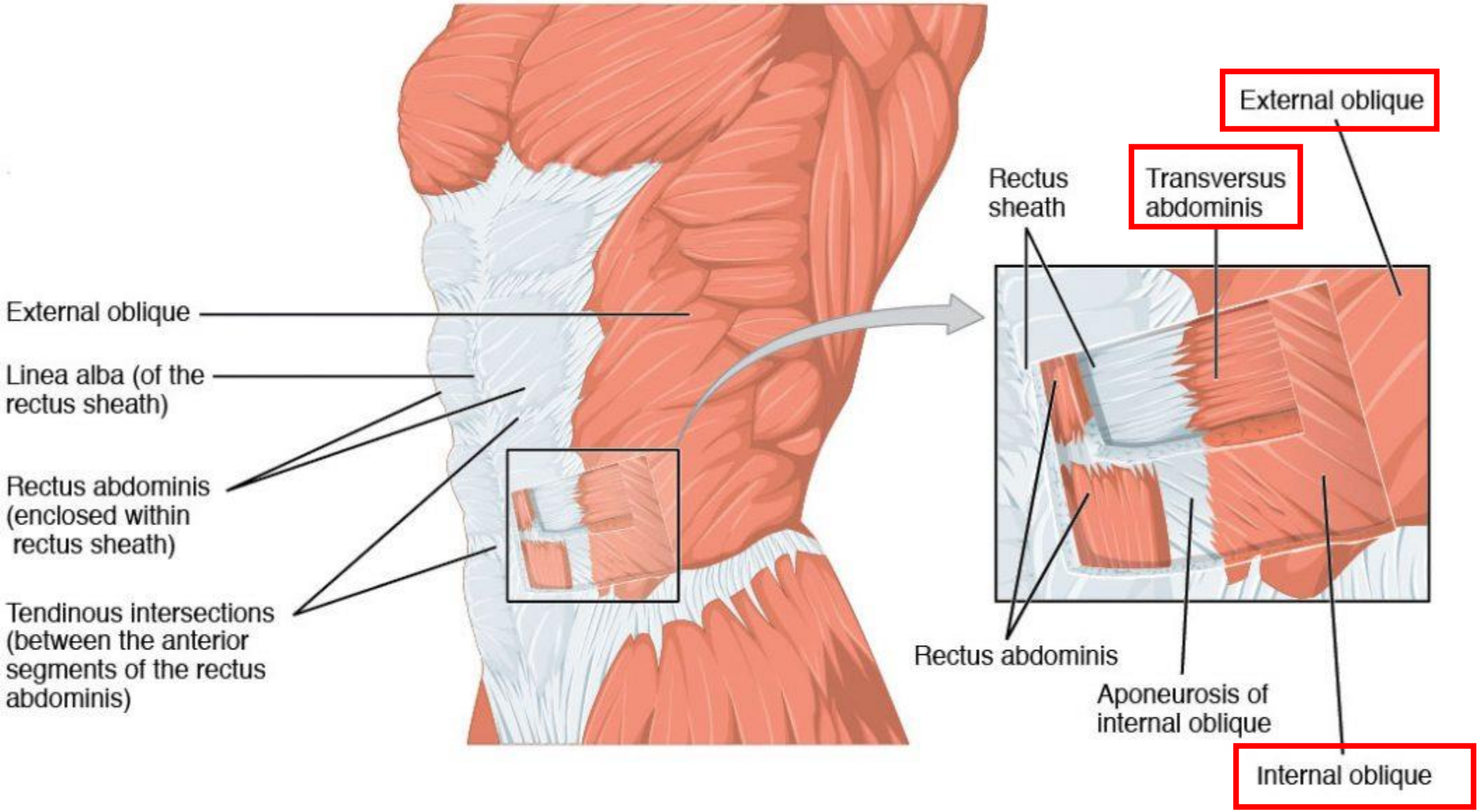

Internal oblique
external oblique
Cremaster muscle
Funiculus spermaticus
Suspensory ligament of penis
Pubic tubercle



Transversus Abdominis

- The deepest of the flat muscles, with **transversely** running fibers.
- Deep to this muscle is a well-formed layer of fascia, known as the **transversalis fascia.**
- **Attachments**: Originates from the inguinal ligament, costal cartilages 7-12, the iliac crest and thoracolumbar fascia. Inserts into xiphoid process, linea alba and the pubic crest.
- **Functions**: Compression of abdominal contents.
- **Nerve supply**: Lower six thoracic nerve and L1

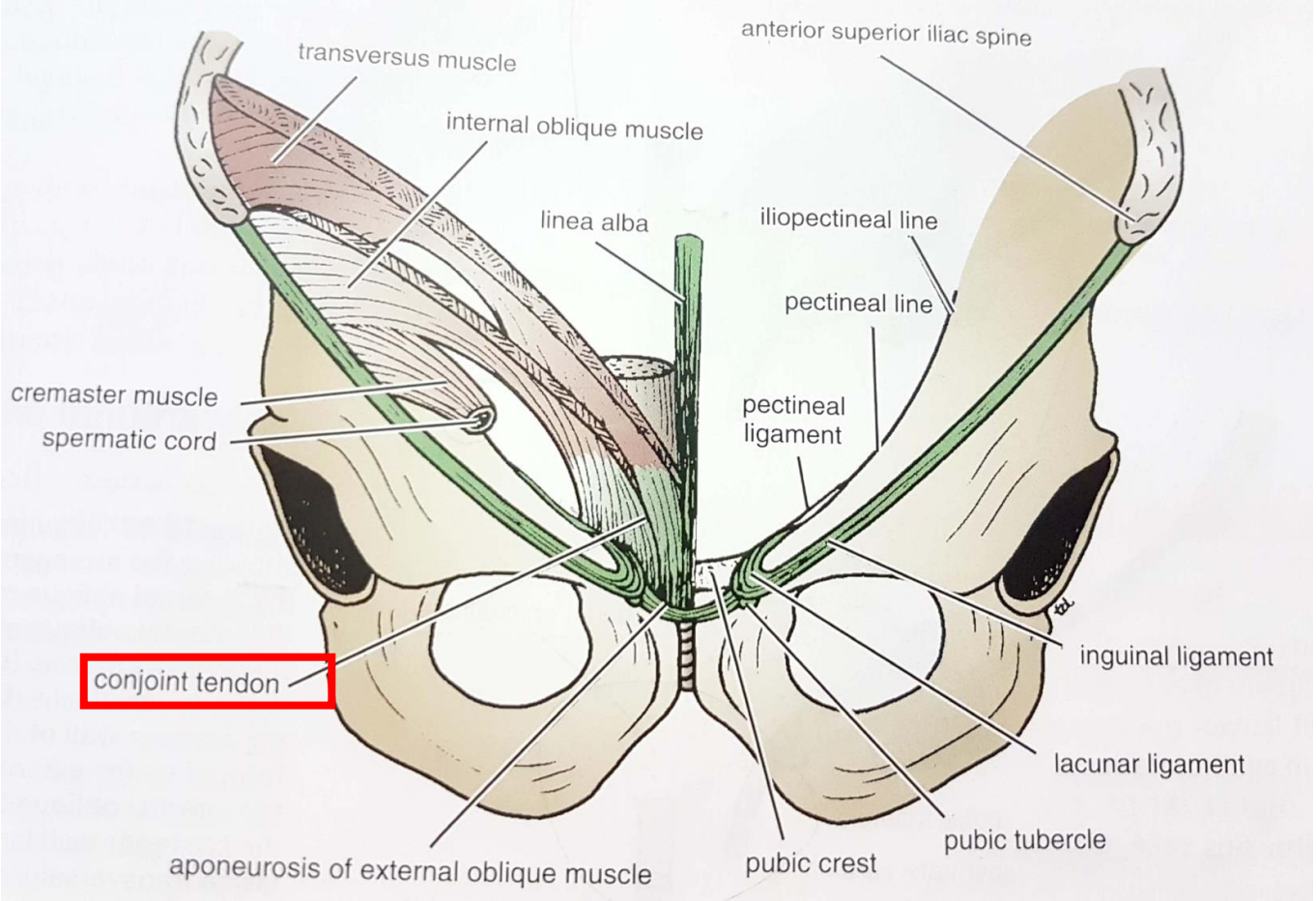


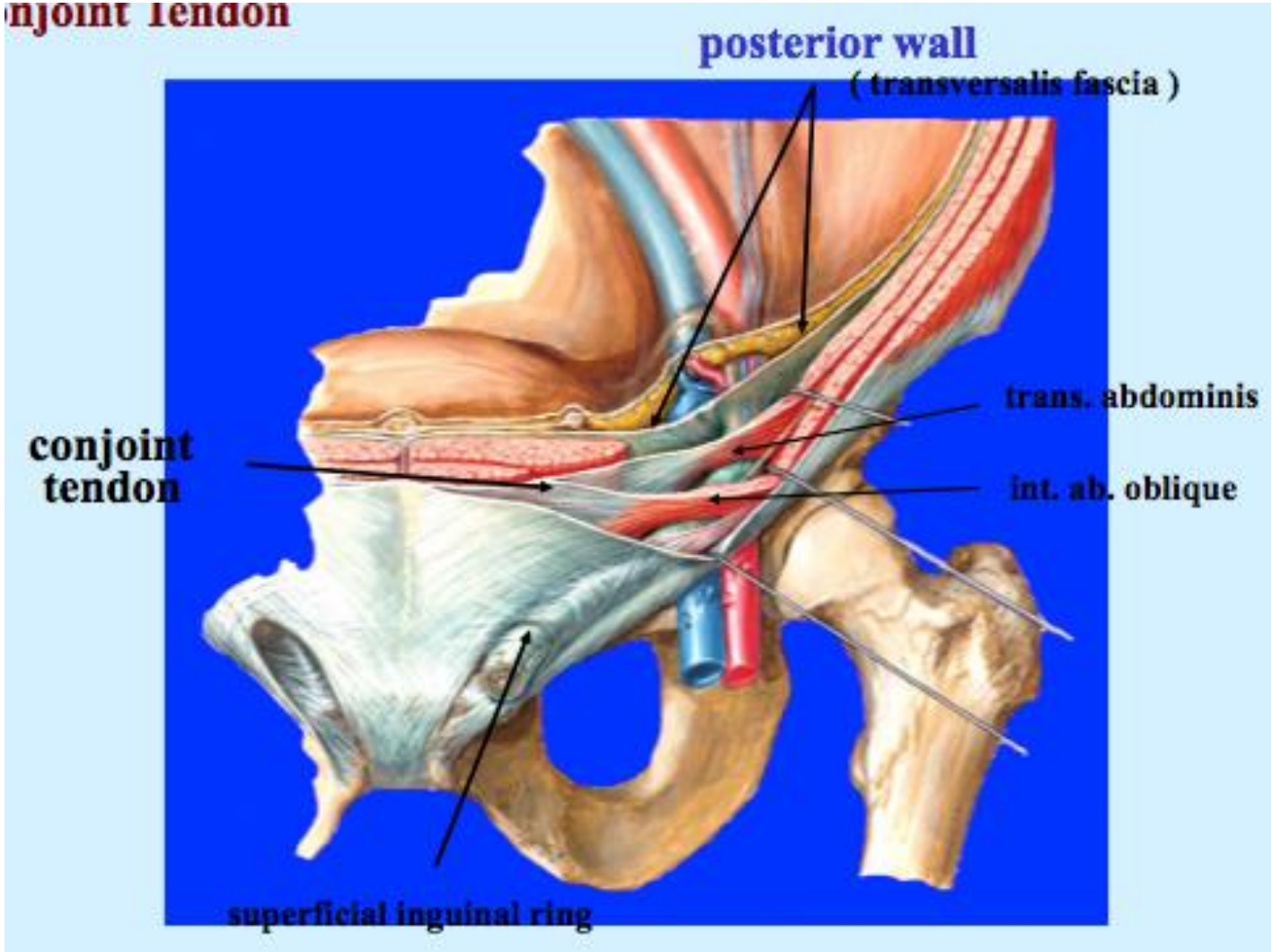

External oblique
Linea alba (of the rectus sheath)
Rectus abdominis (enclosed within rectus sheath)
Tendinous intersections (between the anterior segments of the rectus abdominis)
External oblique
Rectus sheath
Transversus abdominis
Rectus abdominis
Aponeurosis of internal oblique
Internal oblique

Ligament associated with internal oblique and transversus abdominis muscles:

Conjoint tendon

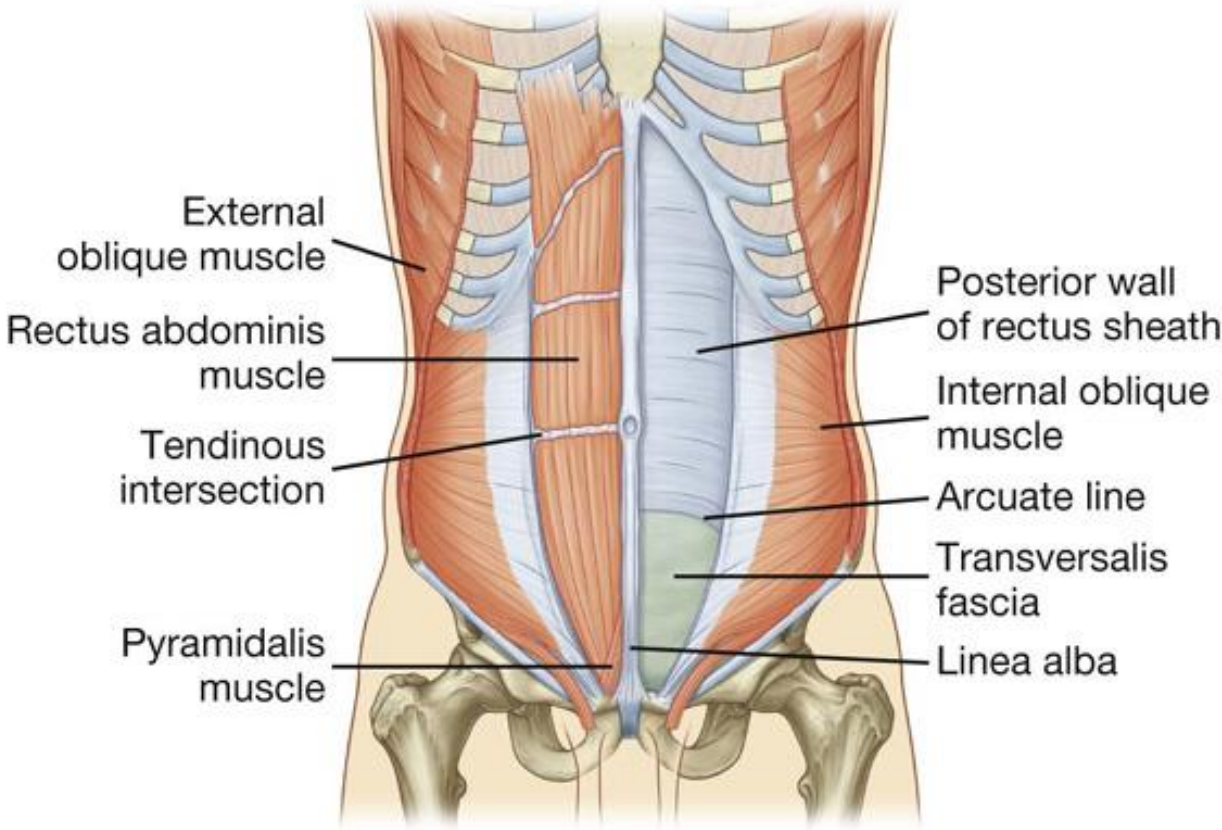
- This tendon is the combined insertion of **internal oblique** and **transversus abdominis** muscles into the pubic crest and pectineal line.




njoint Tendon
posterior wall
(transversalis fascia)
trans. abdominis
conjoint
tendon
int. ab. oblique
superficial inguinal ring

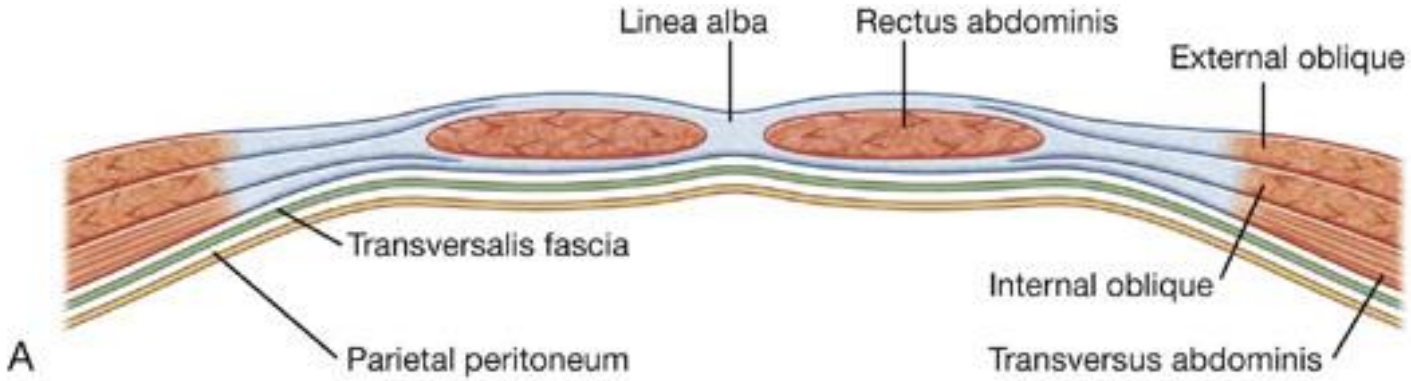
Rectus Abdominis

- Long, paired muscle, found either side of the midline in the abdominal wall. It is split into two by the linea alba.
- **Attachments:** Originates from the crest of the pubis, before inserting into the xiphoid process of the sternum and the costal cartilage of ribs 5-7.
- **Functions:** assists in compressing the abdominal viscera and stabilizes the pelvis during walking.
- **Nerve supply:** Thoracoabdominal nerves (T7-T11).

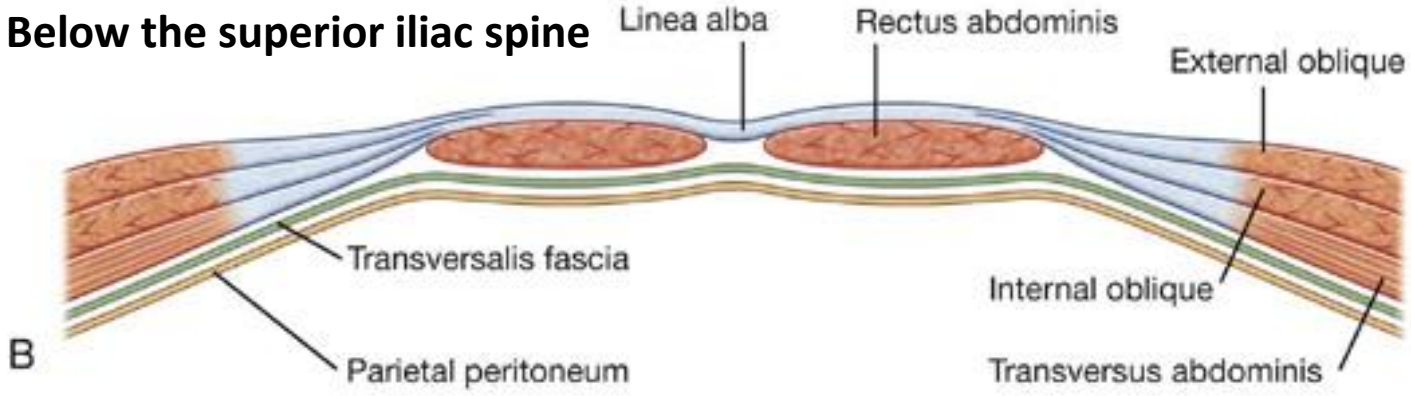


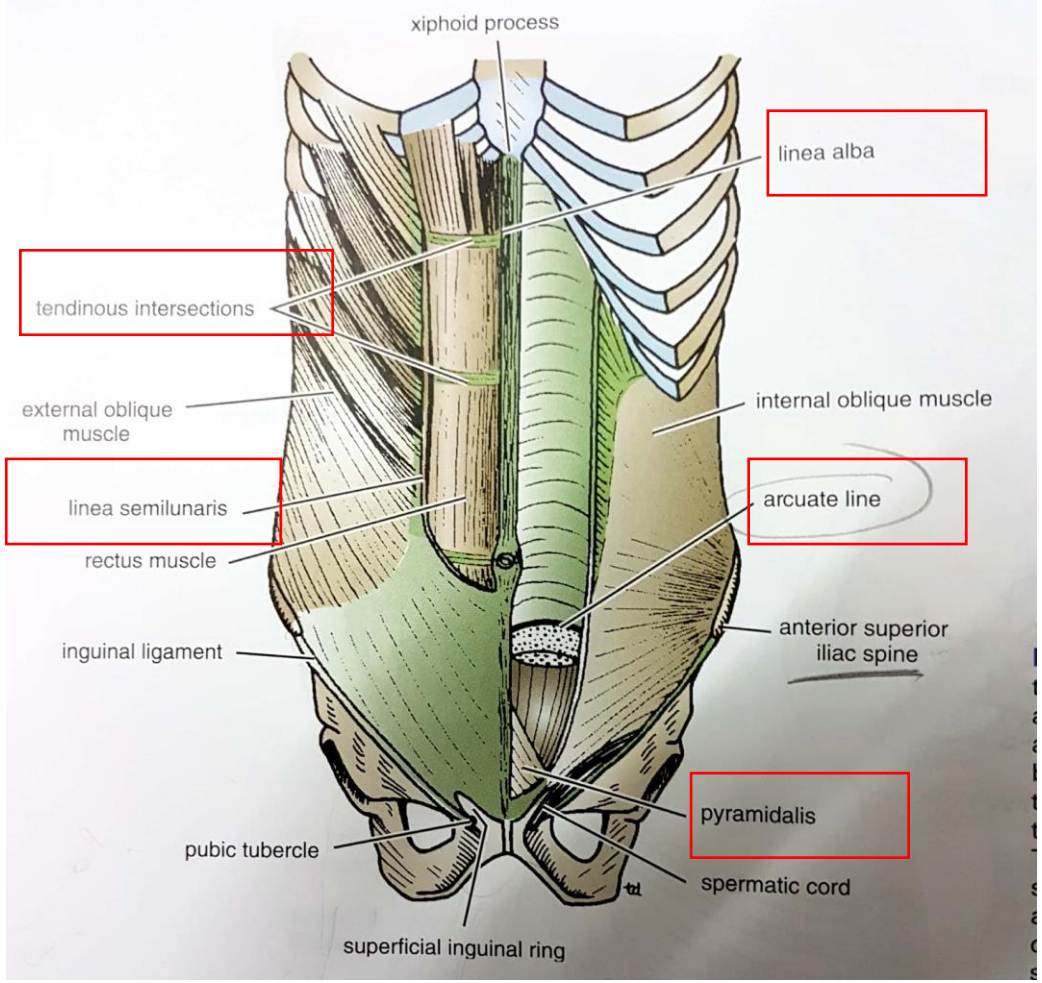
Rectus Sheath

Above the superior iliac spine



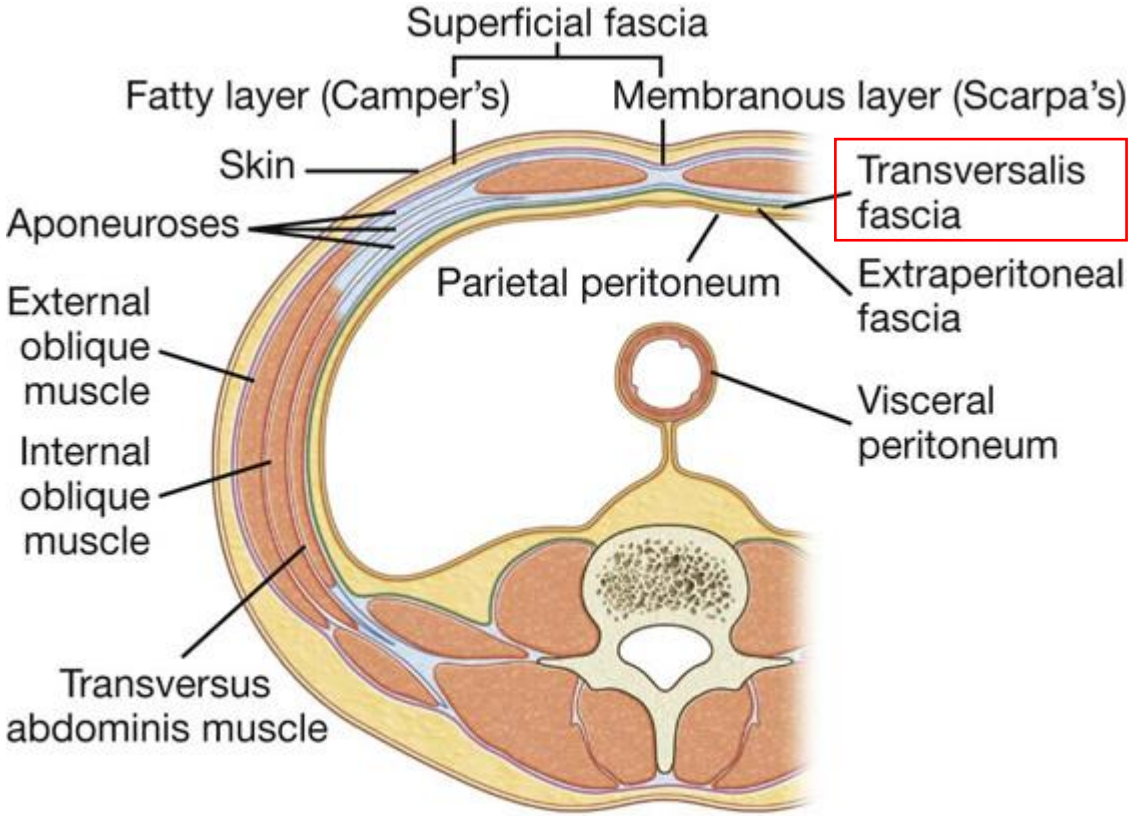
Below the superior iliac spine





Endoabdominal fascia (Fascia transversalis)

- Endoabdominal fascia is Layer of areolar connective tissue line the deep surface of abdominal muscles.
- The portion lining the deep surface of transversus abdominis called **Fascia transversalis.**

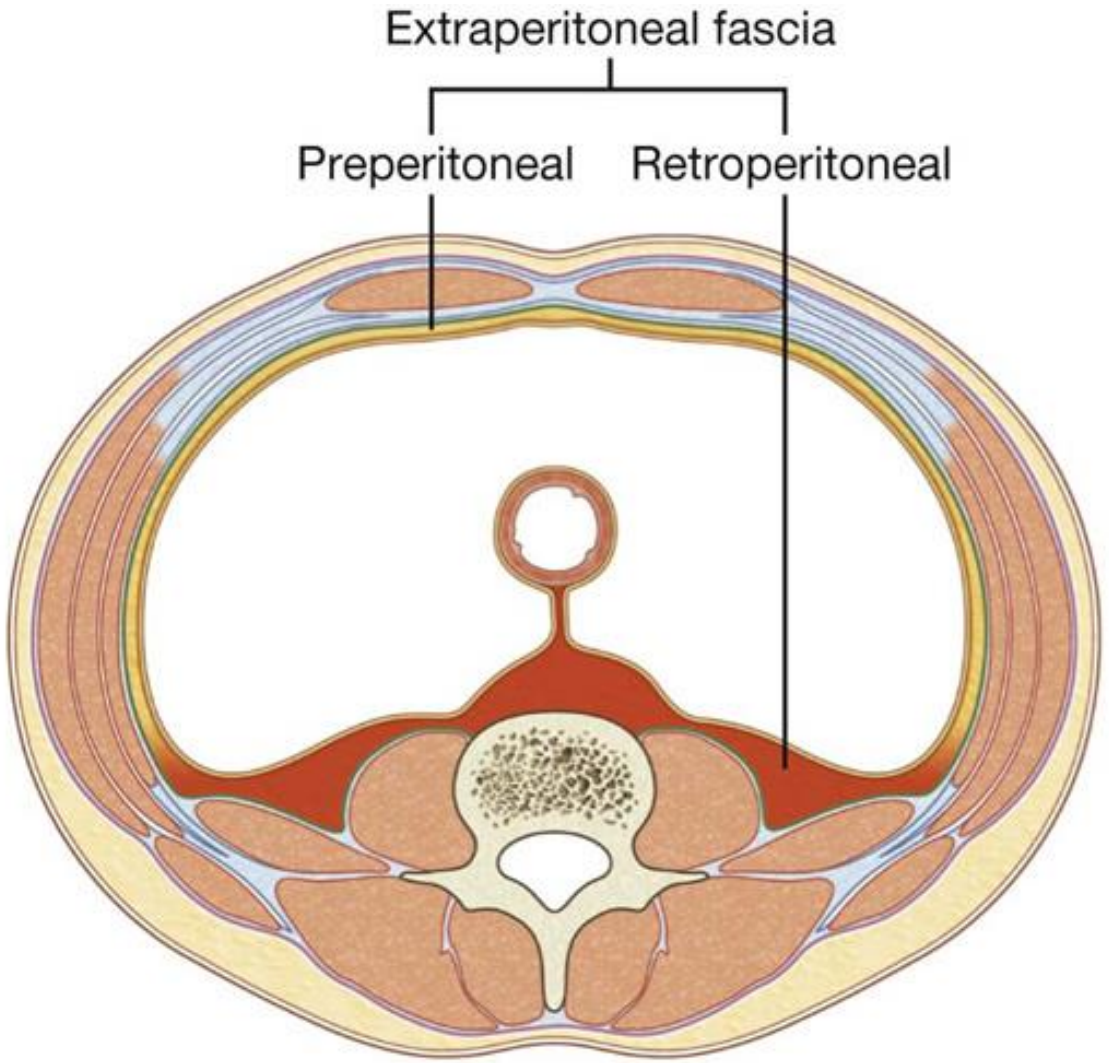


Extraperitoneal fascia

- Extraperitoneal facia is a layer of connective tissue containing variable amount of fat lies between the fascia transversalis and parietal peritoneum.

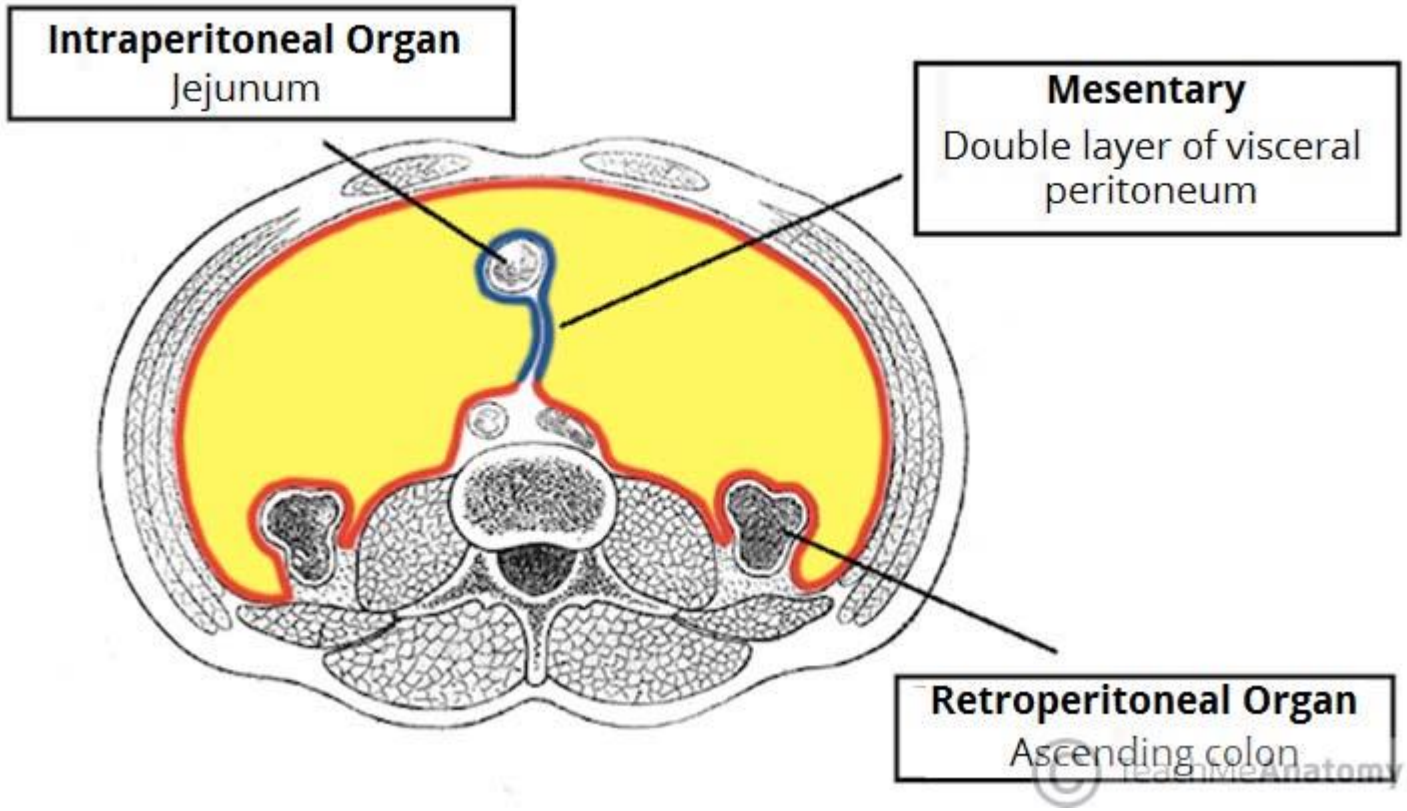
- It is abundant on the posterior abdominal wall, especially around the kidneys.

- Organs in the extraperitoneal fascia are referred to as **retroperitoneal organs**.



Peritoneum

- Thin serous membrane lines the walls of the abdominal cavity and, at various points, reflects onto the abdominal viscera.



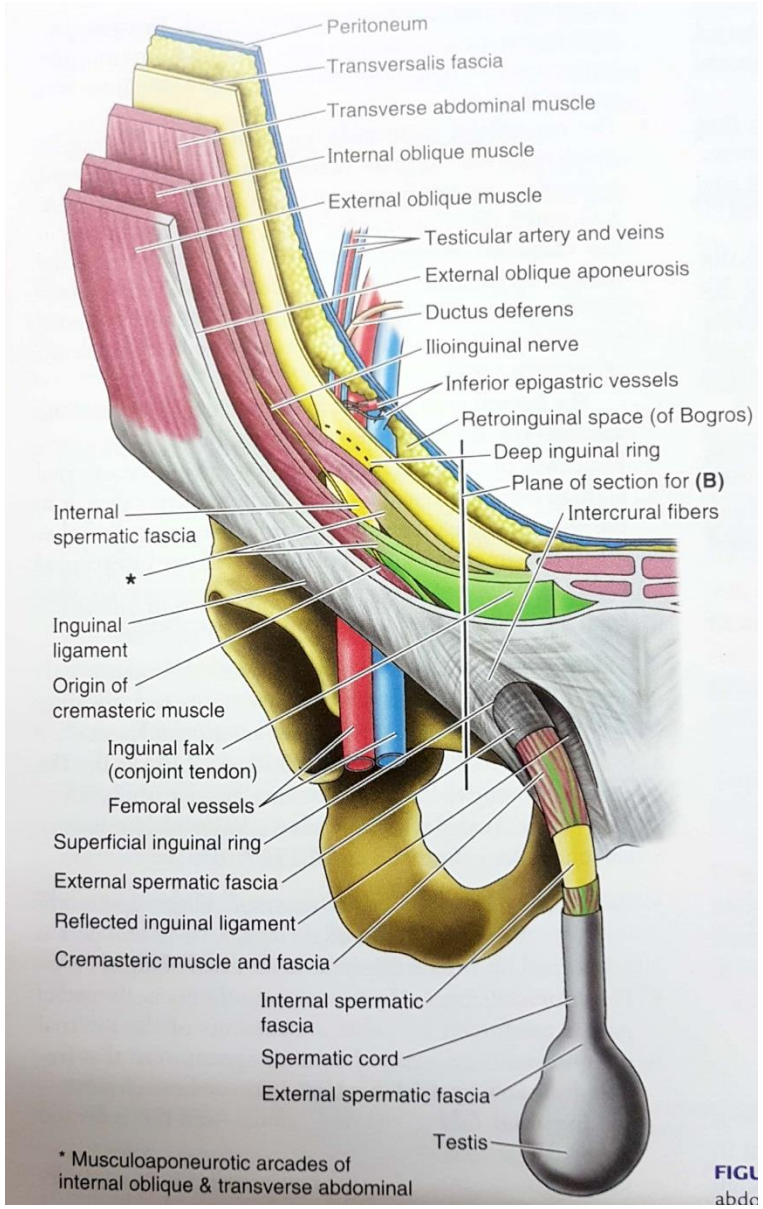
Inguinal Region

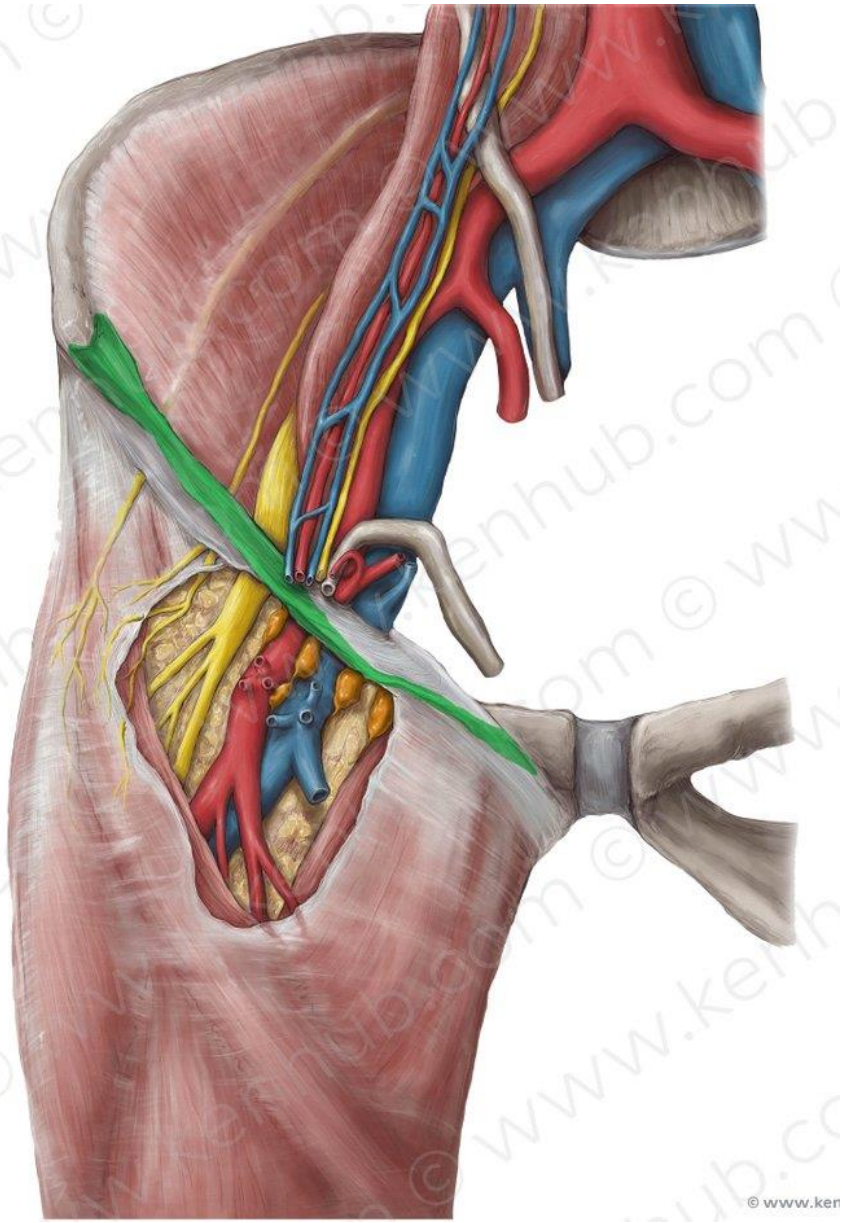
- The inguinal region, or groin, extend between the **ASIS** and **pubic tubercle.**

- It is important anatomically and clinically:

  - It is a region where structures exit and enter the abdominal cavity ??

  - The pathways of exit and entrance are potential sites for herniations ??

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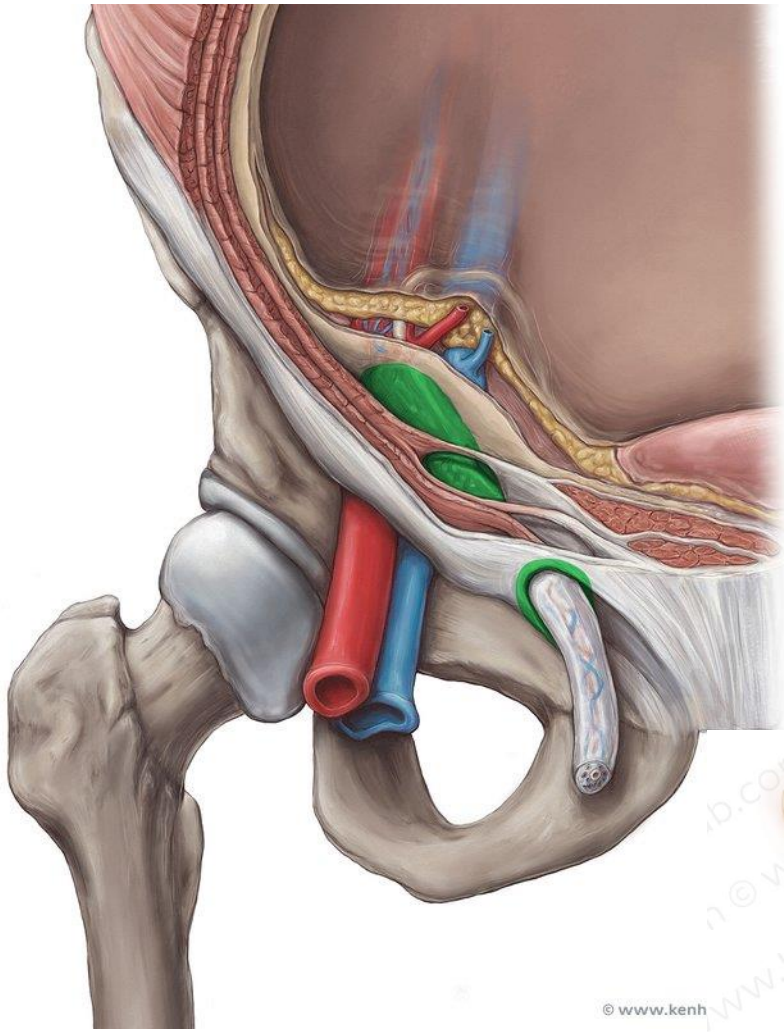
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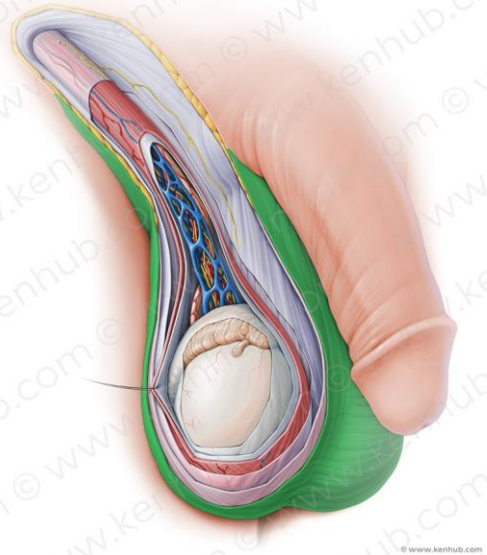
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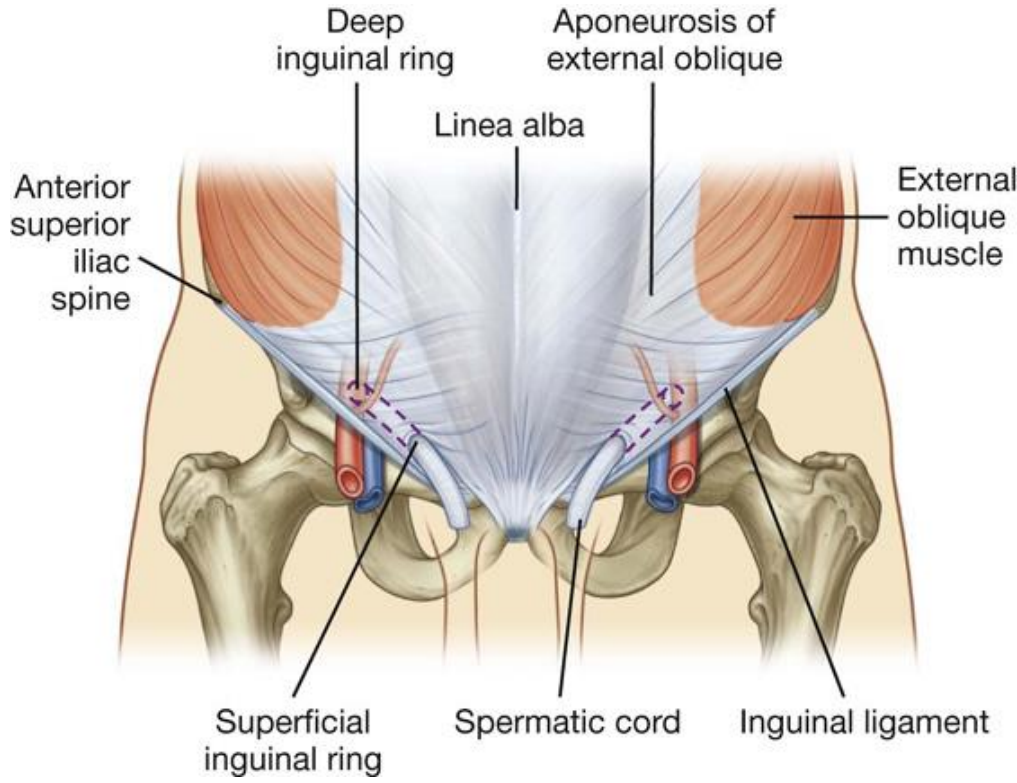
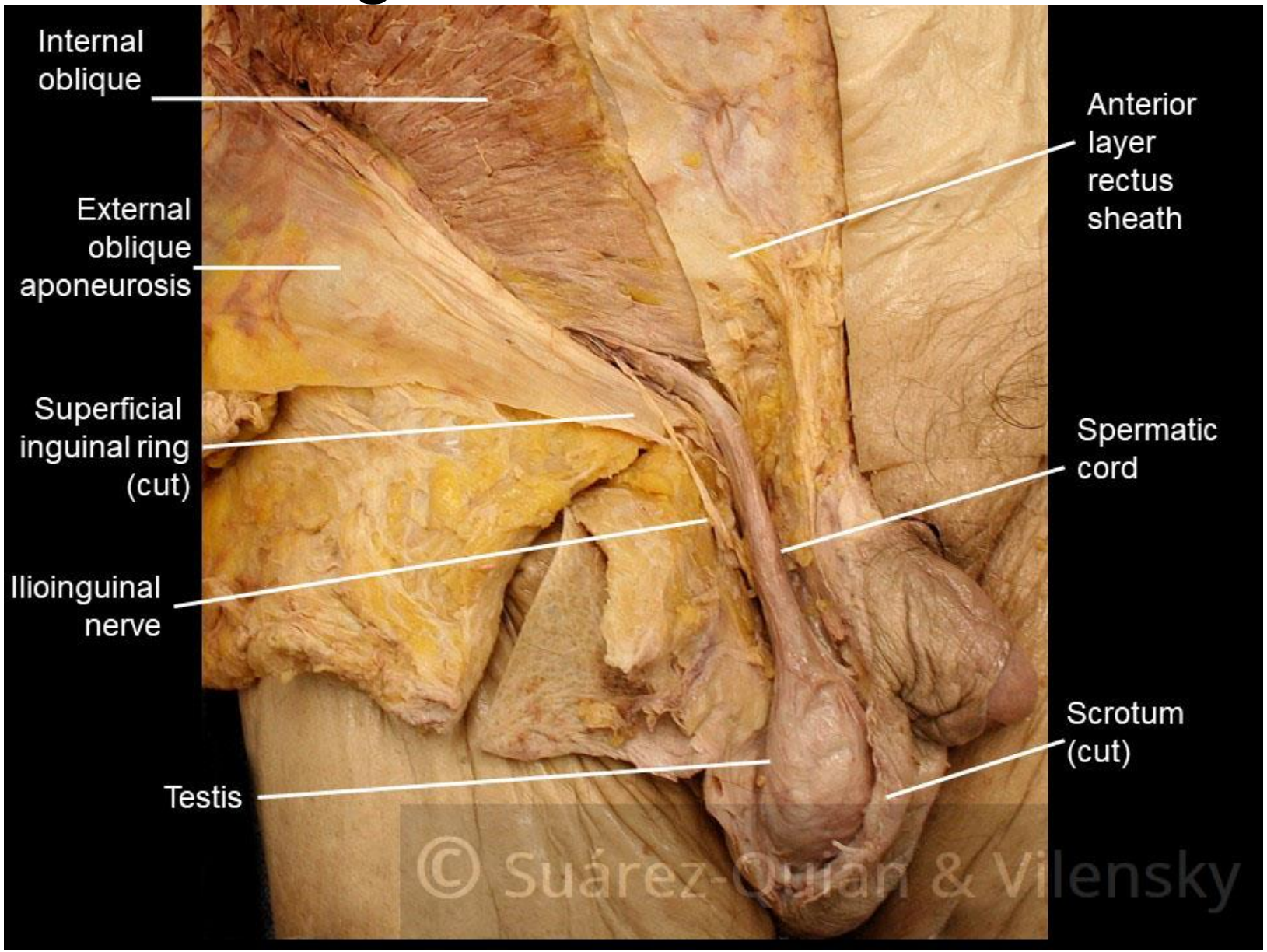
Inguinal canal

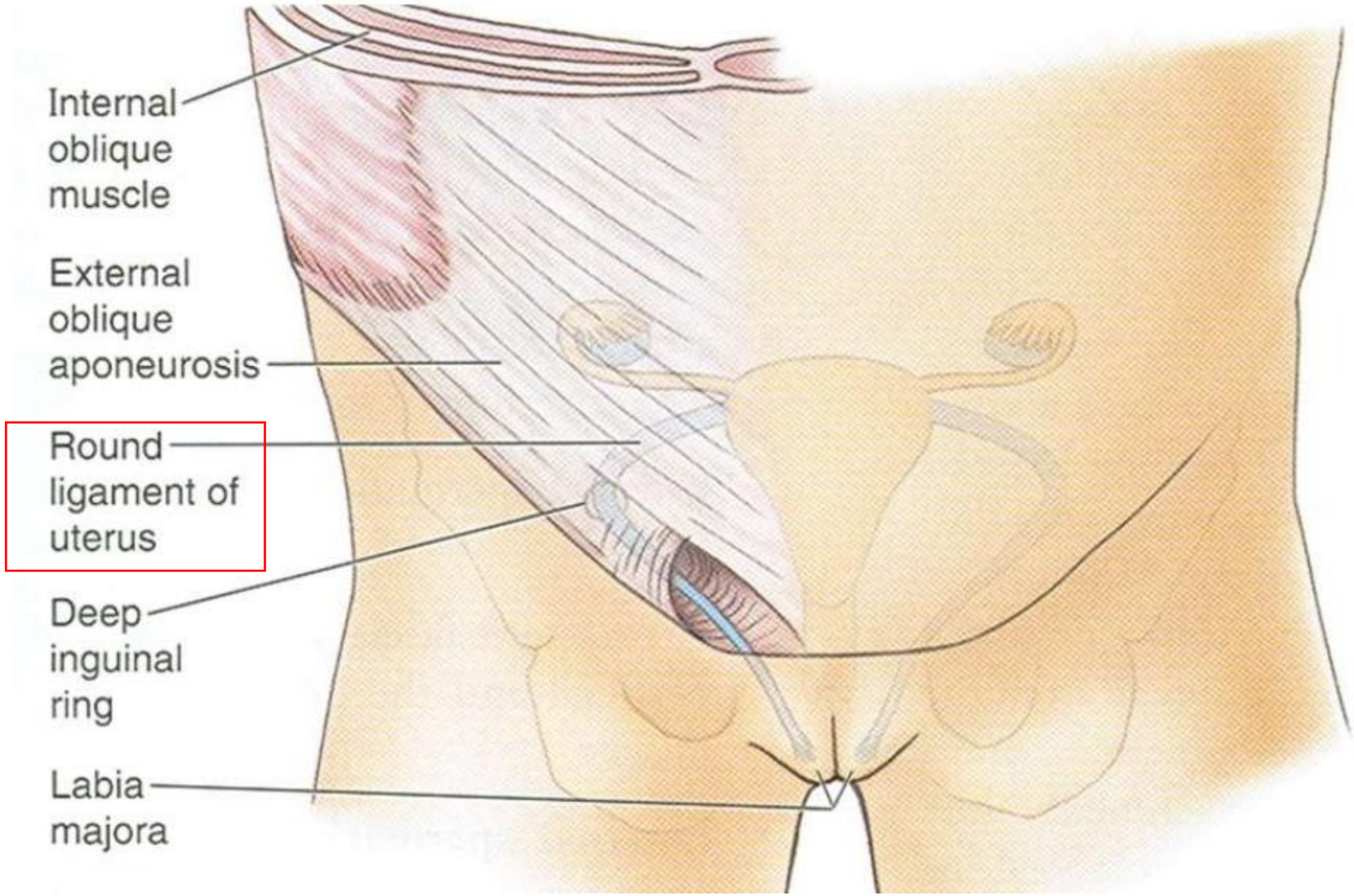
- It is an oblique passage in the lower medial part of the Anterior Abdominal Wall
- Lies above and parallel to the lower part of inguinal ligament
- 5 cm long in adult
- In males, It allows the structures to pass from and to the testis and abdomen.
- In females, it allows the round ligament of the uterus to pass from of the uterus to the labia majora.
- Extend from the **deep inguinal ring** to the **superficial inguinal ring**



Inguinal canal in Male

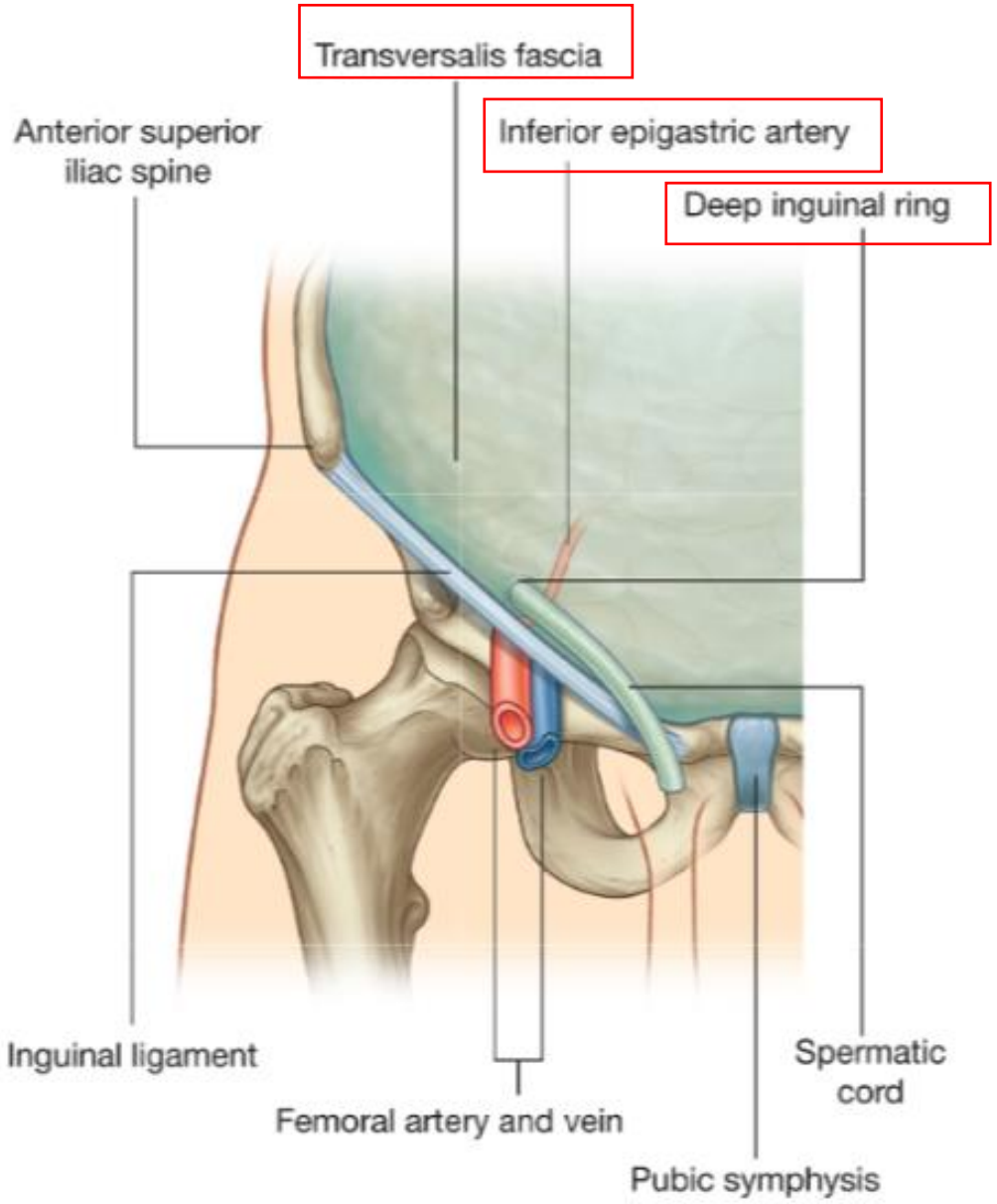


Inguinal canal in females



Deep inguinal ring

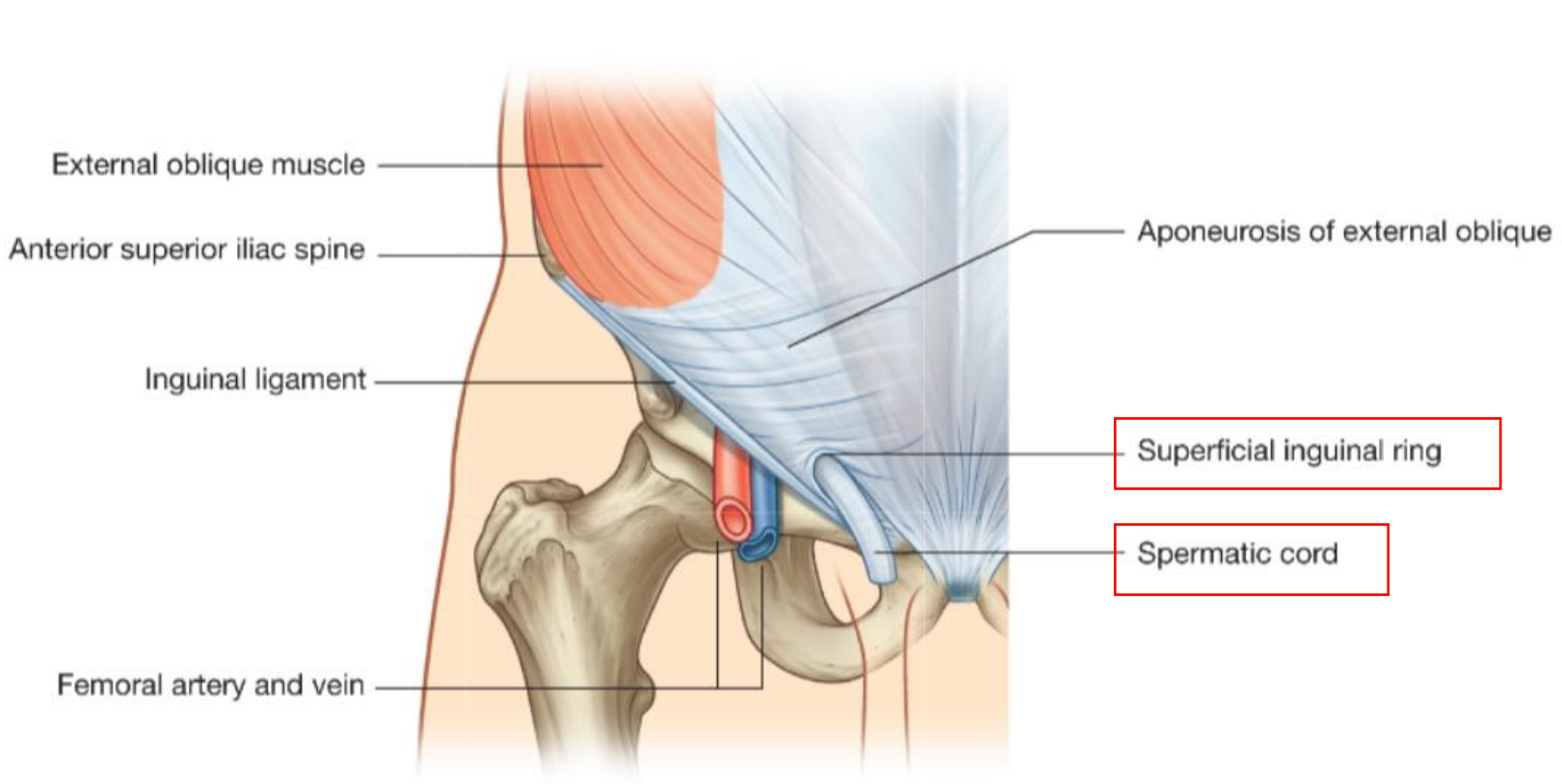
- It is an oval opening in the fascia transversalis
- Lies lateral to the inferior epigastric vessels.
- 1.3 cm above the middle of the inguinal ligament, midway between anterior iliac spine and pubic tubercle.
- Margins of the ring give attachment to the internal spermatic fasica.



Superficial inguinal ring

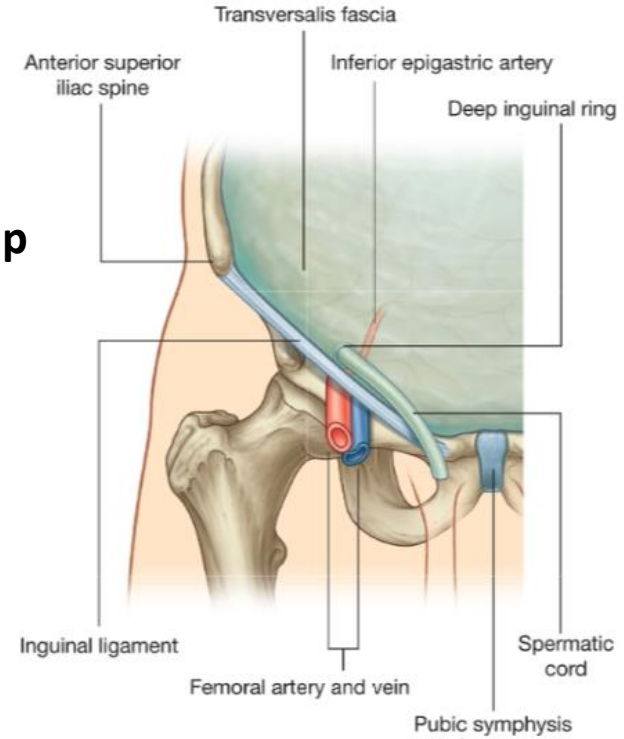
- It's an triangle-shaped defect in the aponeurosis of **external oblique muscle** just above and medial to the **pubic tubercle**.

- Margins of the ring give attachment to the external spermatic fasica.



1

Deep



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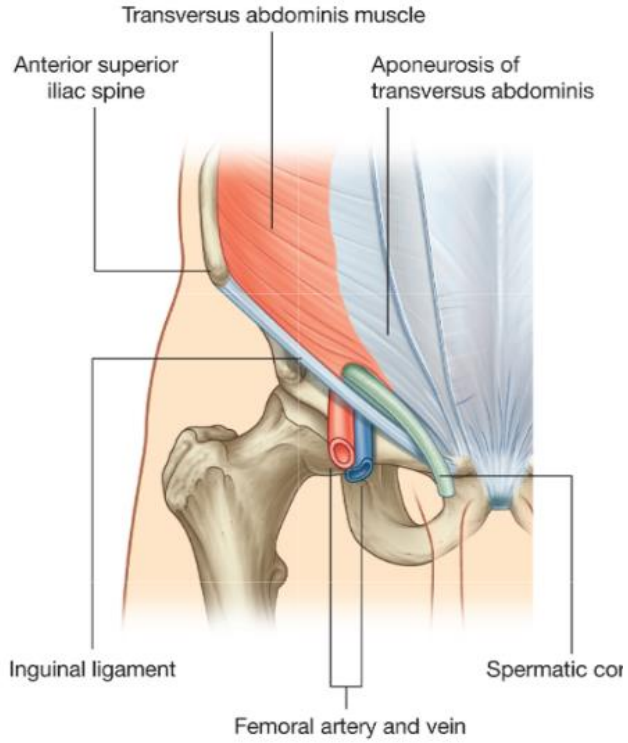

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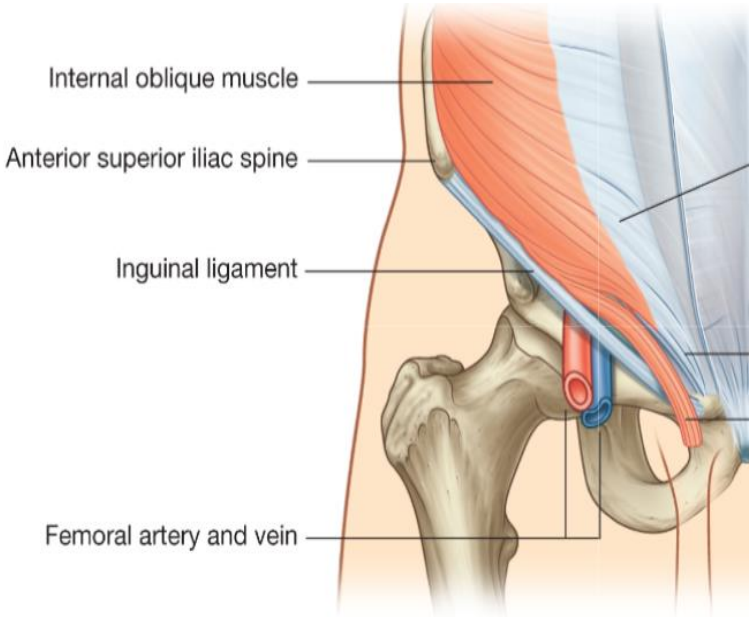
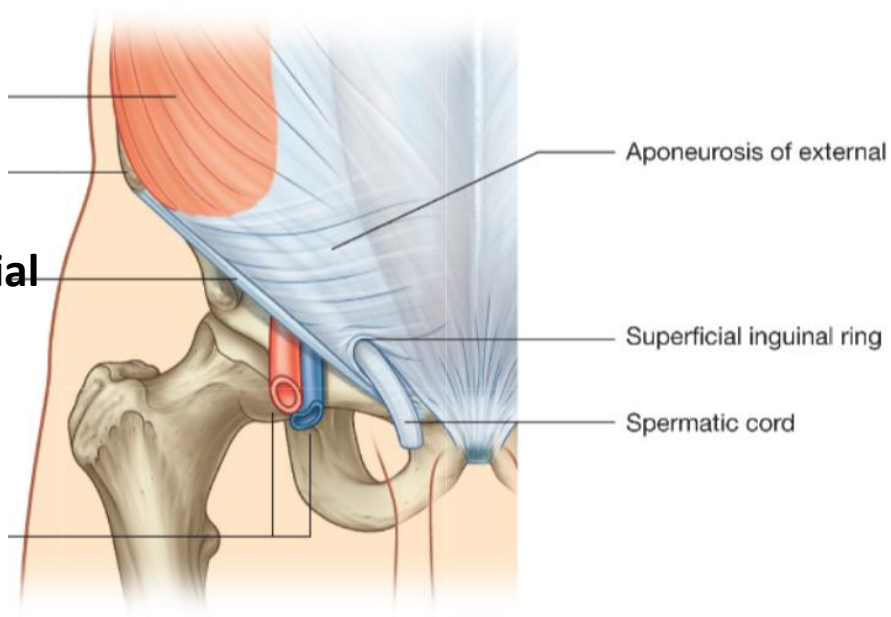
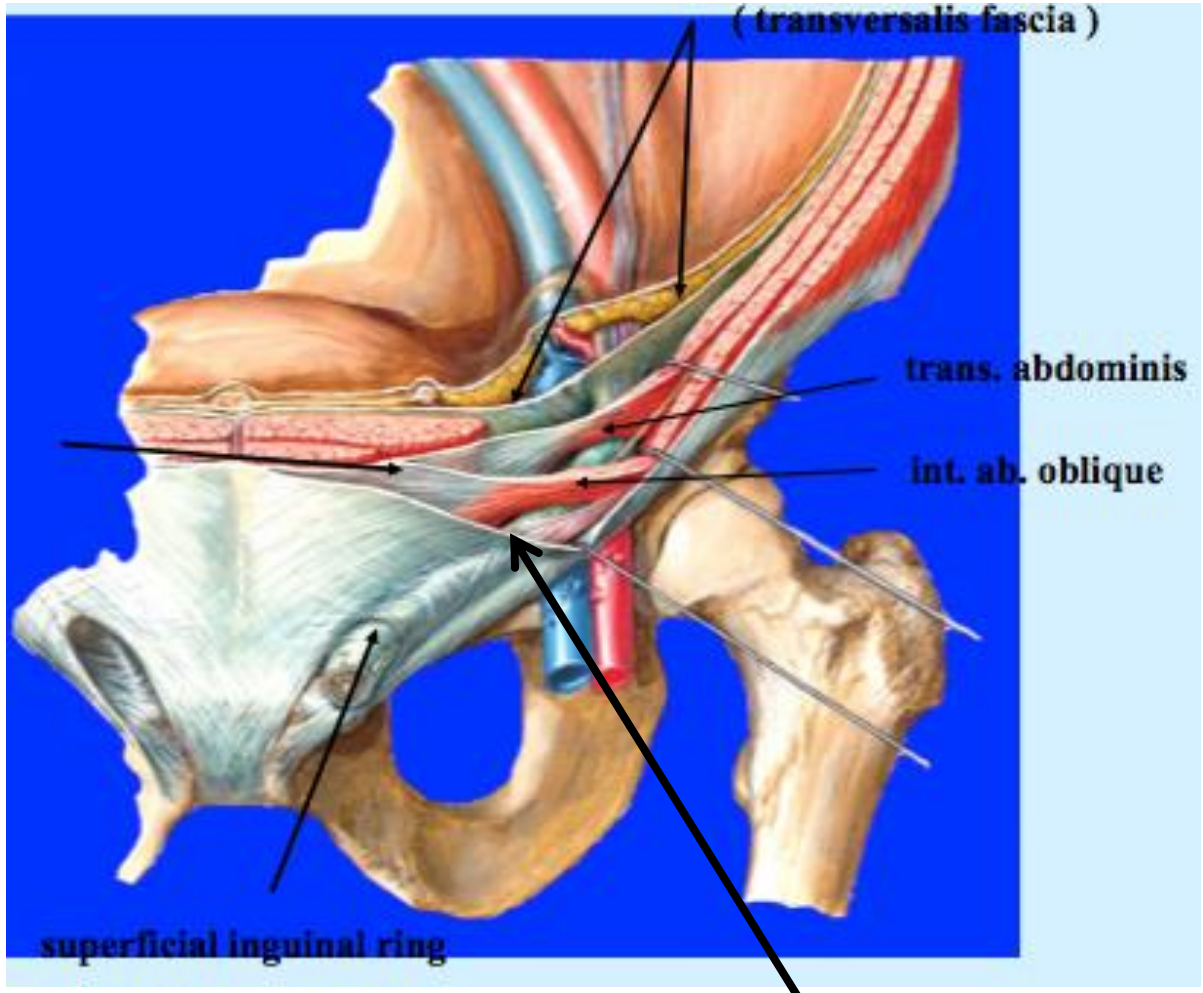


4

Superficial





Aponeurosis of Ext. oblique

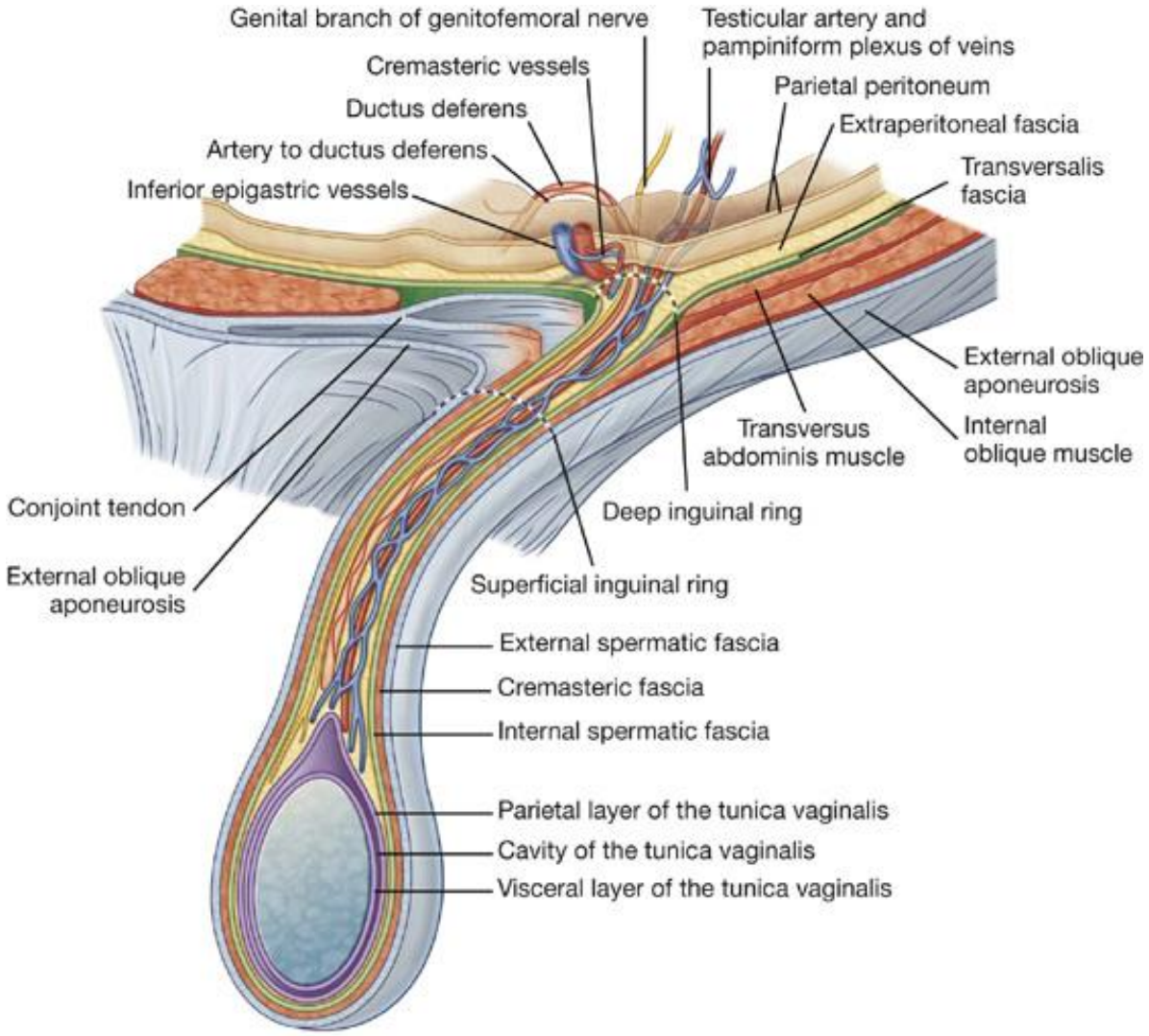
Boundaries of the Inguinal canal

- **Anterior wall:** External oblique aponeurosis, reinforced laterally the origin of internal oblique muscle.
- **Posterior wall**: Conjoint tendon medially, and fascia tranversalis laterally.
- **Superior wall:** Arching fibers of internal oblique and transversus abdominis muscles.
- **Inferior wall :** Inguinal ligament and at its medial end, the Lacunar ligament.

Spermatic cord

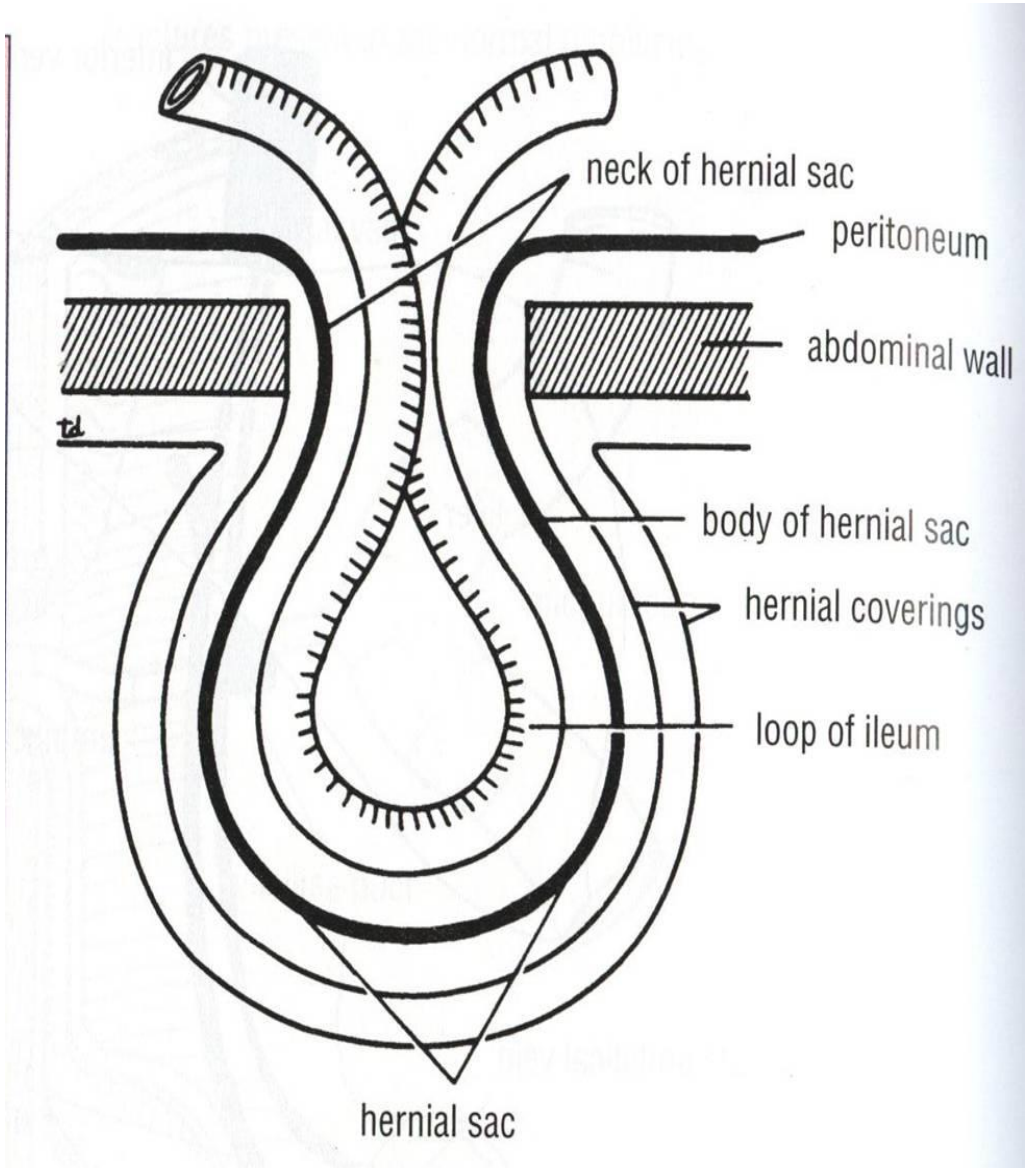
- It is collection of structures that pass through the inguinal canal to and from the testis, these structures include:

1. **The vas deference**
2. **Testicular artery**
3. **Testicular vein (Pampiniform plexus)**
4. **Testicular lymph vessels**
5. **Cremasteric artery**
6. **The genital branch of genitofemoral nerve**



Inguinal Hernia

- A hernia is defined as the protrusion of abdominal contents outside of the abdomen.
- Hernias involving the inguinal canal can be divided into two main categories:
  - **Indirect** – where the peritoneal sac enters the inguinal canal through the deep inguinal ring.
  - **Direct** – where the peritoneal sac enters the inguinal canal though the posterior wall of the inguinal canal.



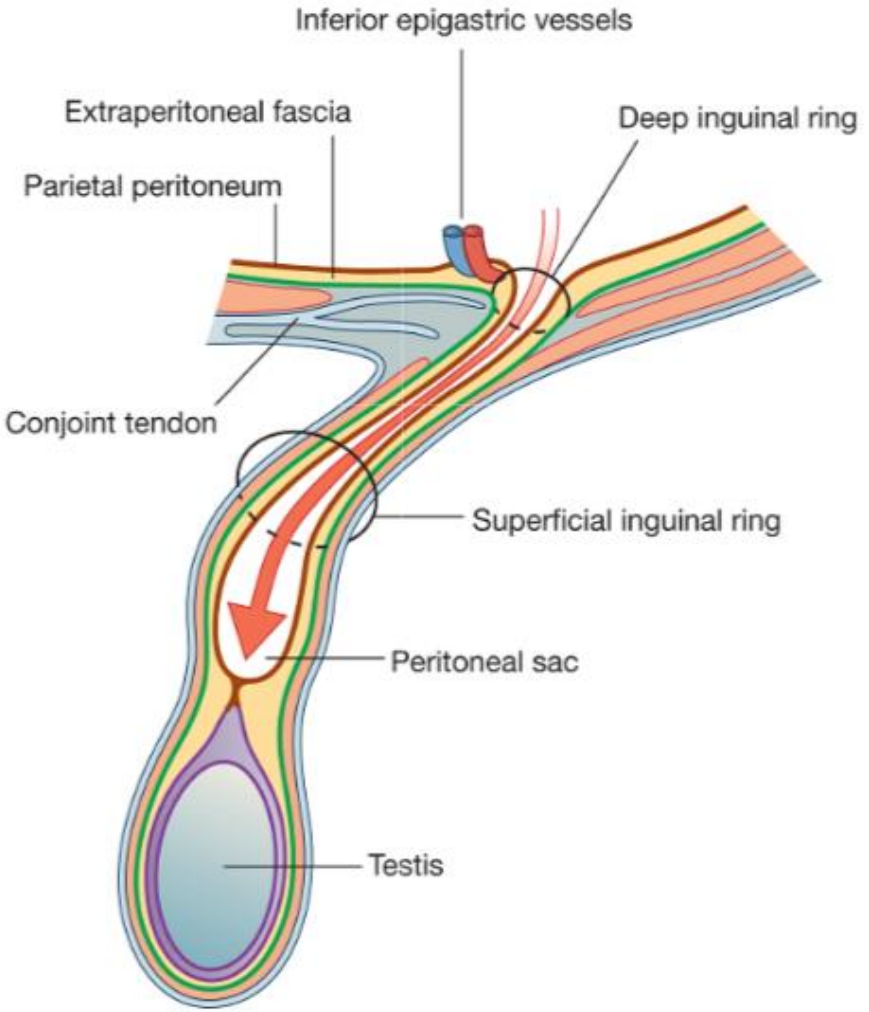
Inguinal Hernia

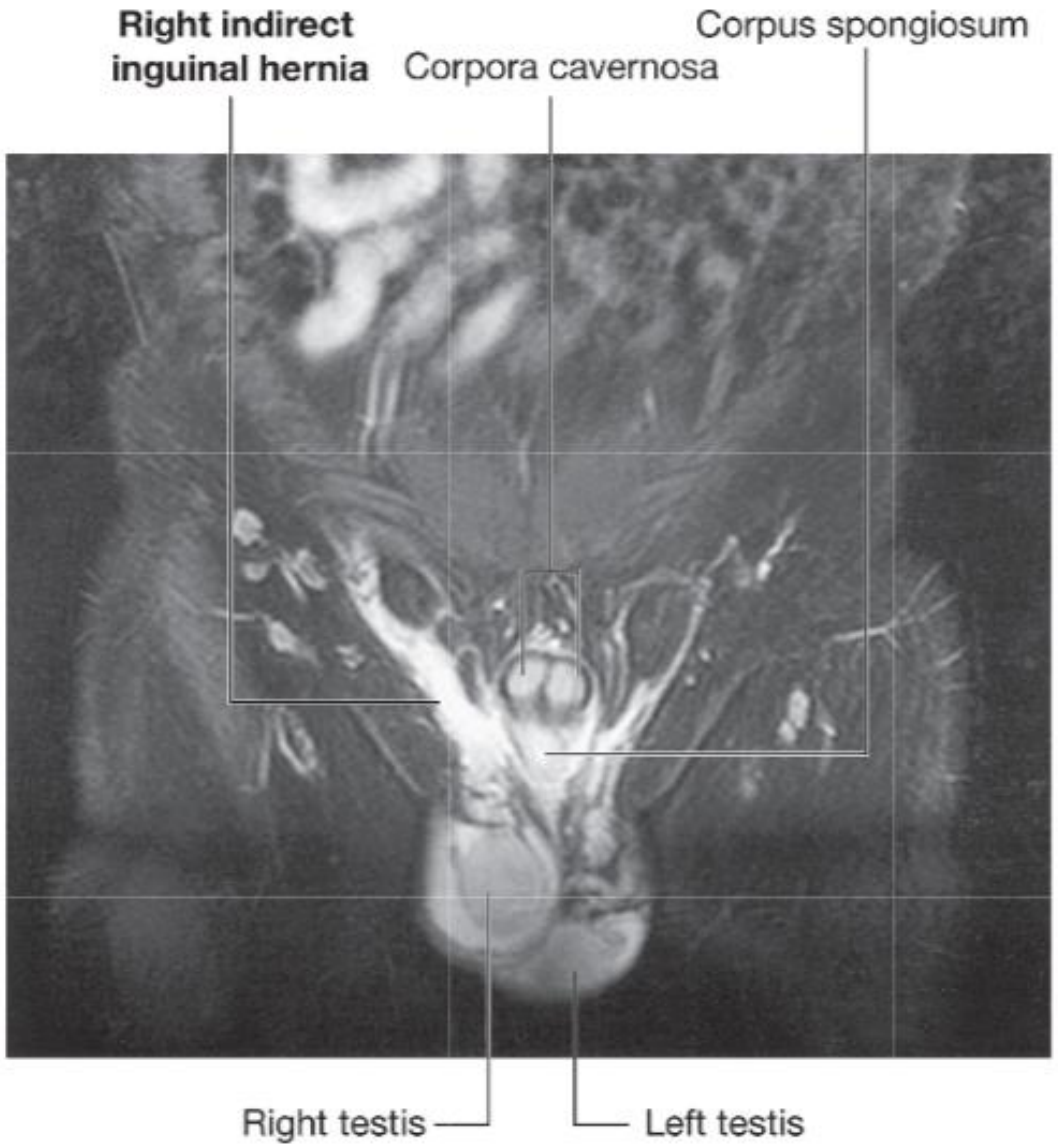
Indirect inguinal hernia

- The indirect inguinal hernia is the most common of the two types of inguinal hernias and is much more common in men than in women.

- The protruding peritoneal sac enters the inguinal canal by passing through the deep inguinal ring, just **lateral to the inferior epigastric vessels**.
- It occurs because some part, or all, of the embryonic processus vaginalis remains open or patent. It is therefore **referred to as being congenital in origin**.

- The neck of the hernial sac is narrow **strangulation of the hernia** ????

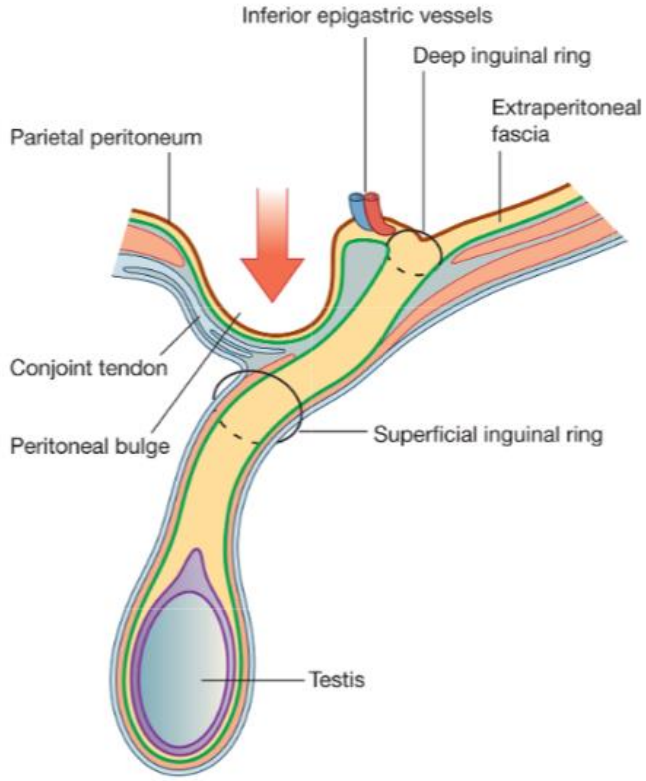




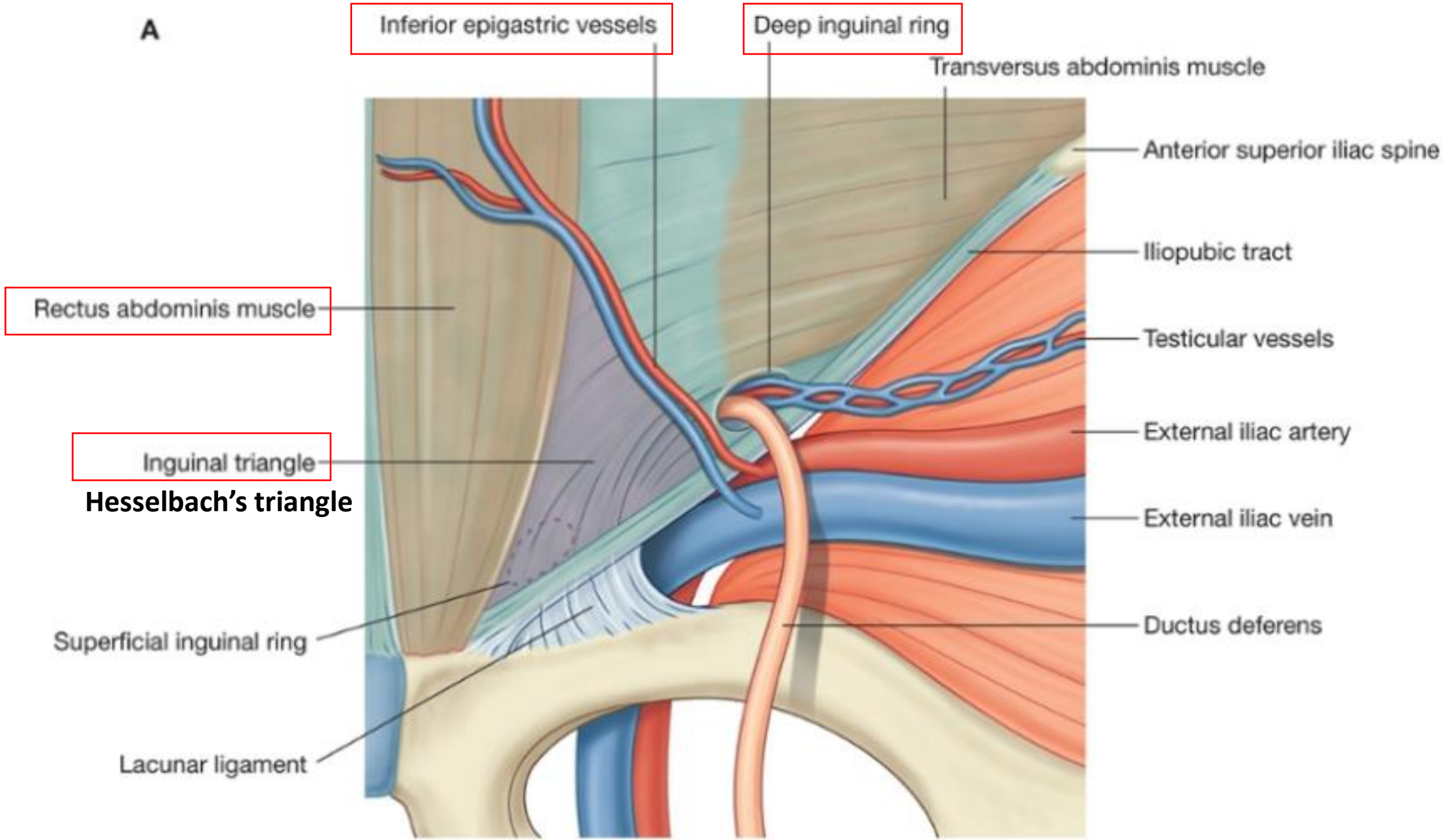
Right indirect inguinal hernia in T2 MRI

Direct inguinal hernia

- 15 % of inguinal herniae.
- Occurs in older men (rarely women).
- Occurs as a result of increasing the intraabdominal pressure, It is therefore **referred to as being acquired in origin**.
- Hernial sac bulges through the posterior wall of the inguinal canal **medial to the inferior epigastric vessels.**



- The bulging occurs medial to the inferior epigastric vessels in the inguinal triangle (**Hesselbach's triangle**), which is bounded:
  - laterally by the inferior epigastric vessels
  - medially by the rectus abdominis muscle
  - inferiorly by the inguinal ligament
- The neck of the hernial sac is **wide**


A
Inferior epigastric vessels
Deep inguinal ring
Transversus abdominis muscle
Anterior superior iliac spine
Iliopubic tract
Rectus abdominis muscle
Testicular vessels
Inguinal triangle
External iliac artery
Hesselbach's triangle
External iliac vein
Ductus deferens
Superficial inguinal ring
Lacunar ligament

Umbilical Hernia

- Noted at birth as a protrusion at the umbilicus (belly button).
- Occurs in 10 -20 % of all children
- This is caused when an opening in the abdominal wall, which normally closes before birth, doesn't close completely.
- Even if the area is closed at birth, these hernias can appear later in life because this spot remains a weaker place in the abdominal wall.

Umbilical Hernia

Thank you

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