ANATOMY

بسم الله الرحمن الرحيم

MID | Lecture #6

Inguinal Canal

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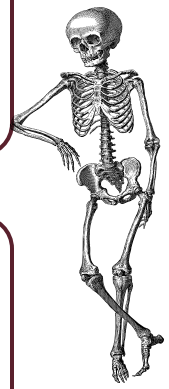


﴿ وَإِن تَتَوَلَّوْا يَسْتَبْدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوا أَمْثَالَكُم ﴾

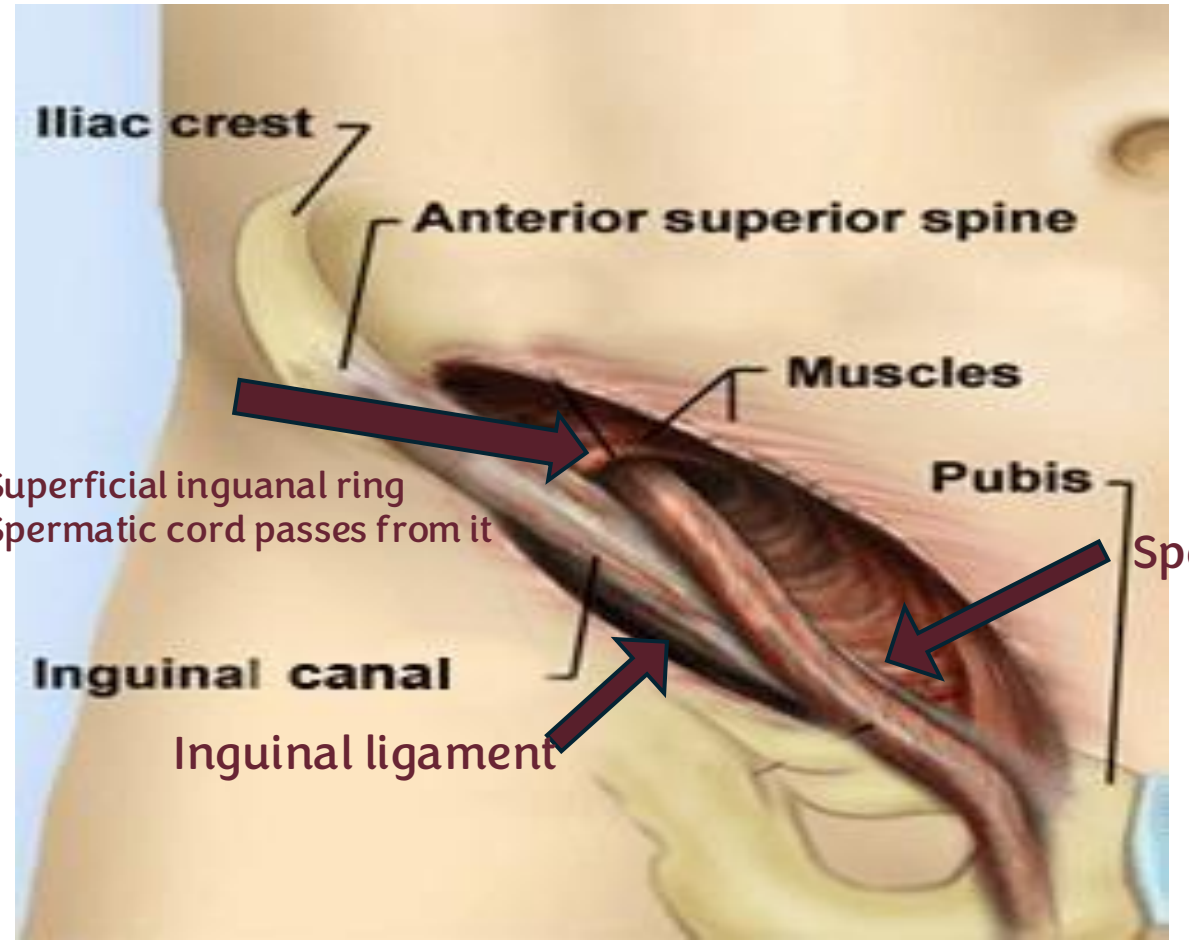
اللهم استعملنا ولا تستبدلنا

Color Code: Slides + Dr. doesn't mention | Slides + Dr. mentions | Extra from Dr.

سلام الله عليكم، لا يُخيفكم عدد السلايدات لانه العديد منهم عبارة عن صور او شرح توضيحي والدكتور تجاوز عن قرابة ١٥ سلايدد اللهم لا سهلا إلا ما جعلته سهلا..

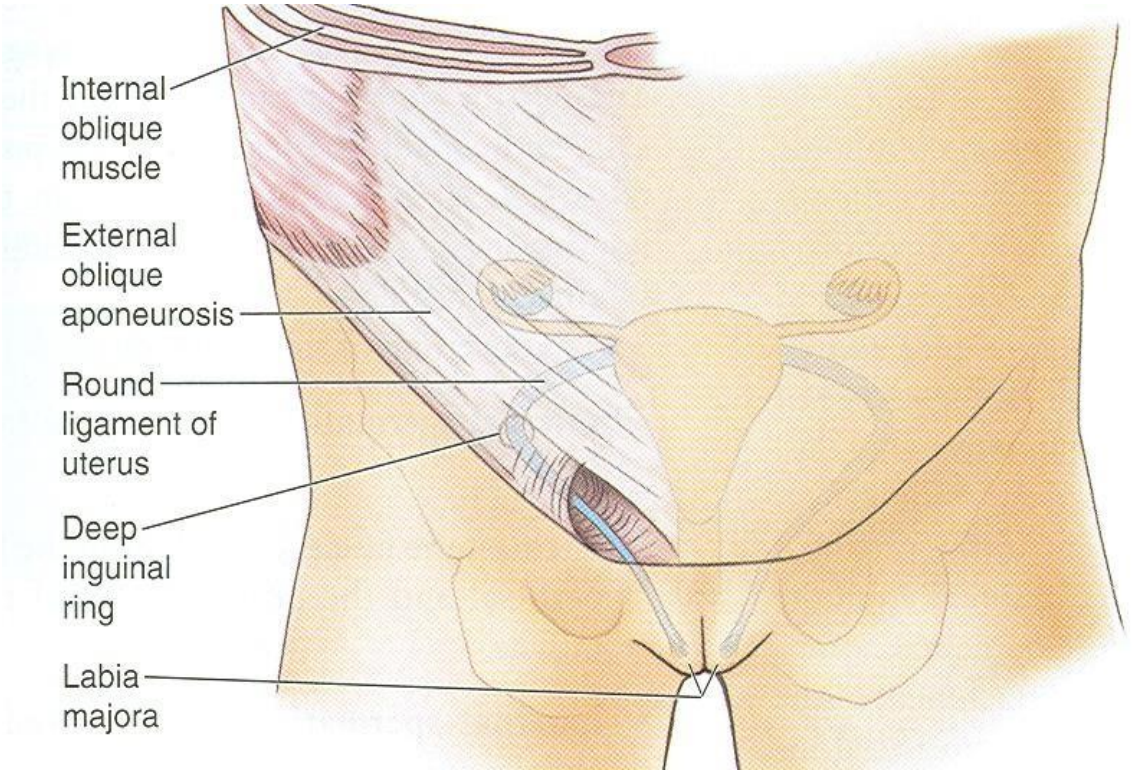
Inguinal canal

Inguinal hernia is a very common condition that occurs in the inguinal canal and requires surgical intervention for treatment



Inguinal Canal

- It is an oblique passage through the lower part of the anterior abdominal wall
- Present in both sexes
- It allows structures to pass to and from the testis to the abdomen in males
- In females it permits the passage of the round ligament of the uterus from the uterus to the labium majus
- Transmits ilioinguinal nerve in both sexes



- The most important structure that passes through the inguinal canal is the spermatic cord in males, while in females it is the round ligament of the uterus that extends to the labia majora .
- The **ilioinguinal nerve** also passes through this canal. It originates from the **L1** spinal nerve and crosses (enters) the inguinal canal through the **posterior wall,** not through the deep inguinal ring to superficial inginal ring .
  - In males, this nerve supplies the skin of the scrotum, in females, it innervates the skin of the labia majora.

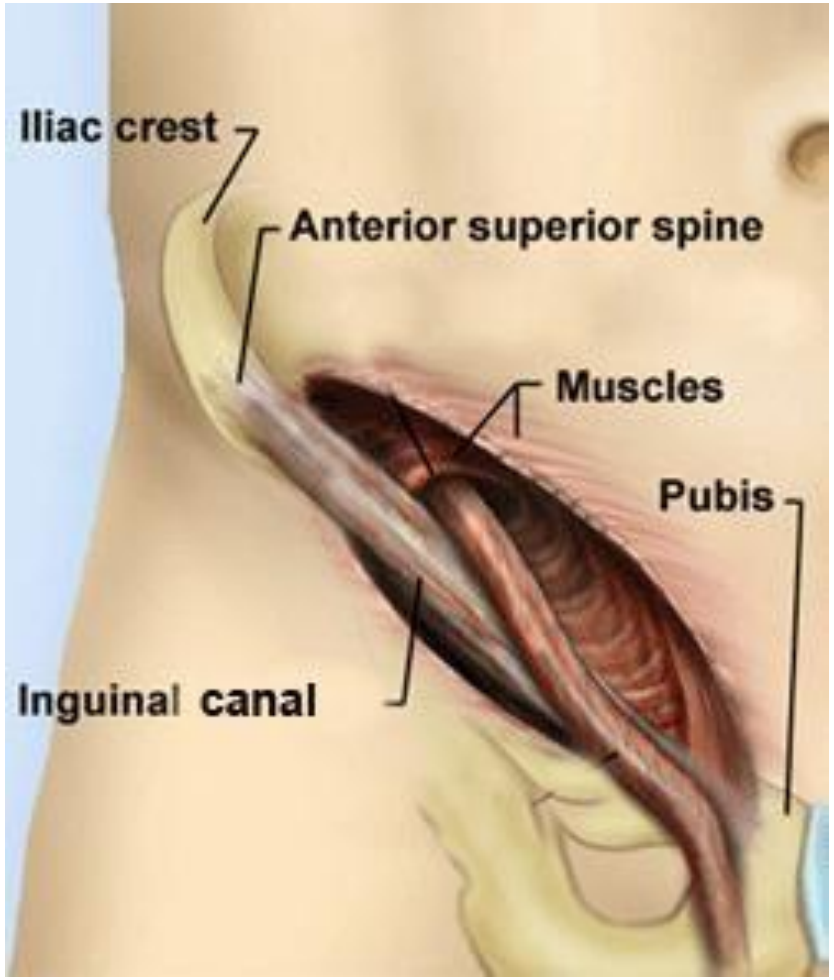
Inguinal Canal

- It is about 1 ½ inches or 4cm long in the **adults**.

- Extends from the deep inguinal ring in transversalis fascia downward and medially to the superficial inguinal ring

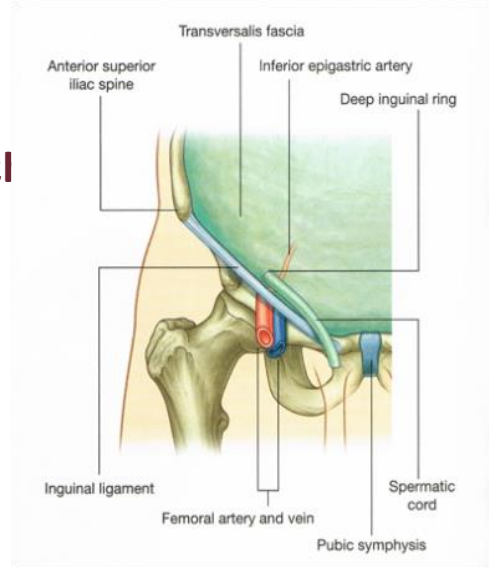
- Lies parallel to medial half of inguinal ligament and immediately above the inguinal ligament

- In the newborn child, the inguinal canal is too short the deep ring lies almost directly posterior to the superficial ring. (superficial and deep are opposite to each other).



- This deep ring is completely closed by fibrous tissue that allows only the spermatic cord and specific structures to pass.

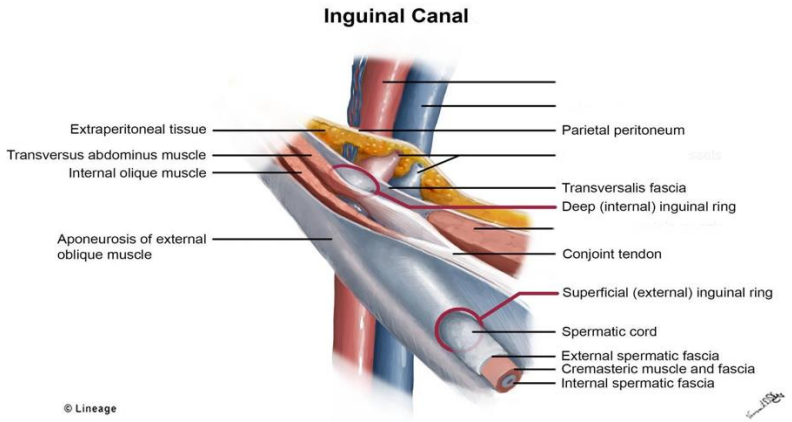
Deep Inguinal Ring



❖ Surface anatomy is important for locating the deep inguinal ring, which can actually be felt by touch

- ✅ The deep inguinal ring lies within the transversalis fascia.
- ✅ It is located about 1.3 cm (½ inch) above the inguinal ligament.
- ✅ The inguinal ligament runs between two landmarks:
- The anterior superior iliac spine (ASIS)
- The pubic symphysis

- To locate the deep ring on surface anatomy:
- Place your finger at the midpoint between ASIS and pubic symphysis – this puts you over the inguinal ligament.
- Then move your finger 1 cm upward → this is the approximate location of the deep inguinal ring.



- Alternative method:
- Feel the pulse of the femoral artery.
- Then move your finger 1 cm upward → this also helps identify the deep ring.

❖ *The spermatic cord is surrounded by three layers of fascia:*

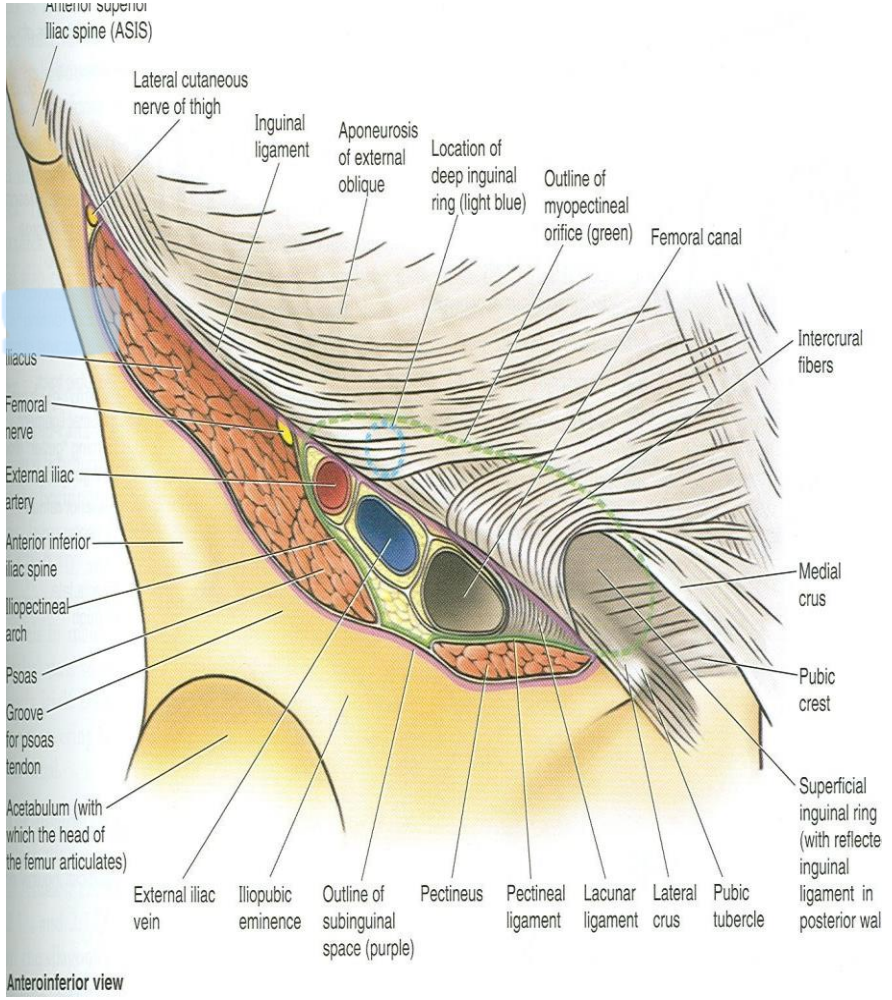
- The internal spermatic fascia, which is derived from the deep inguinal ring.
- The external spermatic fascia, which originates from the superficial inguinal ring.
- The cremasteric fascia is derived from the internal oblique muscle of the abdominal wall and forms part of the coverings of the spermatic cord as it passes through the inguinal canal.

Deep Inguinal Ring – explained in previous slide

- Is an oval opening in the fascia transversalis

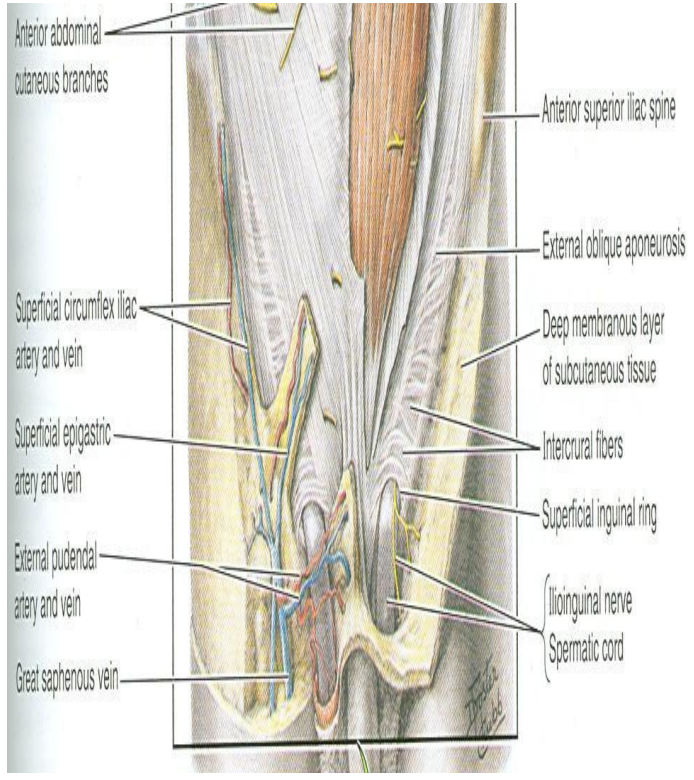
- Lies about ½ inch (1.3cm) above the inguinal ligament midway between the anterosuperior iliac spine and the symphysis pubis

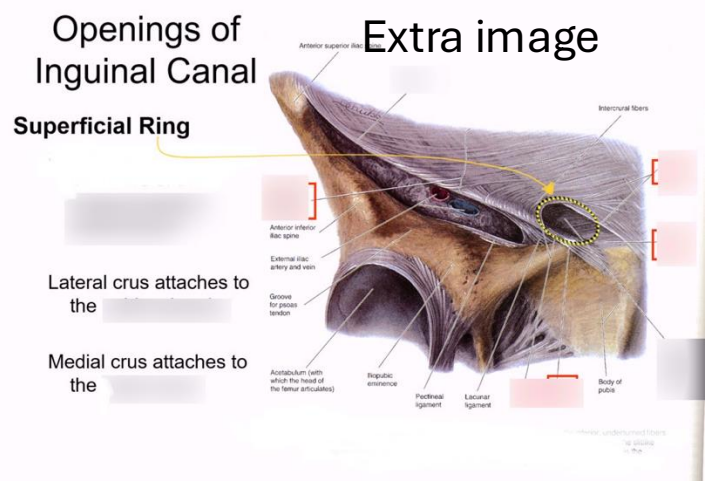
- Margins of the ring give attachment to the internal spermatic fascia



Superficial Inguinal Ring

- Triangular in shape
- Defect in the aponeurosis of the external oblique muscle
- Lies immediately above and medial to the pubic tubercle in contrast to the femoral ring, which is located below and lateral to the pubic tubercle.
- Its margins sometimes called crura (Med & lat crus), give attachment to the external spermatic fascia





"Crura" is the plural of "crus," referring to paired structures that provide support. The right and left crura of the external oblique aponeurosis form the boundaries of the superficial inguinal ring and contribute to the formation of the external spermatic fascia.

Anterior Wall of Inguinal Canal

● The Inguinal Canal – **Key Boundaries** (Important)

The inguinal canal has four main boundaries:
1. **Floor:** Formed by the inguinal ligament and, medially, the lacunar ligament.
2. **Roof**: Formed by the arching fibers of the **internal oblique** and **transversus abdominis muscles**.
3. **Anterior Wall:** Mainly formed by the **external** oblique aponeurosis.
4. **Posterior Wall**: Formed by the **transversalis** fascia.

● **Anterior Wall – Clinical Importance**: During surgery, the inguinal canal is typically accessed through the **anterior wall**. This wall consists of the following layers:
- Skin, Superficial fascia
- (Sometimes) deep fascia
- Muscular layer – the most important layer .

- The main muscular structure of the anterior wall is the **external oblique aponeurosis.**
- In the **lateral third** of the anterior wall, there are also fleshy **fibers of the internal oblique muscle.**

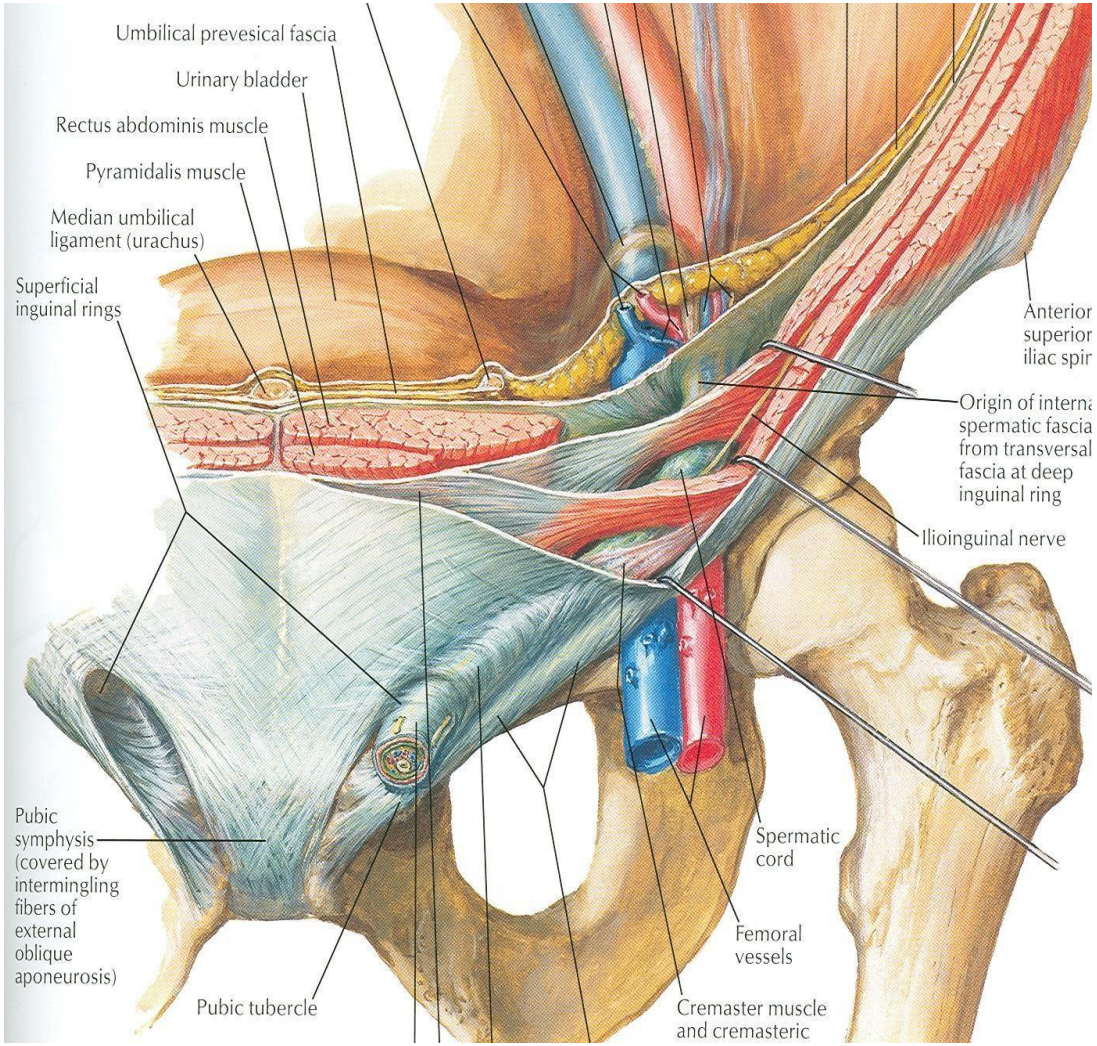
● These fleshy fibers are located **opposite the deep inguinal ring,** which is known as **weak point** in the abdominal wall. The internal oblique muscle fibers **reinforce and support the deep ring**, reducing the likelihood of herniation.

-Why Is This Important? (Example):
Imagine someone like **Sami** lifting heavy weights. This activity increases **intra-abdominal pressure**, which stresses the **inguinal canal**.

· To prevent hernias, the body uses muscle contraction to maintain tension in the canal and **support weak areas like the deep ring.**
· The **internal oblique muscle fibers** act as a dynamic shield, supporting the deep ring and minimizing the risk of herniation.

Anterior Wall of Inguinal Canal

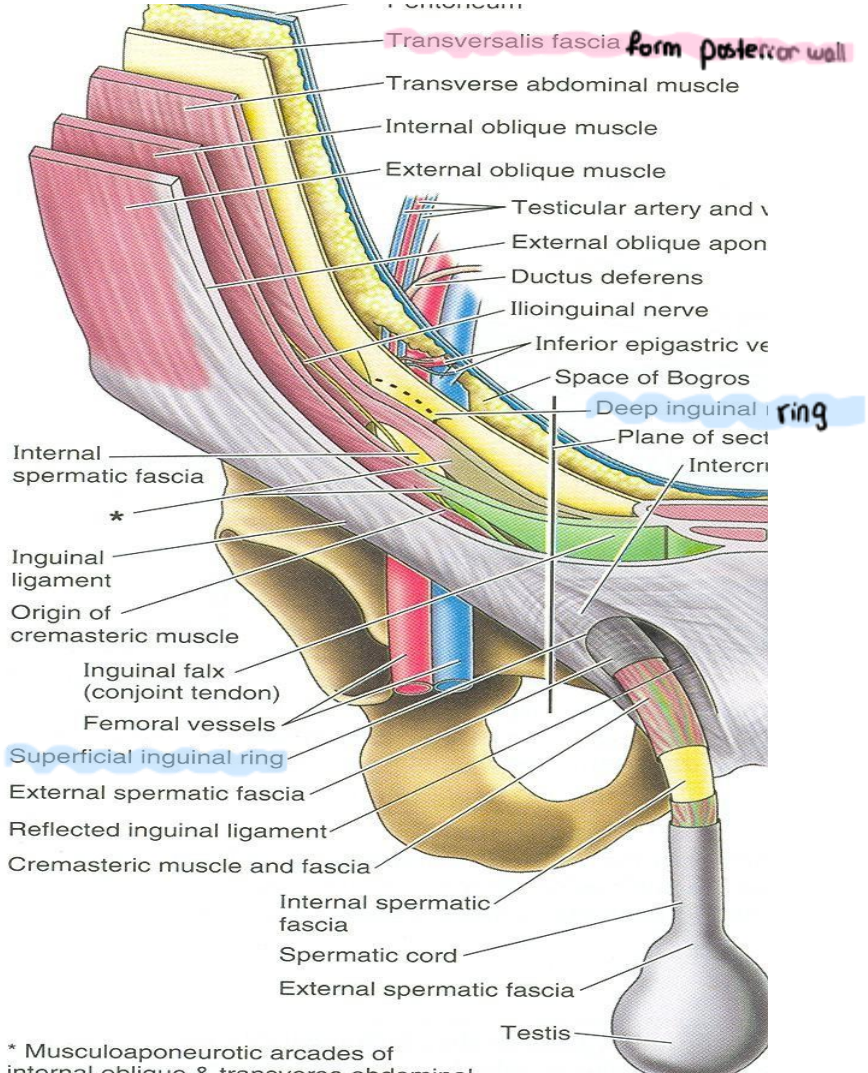
- It is formed along its entire length by aponeurosis of the external oblique muscle
- It is reinforced in its lateral third by the origin of the internal oblique from the inguinal ligament
- This wall is strongest where it lies opposite the weakest part of posterior wall, that is deep inguinal ring



Posterior Wall of Inguinal Canal

- It is formed along its entire length by the fascia transversalis
- It is reinforced in its medial third by conjoint tendon, the common tendon of insertion of internal oblique and transversus, attached to the pubic crest and pectineal line
- This wall is strongest where it lies opposite the weakest part of the anterior wall, that is superficial inguinal ring

○ The **posterior wall** of the inguinal canal is mainly formed by the **transversalis fascia**, with **medial reinforcement from the conjoint tendon** (from internal oblique and transversus abdominis). The **conjoint tendon** supports the area behind the superficial inguinal ring, helping prevent hernias.



Inferior Wall of Inguinal Canal = floor

- It is formed by the rolled-under inferior edge of the aponeurosis of the external oblique muscle called inguinal ligament and at its medial end, the lacunar ligament

- Superior Wall of Inguinal Canal = Roof

- It is formed by the arching lowest fibers of the internal oblique and transversus abdominis muscles

Which of the following statements about the anatomical boundaries and support structures of the inguinal canal is CORRECT?
A) The deep inguinal ring is located in the floor of the canal and is reinforced by the external oblique aponeurosis.
B) The anterior wall of the inguinal canal is formed entirely by the transversalis fascia and is opened during surgery.
C) The conjoint tendon contributes to the posterior wall of the inguinal canal and reinforces the superficial inguinal ring.
D) The roof of the inguinal canal is formed by the inguinal ligament and transversalis fascia.
E) The floor of the inguinal canal is formed by the internal oblique and transversus abdominis muscles.

Functions of Inguinal Canal

- It allows structures of spermatic cord to pass to and from the testis to the abdomen in male

- Permits the passage of round ligament of uterus from the uterus to the labium majus in female

The **inguinal canal** also contains the **ilioinguinal nerve**, which enters **laterally**, crosses the **posterior wall,** and exits through the **superficial** inguinal ring to supply the scrotum or labia majora.
It is also related to the **genitofemoral** nerve **(from L1–L2),** which splits into:

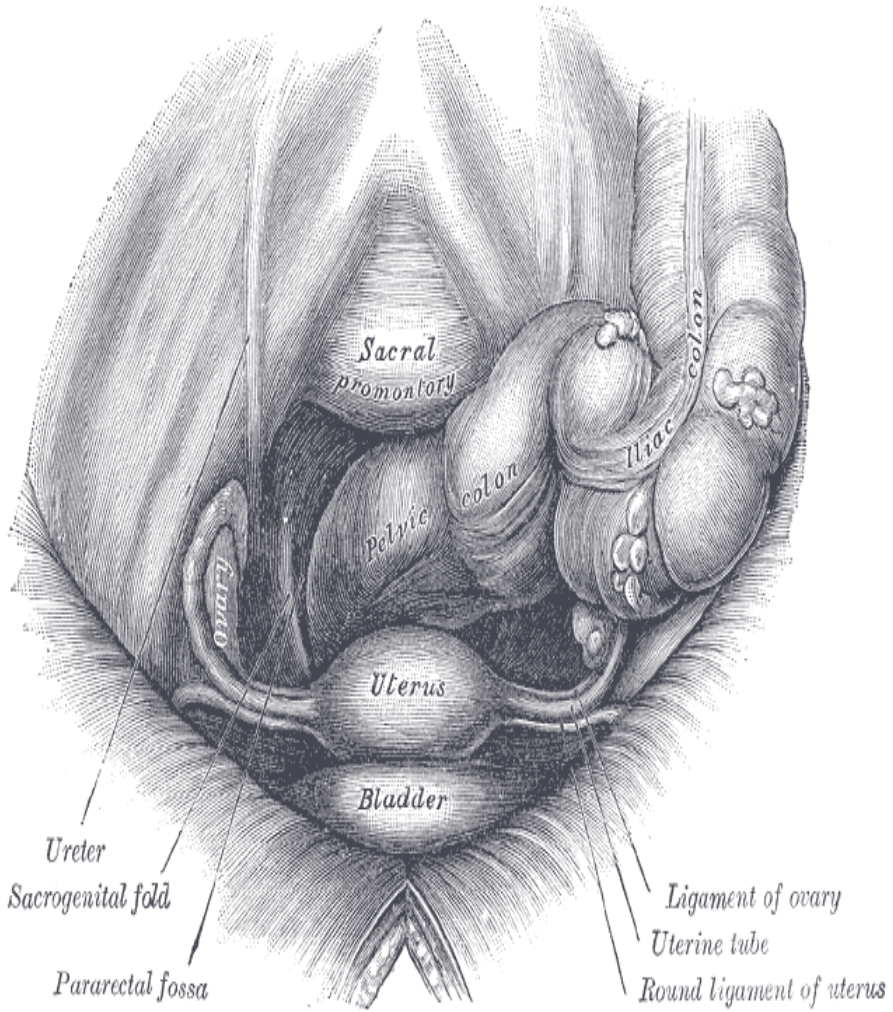
The **femoral** branch, **supplying skin** of the **upper thigh**, and

The **genital** branch, which travels with the spermatic cord to innervate the **cremaster muscle.**

The answer in previous slide is c

Contents of inguinal canal

- Spermatic cord & its contents in male
- Round ligament in female
- Genital branch of genitofemoral nerve
- Ilioinguinal nerve: Enter (pierces) the canal through the posterior wall



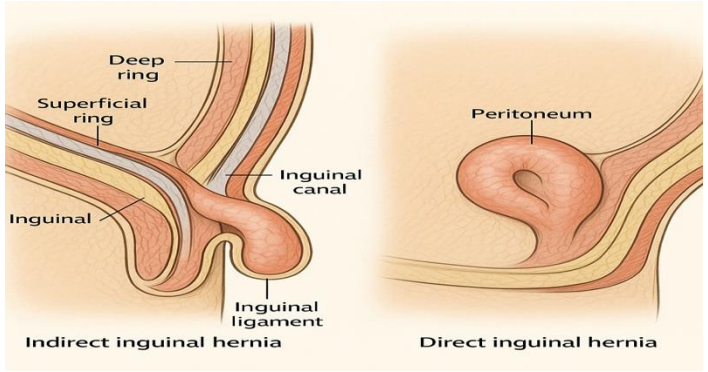
Inguinal triangle

- In the **inguinal canal**, a type of hernia called an **indirect inguinal hernia** may occur.

- A hernia results from **weak points** in the abdominal wall, one of which is the **deep inguinal ring**. Under normal conditions, the deep ring remains **closed**. However, in cases of **chronic constipation** or **chronic cough**, the repeated **increase in intra-abdominal pressure** places stress on this weak point.
- Over time, this constant pressure may **force the deep ring open**. When this happens, **peritoneal contents** such as **small intestines** or **omentum** can enter the deep ring, pass through the **inguinal canal**, exit through the **superficial inguinal ring**, and may eventually **reach the scrotum or with stool**. This process is known as a **hernia**, and since it follows the path of the inguinal canal, it is classified as an **indirect inguinal hernia**.
- On the other hand, another type of hernia can occur through the **inguinal triangle** (Hesselbach's triangle) in the **anterior abdominal wall**. The boundaries of this triangle are:
- **Inguinal ligament** (forms the floor, as in the canal),
- **Inferior epigastric vessels** (superior and lateral border),
- **Lateral edge of the rectus abdominis muscle**, also called **linea semilunaris** (superior and medial border).

- In **older age**, due to weakness of the abdominal muscles, this triangle becomes more vulnerable.

○ Similarly, **chronic cough** or **chronic constipation** increases intra-abdominal pressure, which can cause the posterior wall to give way at the triangle, allowing herniation through it.
- This type of hernia differs from the indirect type because it **pushes forward**, creating a bulge in the anterior abdominal wall. It does not follow the inguinal canal and does **not** reach the scrotum. The bulge is usually **reduced** back into the abdomen manually.

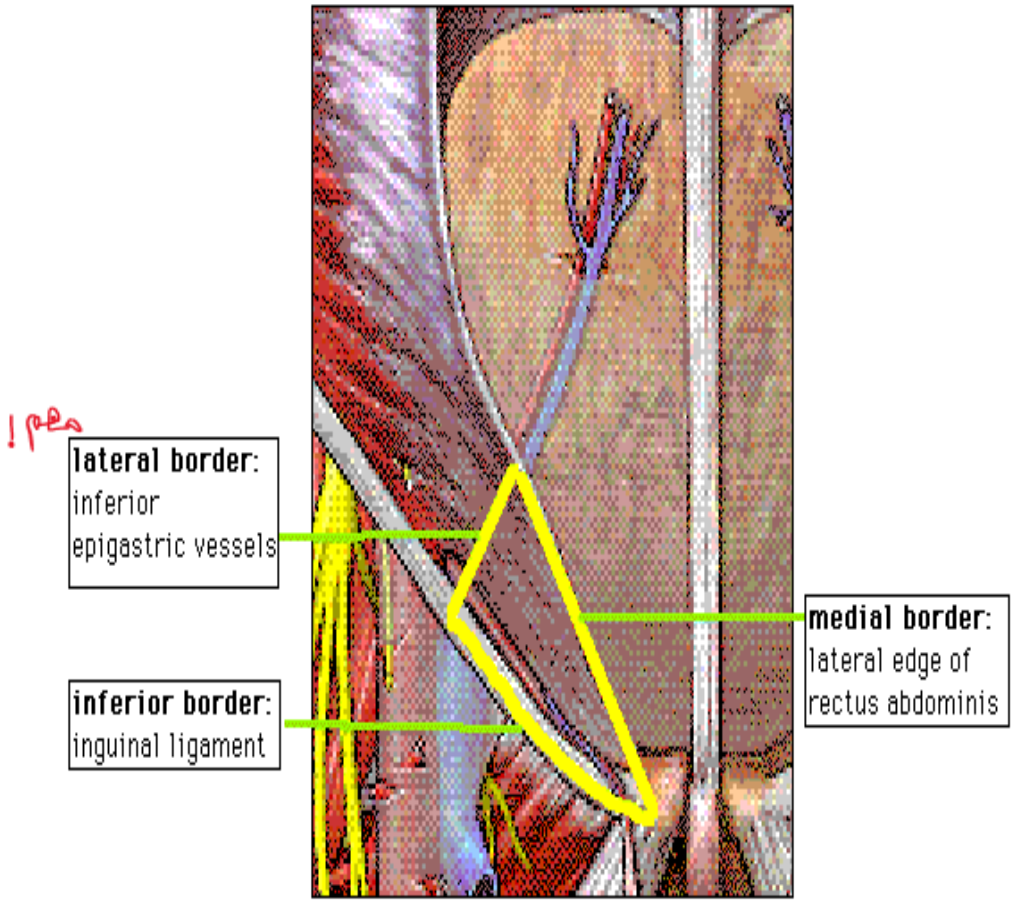


Inguinal triangle- explained in previous slide

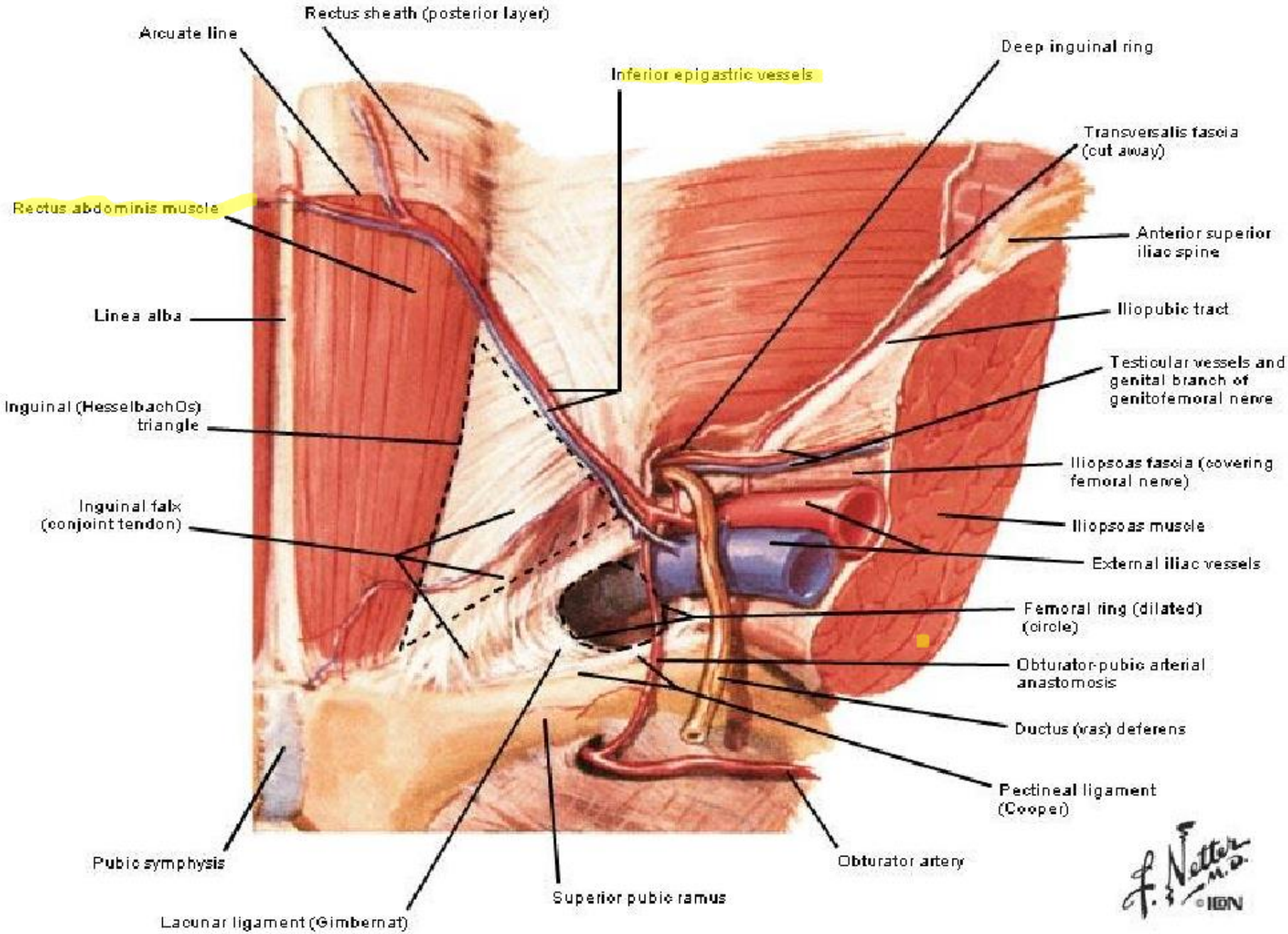
- Region of abdominal wall

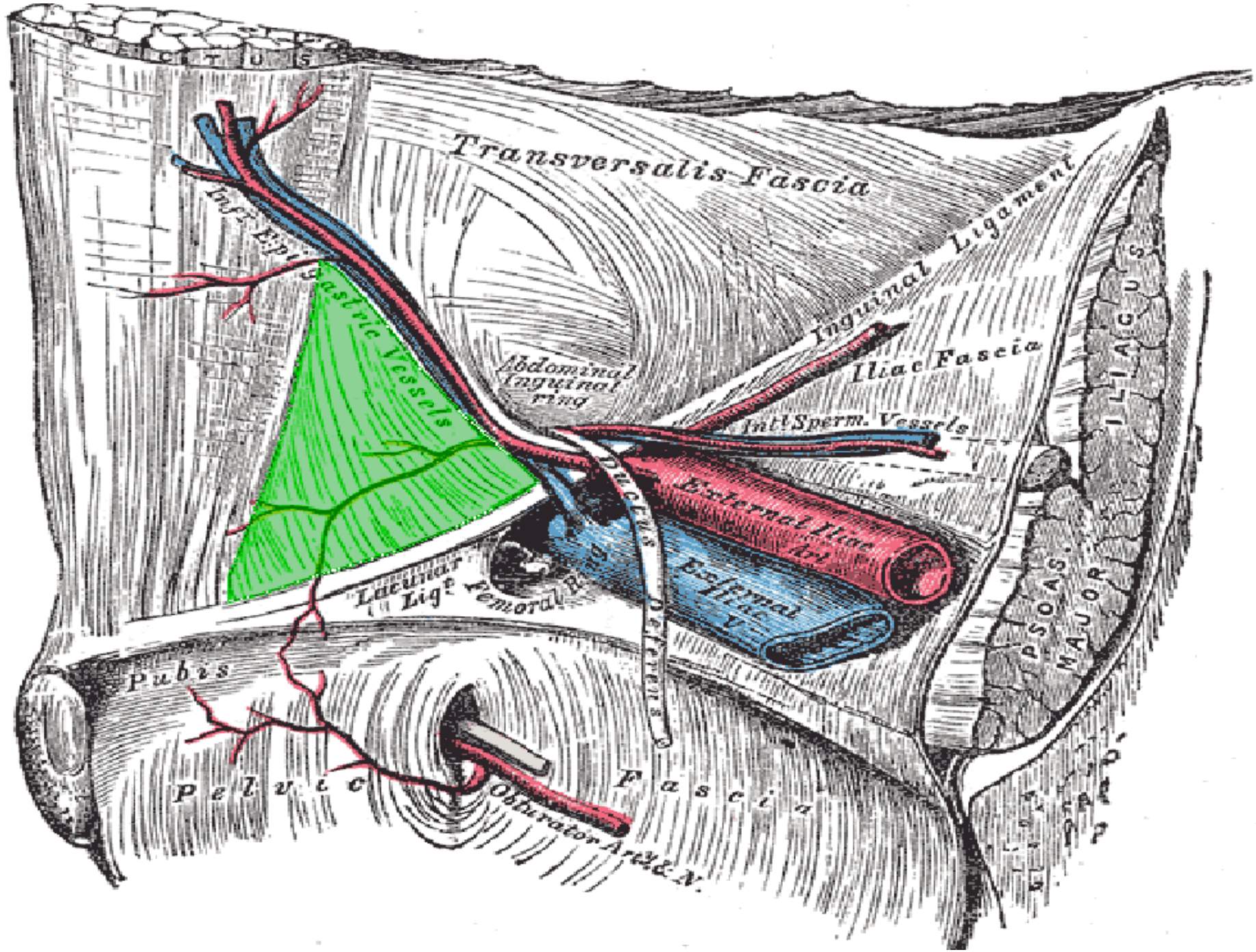
Borders

- Medial border: Lateral margin of the rectus sheath, also called linea semilunaris
- Superolateral border: Inferior epigastric vessels
- Inferior border: Inguinal ligament



Inguinal Region
Dissection - Posterior (Internal) View



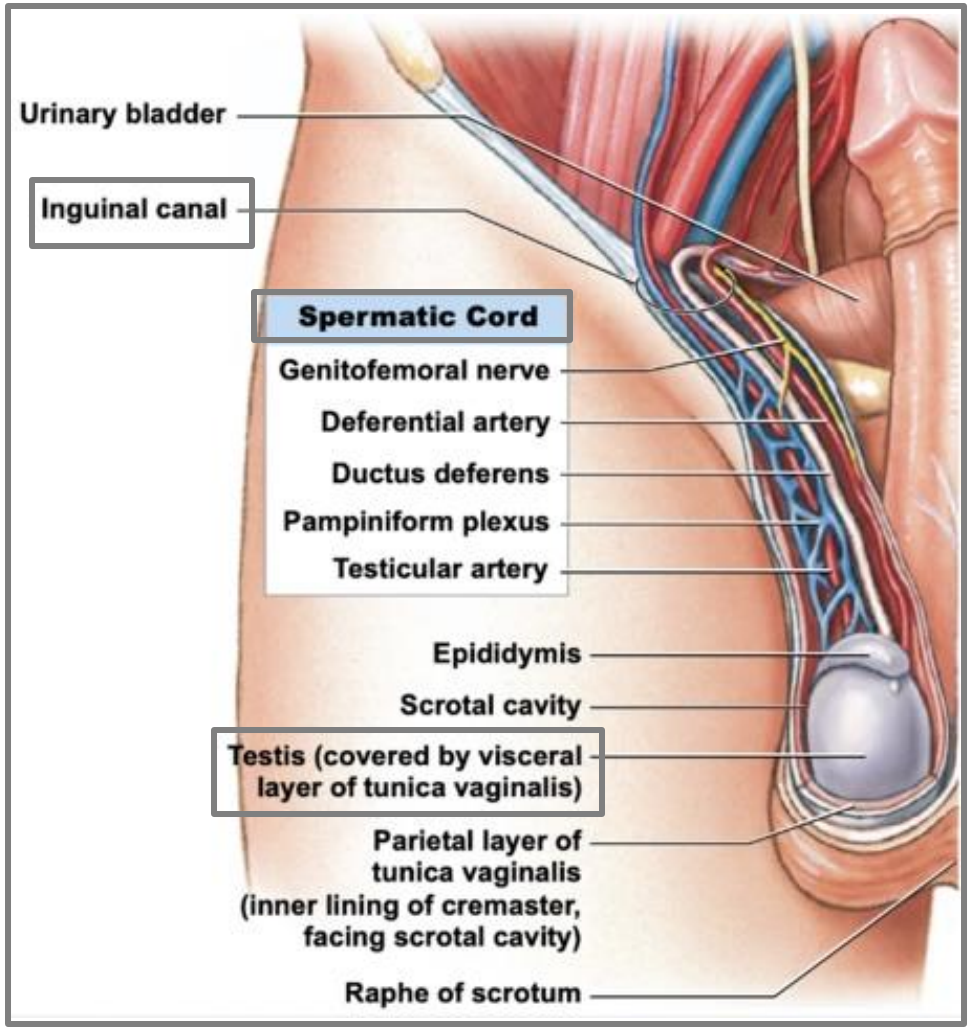

RECTUS
Transversalis Fascia
Inguinal Ligament
Iliac Fascia
Abdominal Inguinal ring
Int. Sperm. Vessels
Epigastric Vessels
External Iliac Art.
External Iliac V.
Lacunar Lig.
Femoral
Pubis
Pelvic Fascia
Obturator Art. & V.
PSOAS MAJOR
ILIACUS

Spermatic Cord

Coverings – slides {17 - 19 }
Structures – slides { 20 – 32 }

Overview:

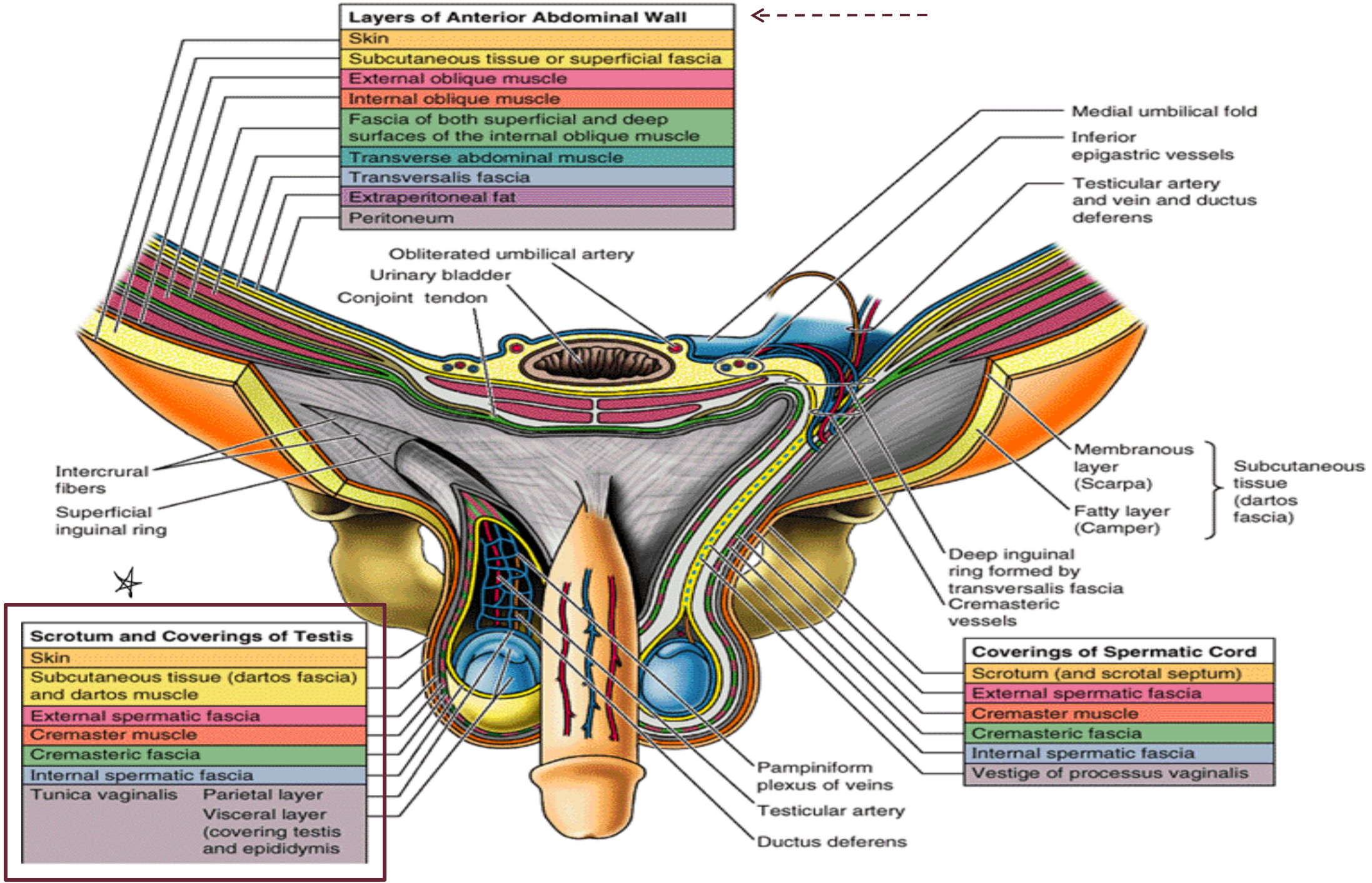
- It is a collection of structures that pass through the inguinal canal **to and from** the testis.
- It is covered with three concentric layers of fascia derived from the layers of anterior abdominal wall.
- It begins at the deep inguinal ring lateral to the inferior epigastric artery and ends at the testis.



Extra figure:

Coverings of the Spermatic Cord

- The covering of the spermatic cord are **three** concentric layers of fascia derived from the layers of the anterior abdominal wall
- Each covering is acquired as the processus vaginalis descends into the scrotum through the layers of the abdominal wall
- **(1)- External Spermatic fascia**: Is derived from the external oblique aponeurosis and attached to the margins of the superficial inguinal ring.
- **(2)-Cremasteric Fascia**: Is derived from the internal oblique muscle.
- **(3)-Internal Spermatic Fascia**: Is derived from the fascia transversalis and attached to the margins of deep inguinal ring.


Layers of Anterior Abdominal Wall
Skin
Subcutaneous tissue or superficial fascia
External oblique muscle
Internal oblique muscle
Fascia of both superficial and deep surfaces of the internal oblique muscle
Transverse abdominal muscle
Transversalis fascia
Extraperitoneal fat
Peritoneum
Medial umbilical fold
Inferior epigastric vessels
Testicular artery and vein and ductus deferens
Obliterated umbilical artery
Urinary bladder
Conjoint tendon
Intercrural fibers
Superficial inguinal ring
Membranous layer (Scarpa)
Fatty layer (Camper)
Subcutaneous tissue (dartos fascia)
Deep inguinal ring formed by transversalis fascia
Cremasteric vessels
Scrotum and Coverings of Testis
Skin
Subcutaneous tissue (dartos fascia) and dartos muscle
External spermatic fascia
Cremaster muscle
Cremasteric fascia
Internal spermatic fascia
Tunica vaginalis
Parietal layer
Visceral layer (covering testis and epididymis
Coverings of Spermatic Cord
Scrotum (and scrotal septum)
External spermatic fascia
Cremaster muscle
Cremasteric fascia
Internal spermatic fascia
Vestige of processus vaginalis
Pampiniform plexus of veins
Testicular artery
Ductus deferens

Coverings of the Spermatic Cord

- When the **layers of the anterior abdominal wall** descend into the **scrotum,** they become **layers of the testis and scrotum**.

	Layers of abdominal wall	**scrotum and testis coverings**
1st	Skin	Skin
2nd	Fatty layer of superficial fascia	Dartos fascia
	Membranous layer of superficial fascia	Colles' fascia
3rd		**External Spermatic fascia**
4th		**Cremasteric Fascia**
5th		**Internal Spermatic Fascia**
6th		Tunica vaginalis

Structures of Spermatic Cord

1. Vas deferens
2. Artery of the vas deference
3. Testicular artery and vein
4. Testicular lymph vessels
5. Autonomic nerves
6. Processus vaginalis
7. Genital branch of genitofemoral nerve
8. Cremastric artery

Supplies
Cremastric muscle.

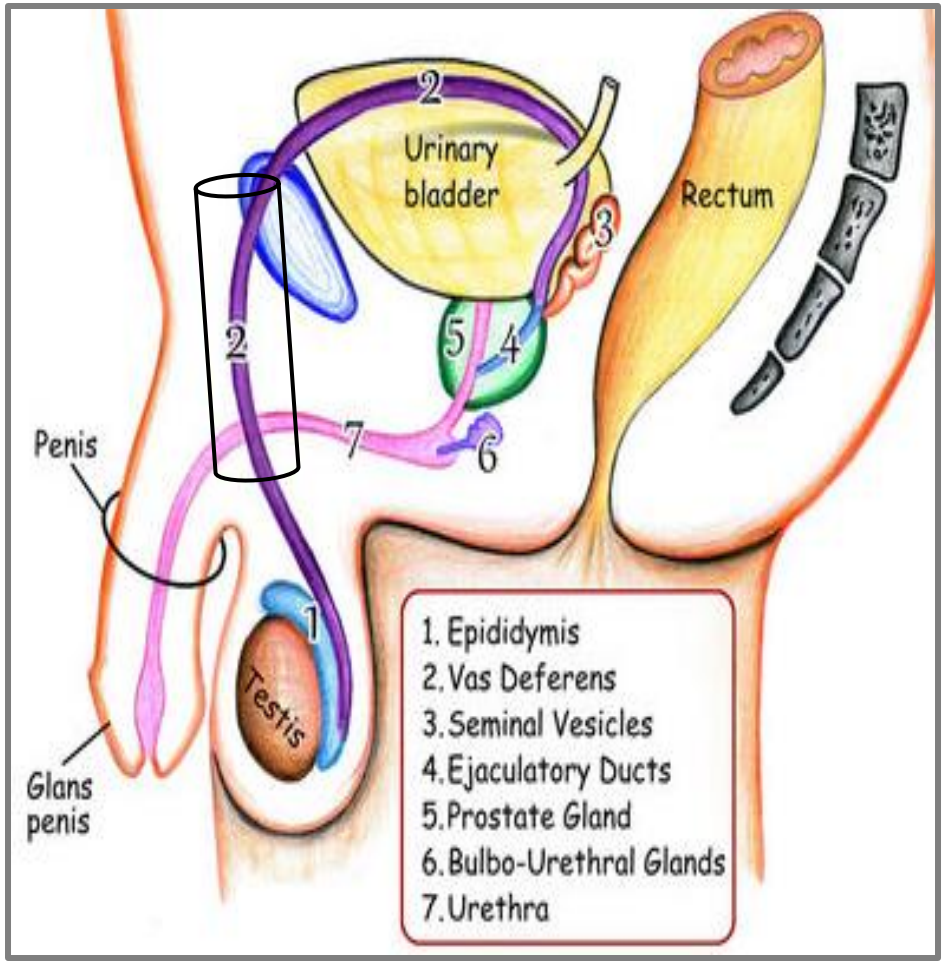
اللَّهُمَّ ارزُقني حُبَّكَ، وحُبَّ مَنْ يَنْفَعُني حُبُّهُ عندَك، اللَّهُمَّ مَا رَزَقْتَنِي مِمَّا أُحِبُّ فَاجْعَلْهُ قُوَّةً لِي فِيمَا تُحِبُّ، اللَّهُمَ مَا زَوَيْتَ عَنِّي مِمَّا أُحِبُّ فَاجْعَلْهُ فَرَاغاً لِي فِيمَا تُحِبُّ

1- Vas Deferens = Vasa Efferentia

- It is a cordlike structure, about 45cm long.
  starts from the tail of epididymis above testis.
  ends in the seminal vesicles behind the urinary bladder.
- Can be palpated between finger and thumb in the upper part of the scrotum.
- It is a thick-walled muscular duct, that transport spermatozoa - mature sperms- from the epididymis to the prostatic urethra.

1- Vas Deferens = Vasa Efferentia

- The **testis function is to form sperm**, which then go to the **epididymis for storage** to help in their **maturation (10-14 days)**.
- From the tail of the **(1)epididymis**, a structure called **(2)vas deferens/vasa efferentia** starts and runs with the spermatic cord.
- Then it pierces **superficial inguinal ring --> inguinal canal --> deep inguinal ring.**
- After that, it goes to the abdominal cavity into the pelvis behind the **urinary bladder and** finally ends as a **(3)seminal vesicle** with an **(4)ejaculatory duct** coming out of it.
- The ejaculatory duct opens into the **(7)prostatic urethra** that excretes the sperm outside the body.



Extra figure:

2- Testicular Artery

- It is a branch of abdominal aorta at level of L2
- It is long and slender
- Descends on the posterior abdominal wall
- It traverses the inguinal canal and supplies the testis and the epididymis

3- Testicular Veins

- Starts from the epididymis and forms extensive venous plexus, called the "**pampiniform plexus".** a network of veins surrounding the testis/epididymis upwards.

- Leaves the posterior border of the testis.

- As the plexus ascends through the inguinal canal, it becomes reduced in size so that at about the **level of deep inguinal ring,** it converges into a single testicular vein.

- The **left testicular vein** drains into **left renal vein**(perpendicular).
- **The right testicular vein** drains into **inferior vena cava**(obliquely).

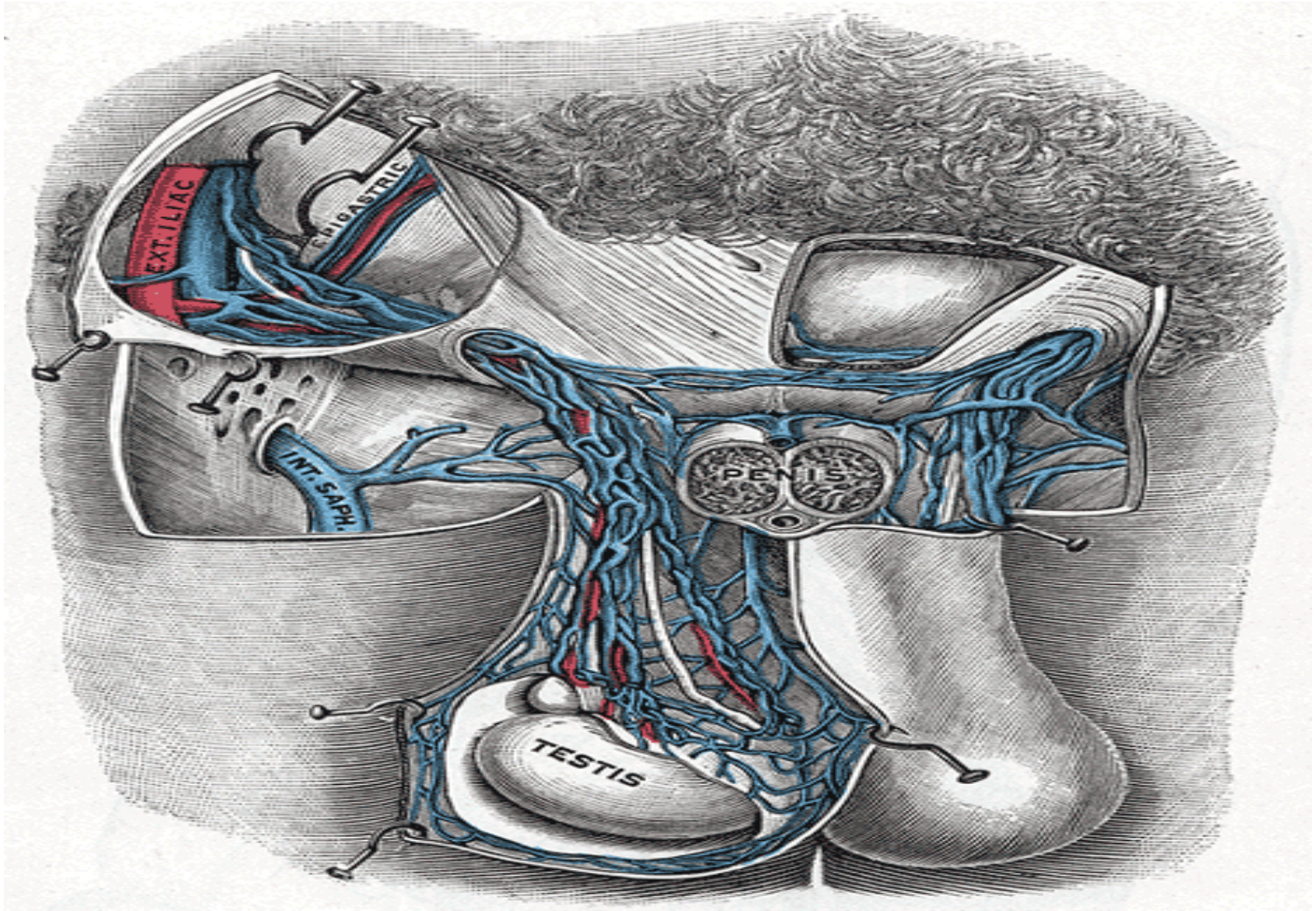
3- Testicular Veins

➢ **Relate to pathology:**

- **Varicocele** refers to engorged, dilated, and tortuous veins of the pampiniform plexus around the testis.
- **It is more common on the left side than the right. (Why?)**
  - The left testicular vein drains (perpendicularly).
  - The left testicular vein is lower than the right.

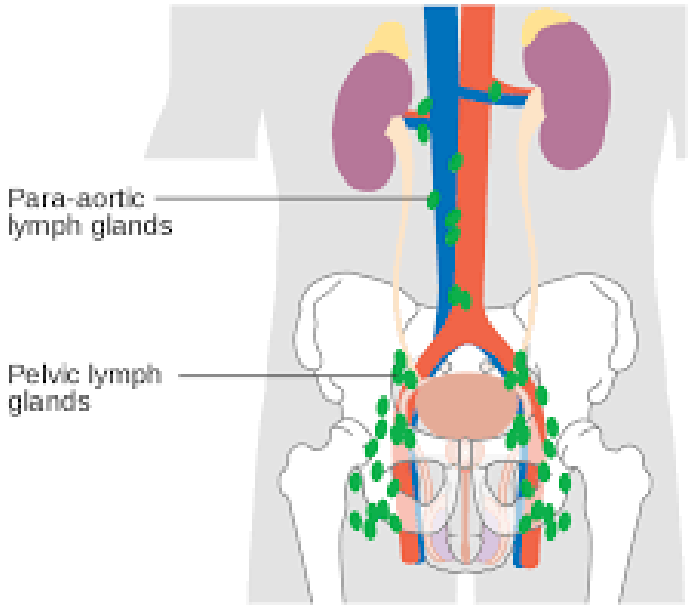
- **Varicocele** of the testis leads to infertility because they increase temperature of the testis.
  - Removal of varicocele returns the testis to their optimum temperature and the patient is fertile again.

Testicular artery & vein



4- Testicular lymphatic vessels

- Ascend through the inguinal canal
- Passes up over the post. Abdominal wall
- Reach the lumbar **(Para-aortic) lymph nodes** on each side of the aorta **at level L1**



5- Autonomic nerve & Genitofemoral nerve

- **Autonomic nerves**
  - Although both sympathetic and parasympathetic fibers are present, it is mainly sympathetic fibers that innervate the testis.
  - Sympathetic fibers, run with testicular artery from renal or aortic sympathetic plexuses
  - These sympathetic fibers contain afferent sensory nerves, so if a patient experiences severe testicular pain, the pain sensation is carried through these sympathetic fibers.

- **Genital branch of the genitofemoral nerve**
  - Its root L1& L2
  - Supply the cremastric muscle --> **cremasteric reflex** - next slide -

"Cremastric muscle"

- The cremasteric muscle contracts in **cold** weather, pulling the scrotum **upwards** toward the abdomen. While in **warm** weather, the muscle relaxes, and the scrotum **hangs down**.
- This action helps regulate the temperature for sperm production, which requires a temperature 2–3°C below core body temperature.

- Stimulation (Ex: itching) of the upper medial thigh leads to contraction of the cremasteric muscle, this is called the **cremasteric reflex.** (How?)
    - **Afferent limb (sensory):** **Femoral** branch of the genitofemoral nerve senses the touch.
    - **Signal travels to the spinal cord** (L1–L2).
    - **Efferent limb (motor):** Signal returns via the **genital** branch of the genitofemoral nerve, causing the cremasteric muscle to contract.

6- Processus vaginalis

- An out pouching of peritoneum that in the fetus is responsible of descending testis to the scrotum & the formation of the inguinal canal.

- The remains of the processus vaginalis causes the **indirect hernia.**

6- Processus vaginalis

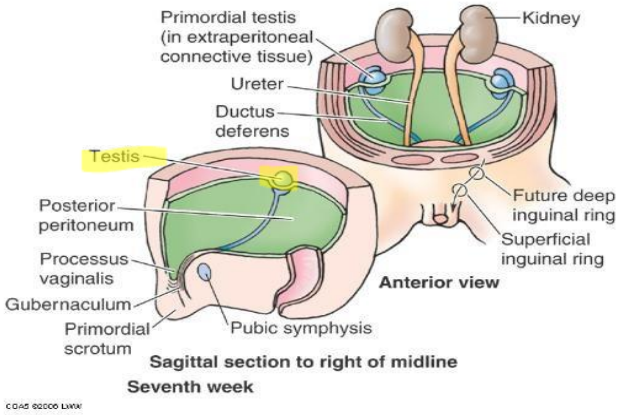
➢ **Relate to embryology :**

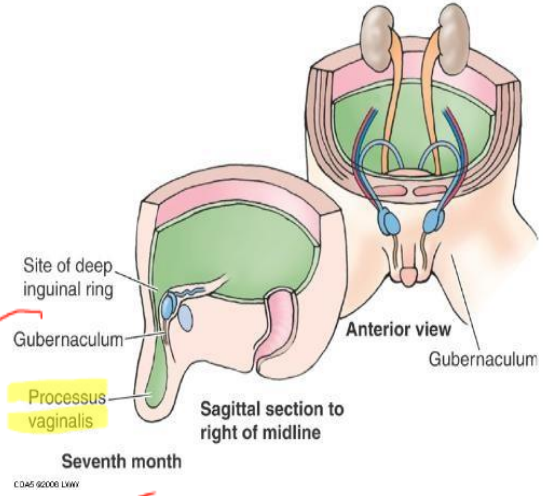
- The testis and ovaries originally develop in the posterior abdominal wall at the level of **L1**.
- In the 8th month of pregnancy, the **processus vaginalis** and the **gubernaculum** are responsible for pulling the testis downward through:

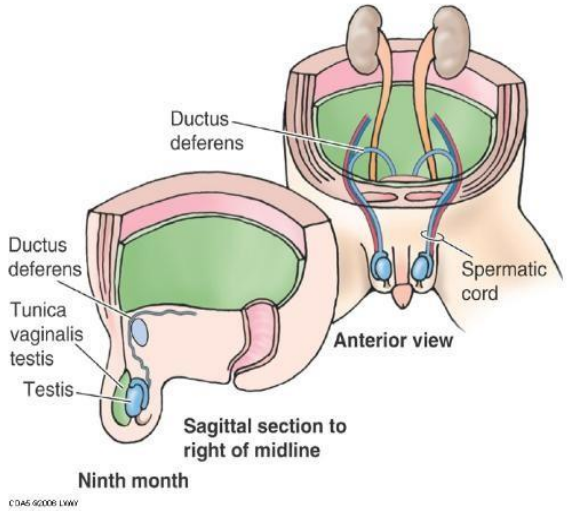
Posterior abdominal wall → Deep inguinal ring → Inguinal canal → Superficial inguinal ring → Scrotum.

- Once the testes reach the scrotum, the proximal part of processus vaginalis should undergo **complete obliteration**. The distal part of the processus vaginalis remains and forms the **tunica vaginalis**.
- If the processus vaginalis fails to close, This can lead to a **congenital indirect inguinal hernia**.

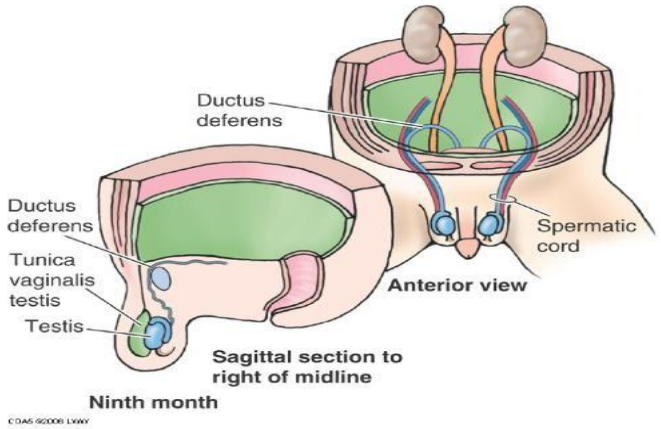
Developing of process vaginalis

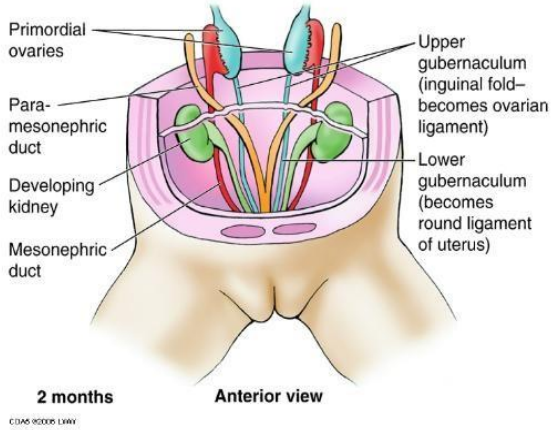


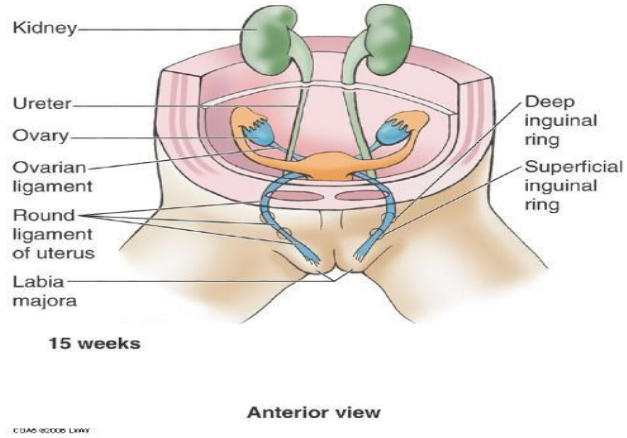




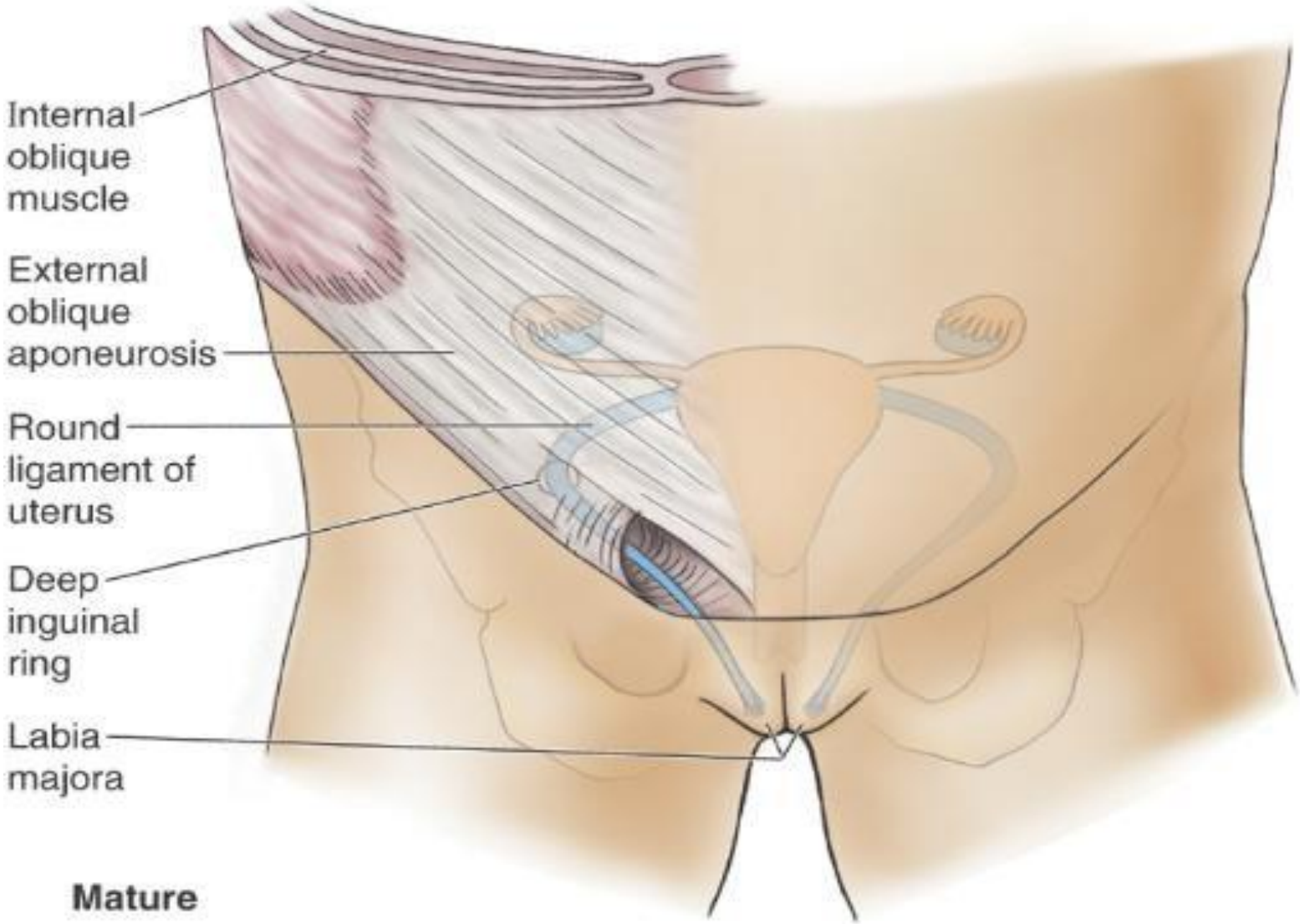
- The processus vaginalis forms as a peritoneal pouch guiding the testis into the scrotum.
- By the 8th month, the testis descends, and the upper part of the processus obliterates, leaving the tunica vaginalis around the testis.







Developing of process vaginalis



Inguinal Hernia

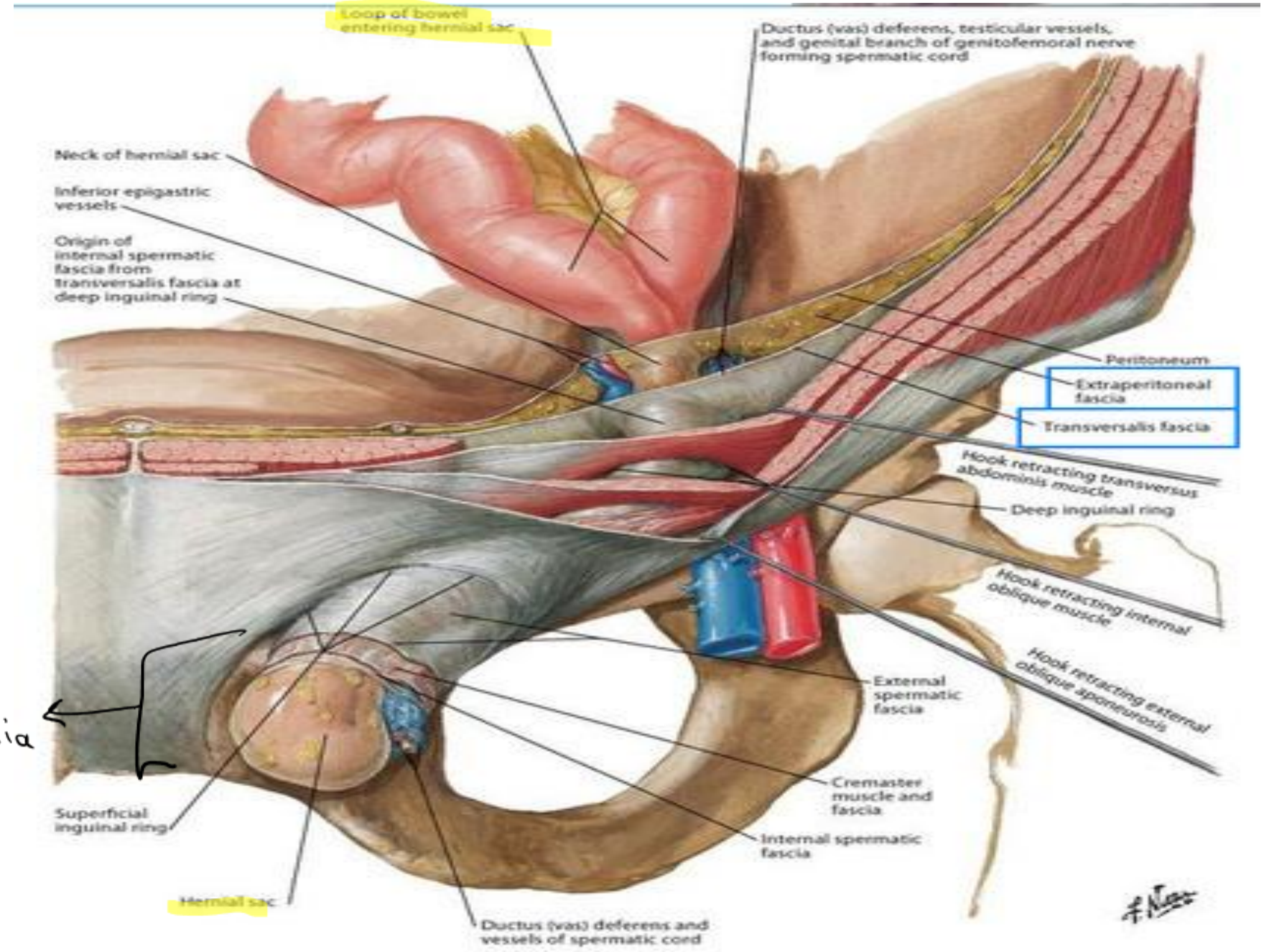
- A hernia is the protrusion of peritoneum and part of the abdominal contents through weak points of the abdominal wall. – Weak points such as: Deep inguinal ring, Inguinal triangle, Femoral ring.

- Consists of three parts: the sac, contents of the sac, covering of the sac
- Hernial coverings are formed from the layers of the abdominal wall through which the hernial sac passes

● The peritoneum forms the hernial sac in an inguinal hernia, which encloses the protruding abdominal contents. In an indirect inguinal hernia, the sac passes through the deep inguinal ring, continues along the inguinal canal, and may extend into the scrotum. The neck of the sac is located at the deep inguinal ring.

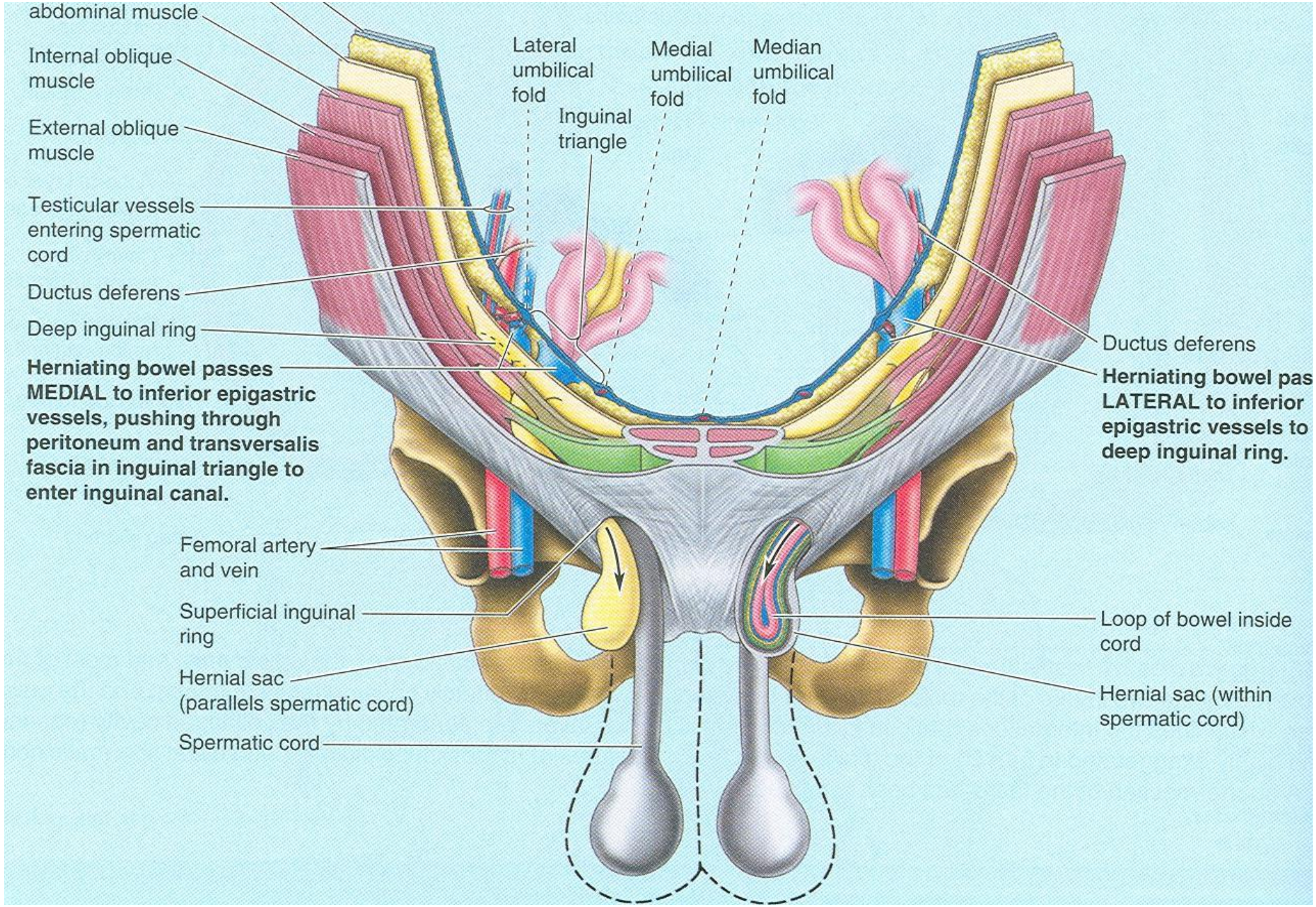
The image shows indirect hernia, where hernial contents pass through the deep inguinal ring, lateral to the inferior epigastric vessels.

The contents are:
- Loop of bowel (commonly a segment of small intestine).
- Hernial sac: Lined by peritoneum, enclosing the herniated bowel.



Indirect Inguinal Hernia

- It is the most common form of hernia
- Is believed to be congenital in origin
- The hernial sac is remains of processus vaginalis
- Enters the inguinal canal through the deep inguinal ring lateral to the inferior epigastric vessels
- It may extend part of the way along the canal or as far as the superficial inguinal ring reaching the scrotum.


abdominal muscle
Internal oblique muscle
External oblique muscle
Testicular vessels entering spermatic cord
Ductus deferens
Deep inguinal ring
Herniating bowel passes MEDIAL to inferior epigastric vessels, pushing through peritoneum and transversalis fascia in inguinal triangle to enter inguinal canal.
Femoral artery and vein
Superficial inguinal ring
Hernial sac (parallels spermatic cord)
Spermatic cord
Lateral umbilical fold
Inguinal triangle
Medial umbilical fold
Median umbilical fold
Ductus deferens
Herniating bowel pas LATERAL to inferior epigastric vessels to deep inguinal ring.
Loop of bowel inside cord
Hernial sac (within spermatic cord)

○ Patients with an **indirect** inguinal hernia often notice a **reducible swelling** that can be **pushed back into the abdomen**. However, the swelling typically reappears with **increased** intra-abdominal pressure, such as straining or standing. This cycle may continue over time.

- If left untreated, the hernia may **enlarge**, and in rare cases, **loops** of the **small intestine**, including parts of the **jejunum** and **ileum**, may **descend into the scrotum.**

○ During examination, the doctor may ask the patient to reduce the hernia and then perform a cough impulse test. If the hernia reappears **lateral to the inferior epigastric vessels**, it is an **indirect** inguinal hernia. If it appears **medial to these vessels**, it is a **direct** inguinal hernia.

Indirect Inguinal Hernia

- If the processus vaginalis has undergone no obliteration, the hernia is complete and extends through the superficial inguinal ring down into the scrotum or labium majus
- Under these circumstances the neck of the hernial sac lies at the deep inguinal ring
- It is 20 times more common in young males than females
- Is more common on the right side(the Rt. testis descends later than the Lt. testis)

Direct Inguinal Hernia

- It composes about 15% of all inguinal hernias
- Common in old men with weak abdominal muscles and rare in women
- Hernial sac bulges forward through the posterior wall of the inguinal canal, medial to the inferior epigastric artery.
- The neck of the hernial sac is wide

Inguinal Hernia

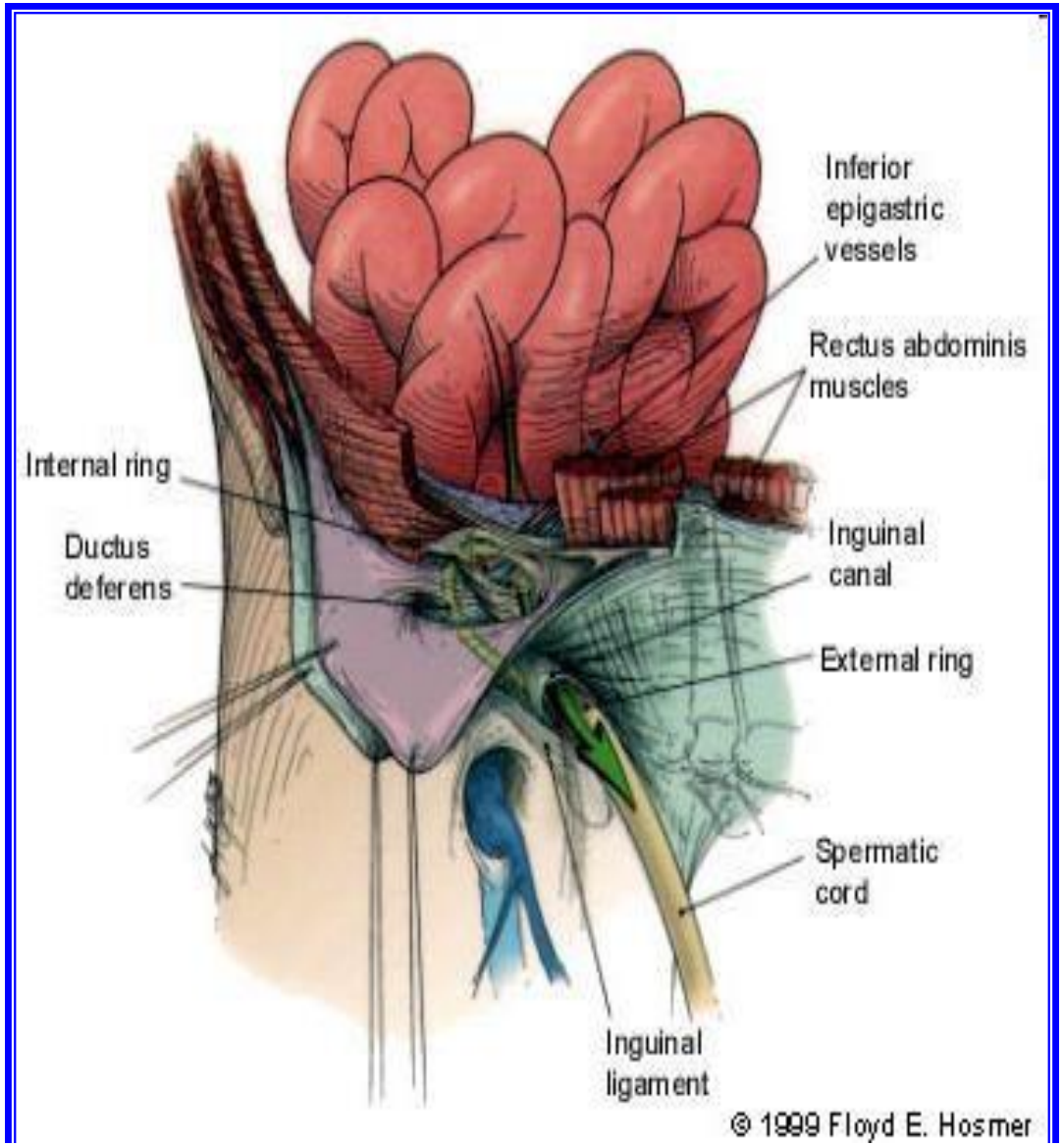
	Direct	Indirect
Age	Common on old	young
Bilaterally	Usually bilateral	unilateral
Shape	Hemispherical	Oval
Reaches scrotum	never	Can reach the scrotum
Direction of descent	Forwards	Downwards , forwards medially
Reduction	backward	Upward, backward laterally
Relation to inf. epigastric art.	Medially	Laterally
Superficial inguinal ring test	Feel impulse on the side finger	Feel an impulse on the tip of the finger
Deep ring test: Reduction of hernia, put thumb over deep ring, ask patient to cough	Hernia appears	Hernia does not appear
Coverings	1 Lat. To lat. Umbilical lig Same as indirection 2 Med. To lat.	Skin, superfacial fascia, Ex.sp.fascia, cremastric muscle & fascia, Int.spermatic fascia,

Direct Hernia Route

Note:

The hernia sac passes directly through inguinal triangle and may disrupt the floor of the inguinal canal.

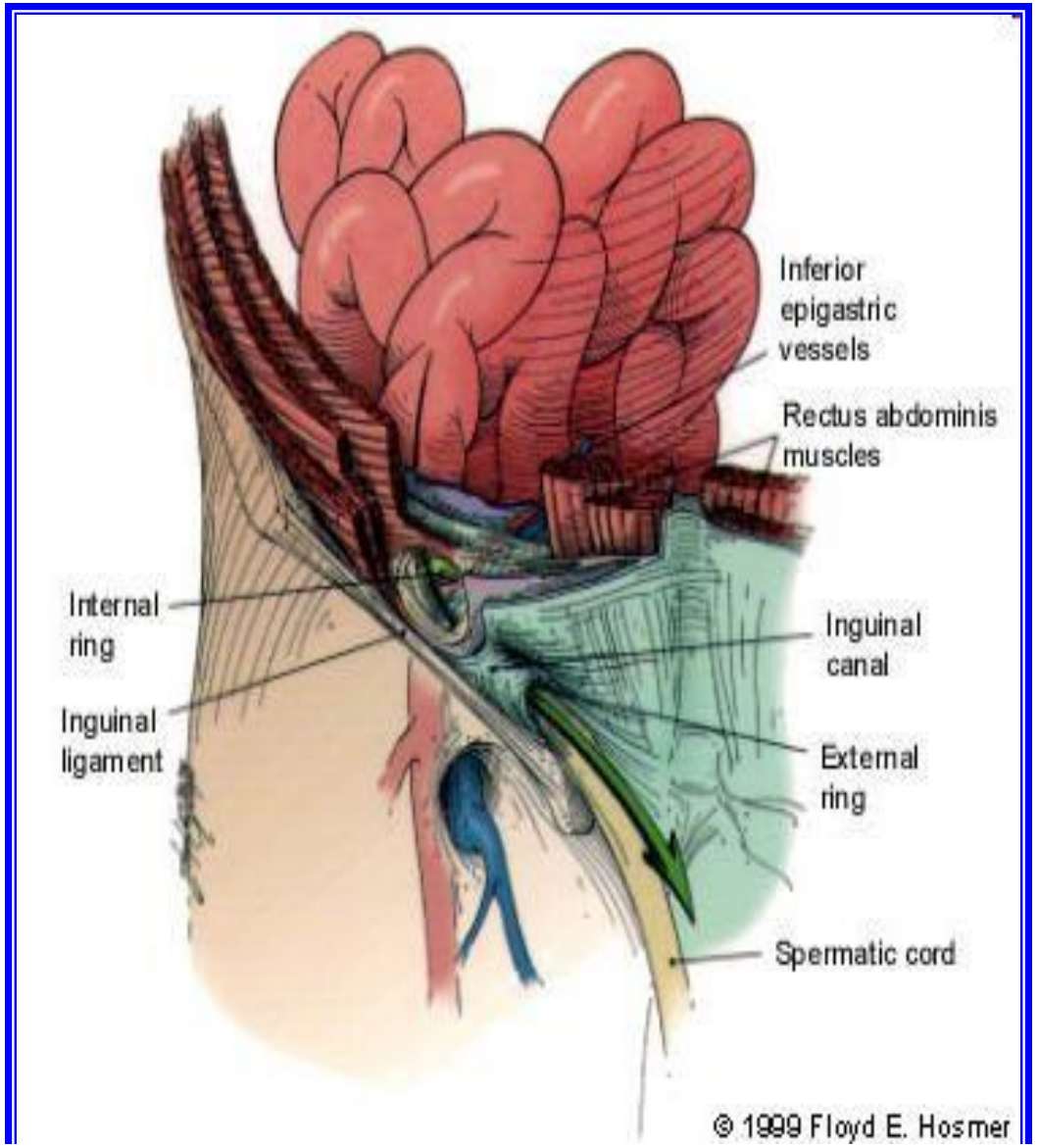
- The inguinal triangle is the site of protrusion for a direct inguinal hernia, which pushes through the posterior wall and floor of the inguinal canal, potentially pressing on its contents, including the **inguinal ligament**. While it may enter the canal from behind, it **does not pass** through the deep inguinal ring, so it has **no** relation with the inguinal canal.
- The inguinal canal normally has a defined path with walls and deep and superficial rings, which the direct hernia bypasses.



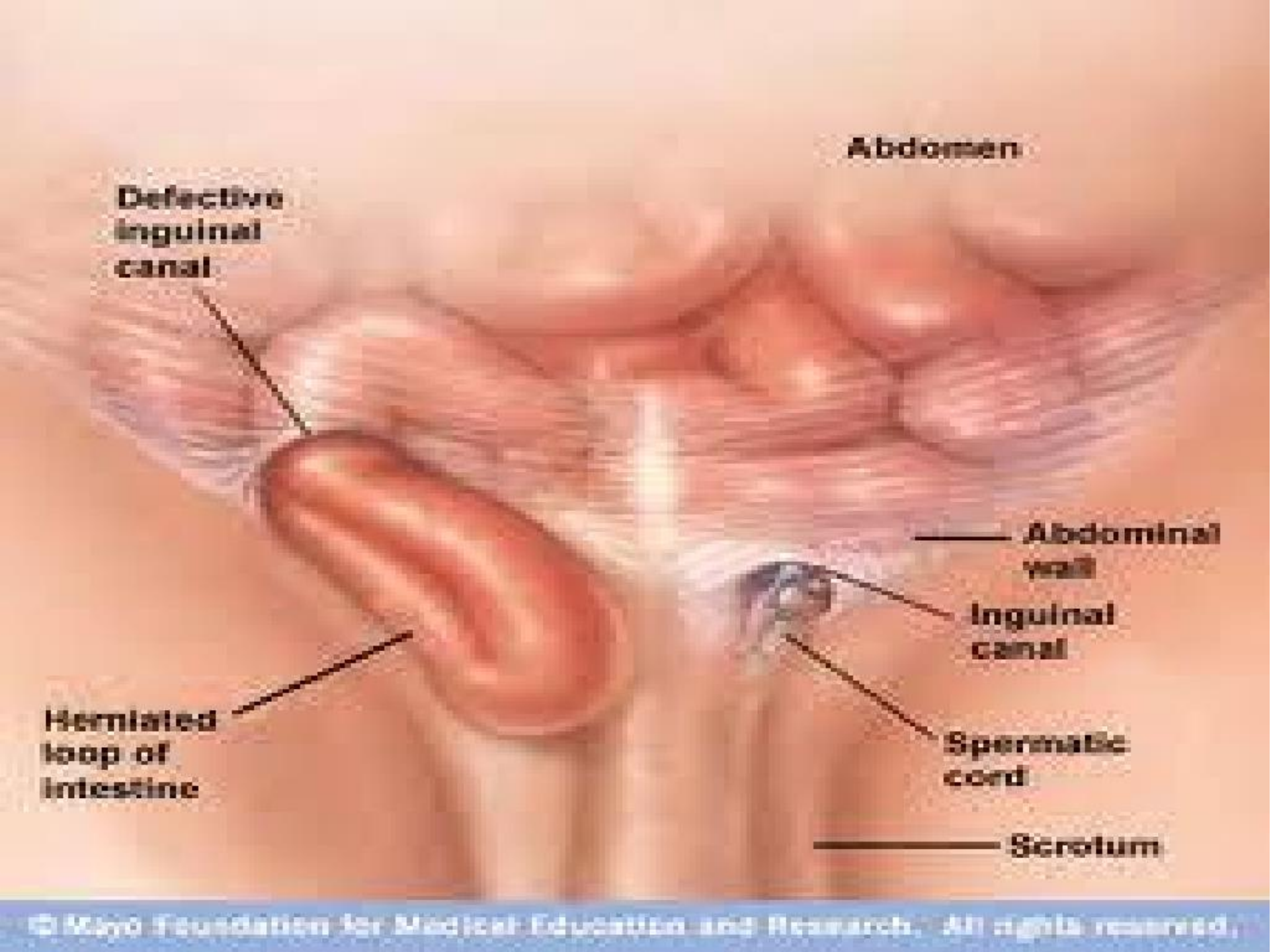
Indirect Hernia Route

Note:

The hernia sac passes outside the boundaries of Hesselbach's triangle(inguinal triangle) and follows the course of the spermatic cord.



Indirect inguinal hernia



Scrotum

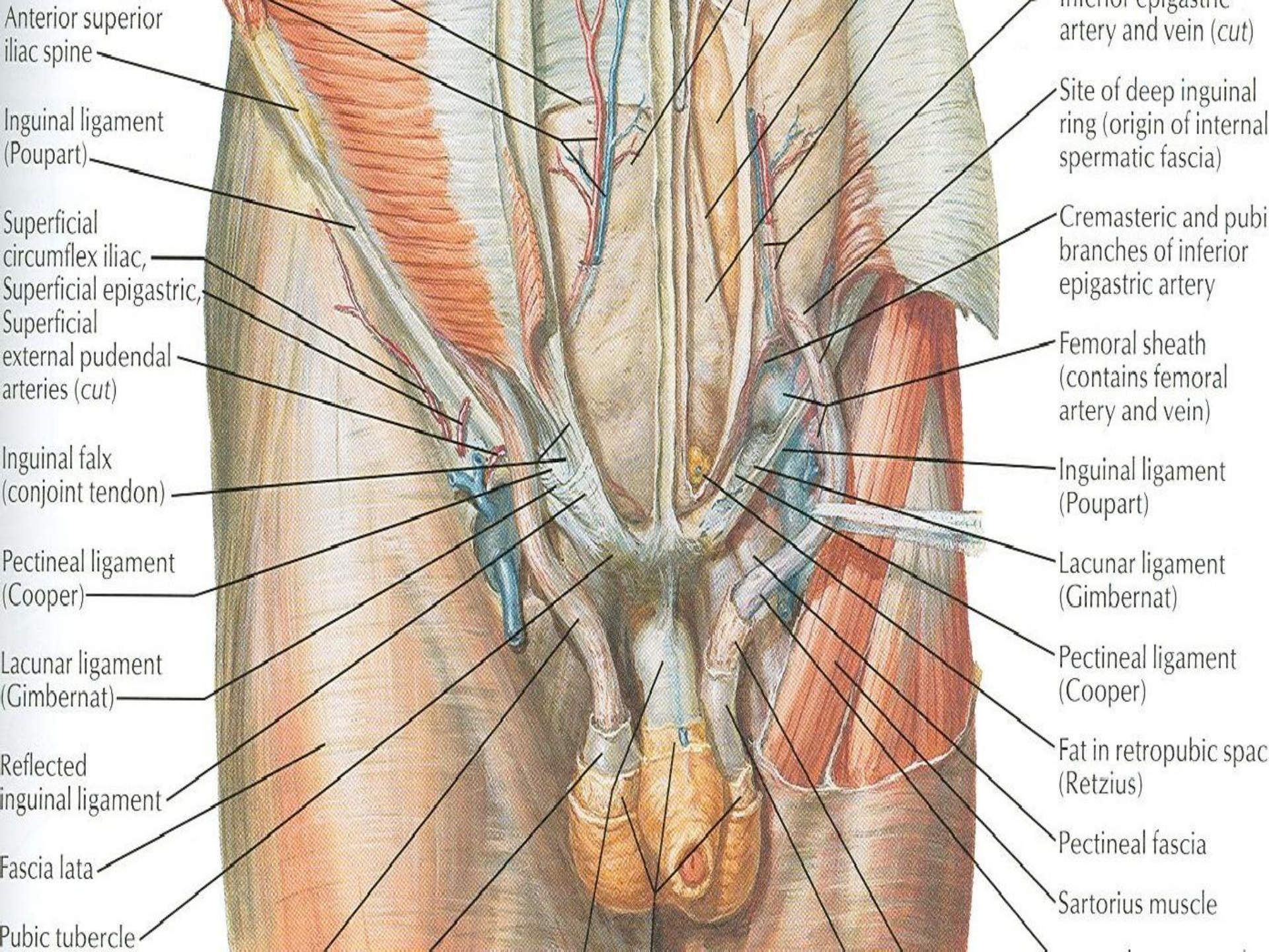
- It is an outpouching of the lower part of the anterior abdominal wall
- It contains testes, epididymis, and the lower ends of the spermatic cord
- Its wall has following layers: skin, superficial fascia, external spermatic fascia derived from external oblique, cremastric fascia derived from internal oblique internal spermatic fascia derived from transversalis, and tunica virginals(parietal & visceral layer)

Skin of the Scrotum

- Skin of the scrotum is thin, wrinkled, and pigmented and forms a single pouch
- A ridge in the midline indicates the line of fusion of the two lateral labioscrotal swellings
- Superficial fascia is continuous with the fatty and membranous layers of the anterior abdominal wall

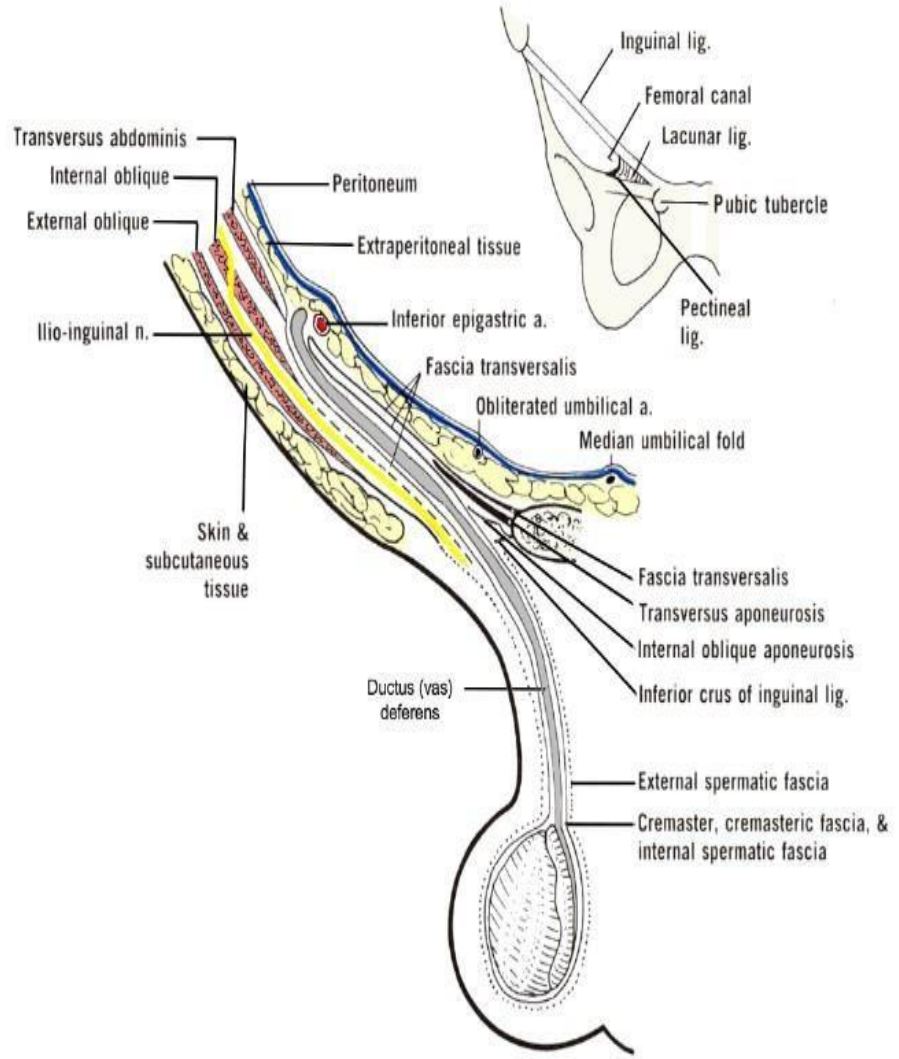
Superficial Fascia

- Superficial fascia is continuous with the fatty and membranous layers of the anterior abdominal wall
- The fat is replaced by smooth muscle called dartos muscle
- It is responsible for wrinkles of the skin
- Membranous layer referred to as Colle's fascia
- Innervated by sympathetic nerve fibers
- Both layers of sup. Fascia contribute to a median partition that crosses the scrotum and separates the testes from each other


Anterior superior iliac spine
Inguinal ligament (Poupart)
Superficial circumflex iliac, Superficial epigastric, Superficial external pudendal arteries (cut)
Inguinal falx (conjoint tendon)
Pectineal ligament (Cooper)
Lacunar ligament (Gimbernat)
Reflected inguinal ligament
Fascia lata
Pubic tubercle
artery and vein (cut)
Site of deep inguinal ring (origin of internal spermatic fascia)
Cremasteric and pubi branches of inferior epigastric artery
Femoral sheath (contains femoral artery and vein)
Inguinal ligament (Poupart)
Lacunar ligament (Gimbernat)
Pectineal ligament (Cooper)
Fat in retropubic spac (Retzius)
Pectineal fascia
Sartorius muscle

Spermatic Fasciae

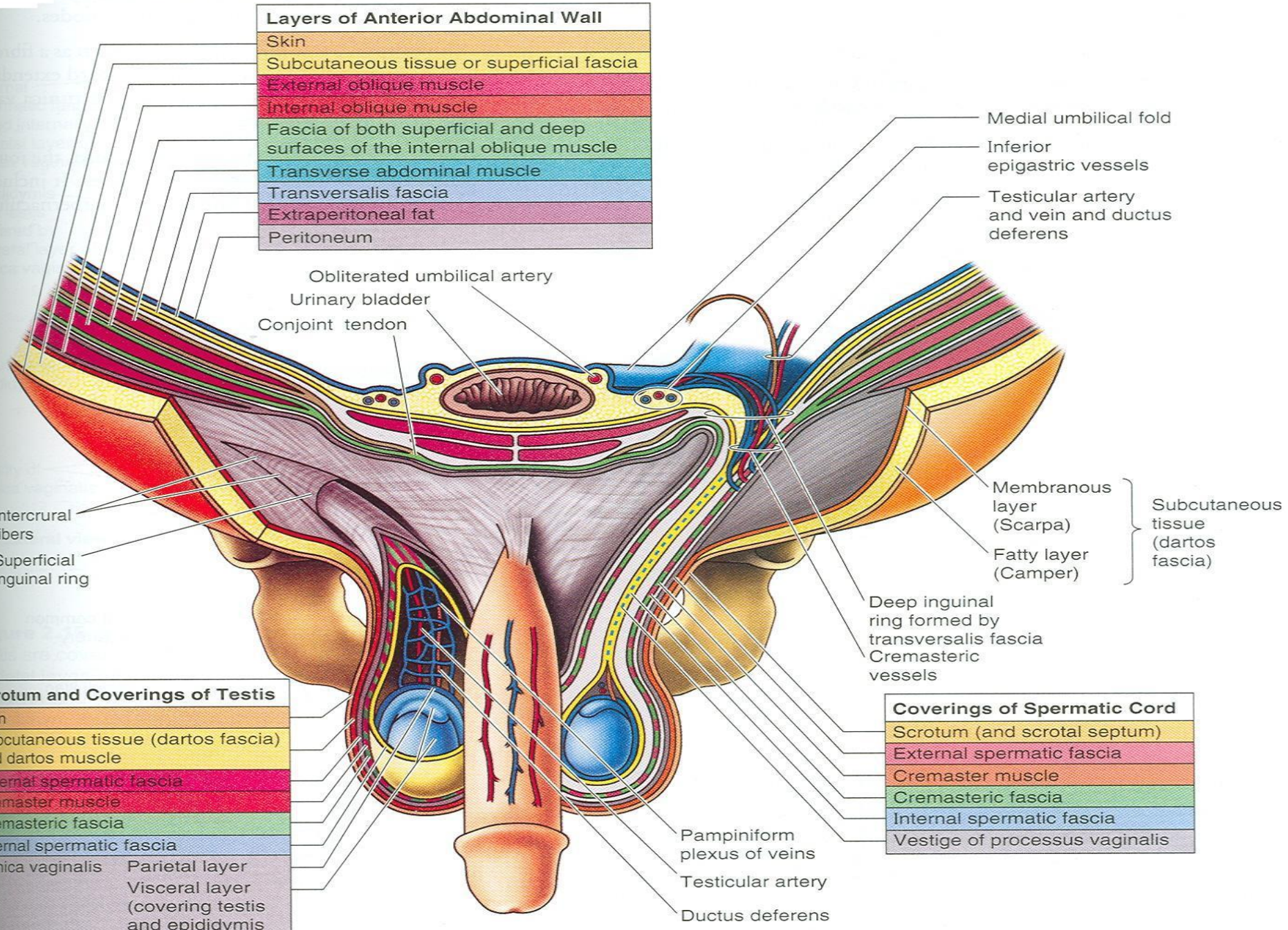
- Lies beneath the superficial fascia
- Derived from three layers of anterior abdominal wall on each side
- The external spermatic fascia is derived from externa oblique
- The cremastric fascia is derived from internal oblique
- The internal spermatic fascia is derived from the fasc transversalis



Tunica Vaginalis

- Lies within the spermatic fasciae
- Covers the anterior, medial and lateral surfaces of each testis
- It is the lower expanded part of the processus vaginalis
- Normally shut off just before birth from the upper part of the processus and the peritoneal cavity

Corresponding Layers of the Anterior Abdominal Wall, Scrotum, and Spermatic Cord



Internal structures of the scrotum

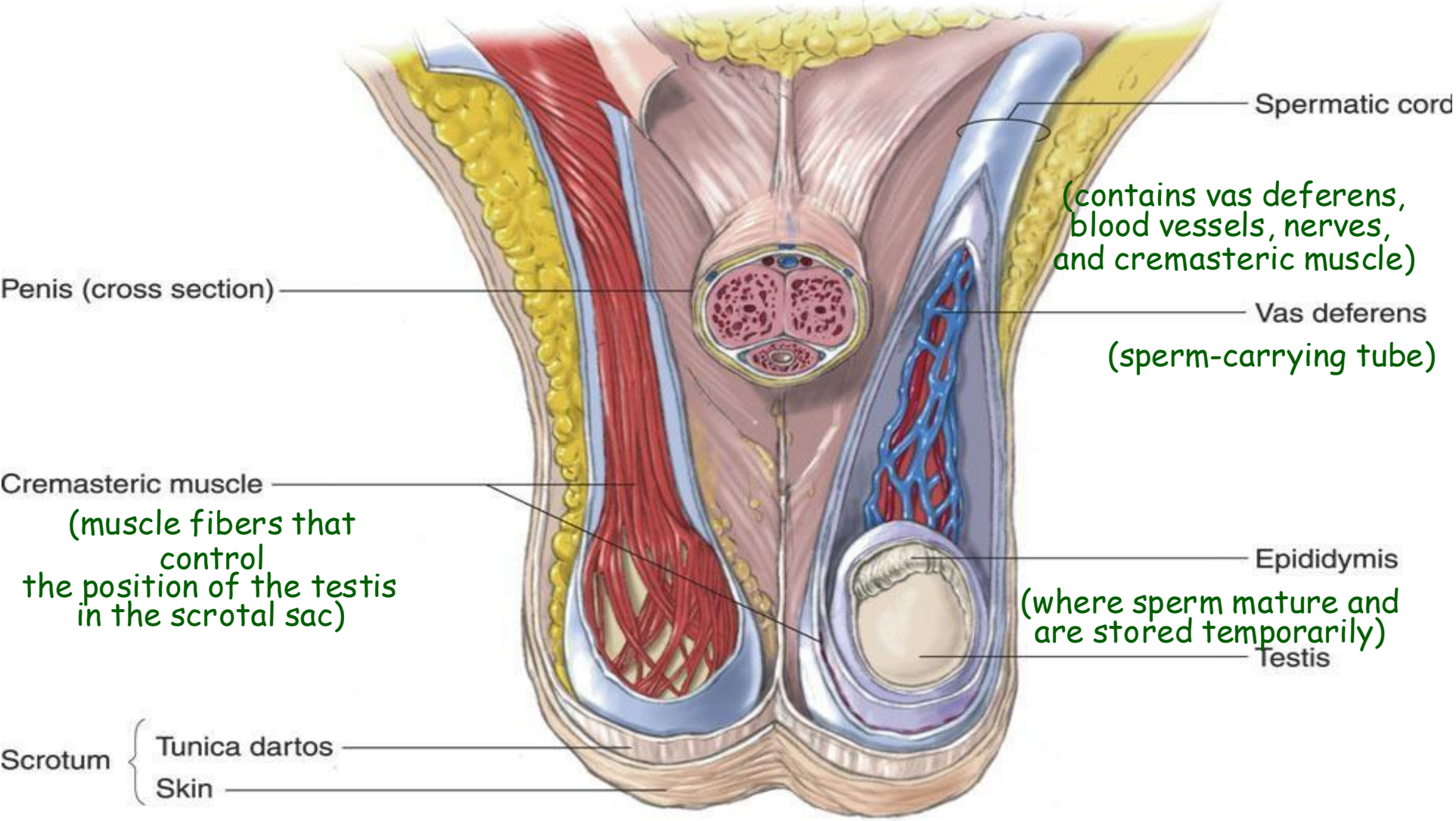


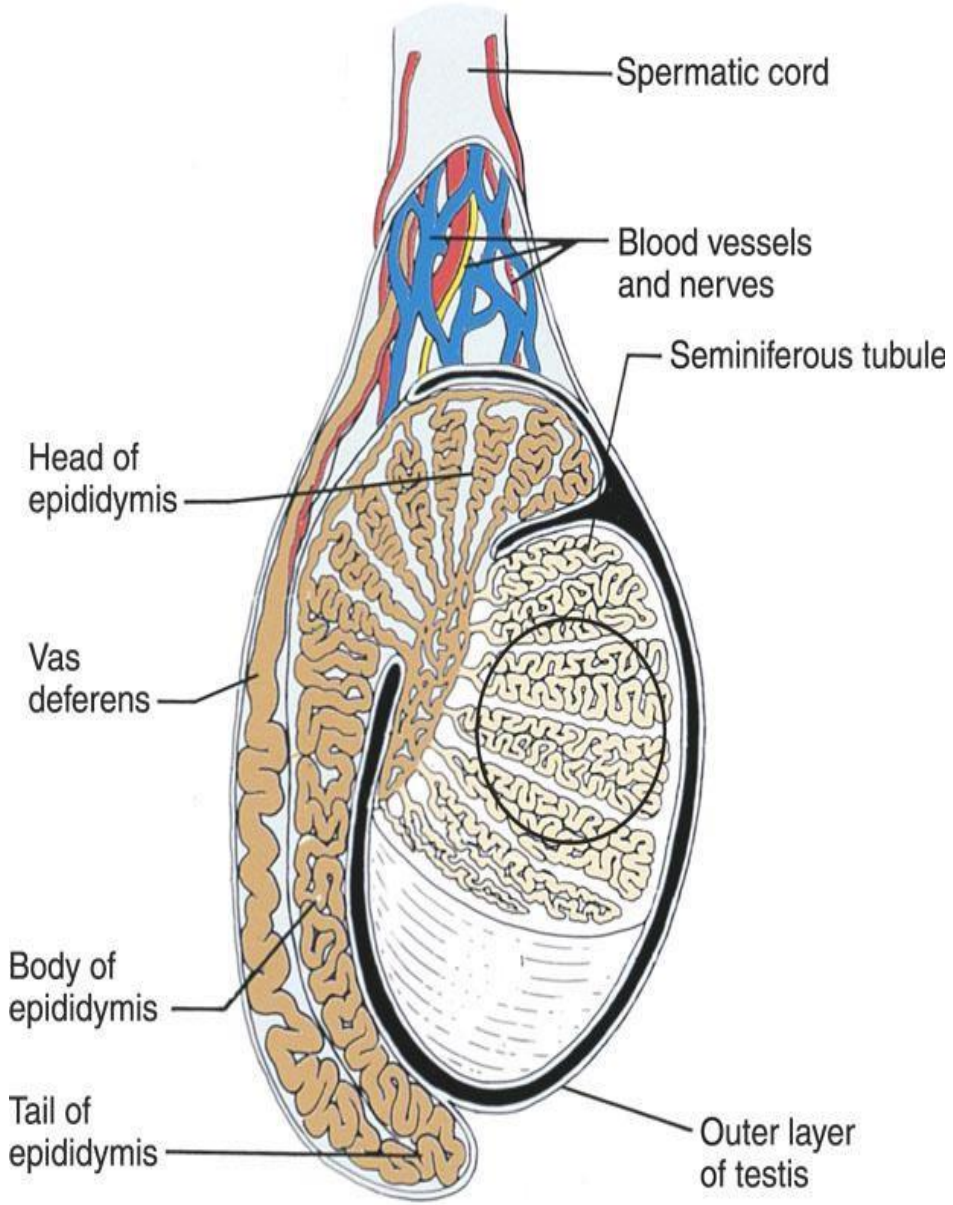
Fig : Internal structures of the scrotum. This illustration shows portions of the scrotum cut away to reveal the cremasteric muscle, spermatic cord, vas deferens, and a testis within the scrotal sac.

Testis

- They are a firm, mobile organ, within the scrotum
- Left testis usually lies at a lower level than the right
- Upper end of the gland is tilted forward
- Surrounded by a tough fibrous capsule, the tunica albuginea
- A series of fibrous septa divide the interior of the organ into lobules
- Lying in each lobule are one to three coiled seminiferous tubules
- The tubules open into the network of channels called the rete testis
- Small efferent ductules connect the rete testis to the upper end of the epididymis

Structures inside the testis

- **Seminiferous tubules**
  - Thin, highly coiled structures where sperm production occurs.
- **Interstitial cells**
  - Major source of androgens
  - Located between seminiferous tubules
- **Epididymis**
  - Site of sperm maturation
  - Runs along back of testis
- **Vas deferens**
  - Sperm-carrying tube
  - Begins at the testis and ends at the urethra.



Overview: male sexual anatomy

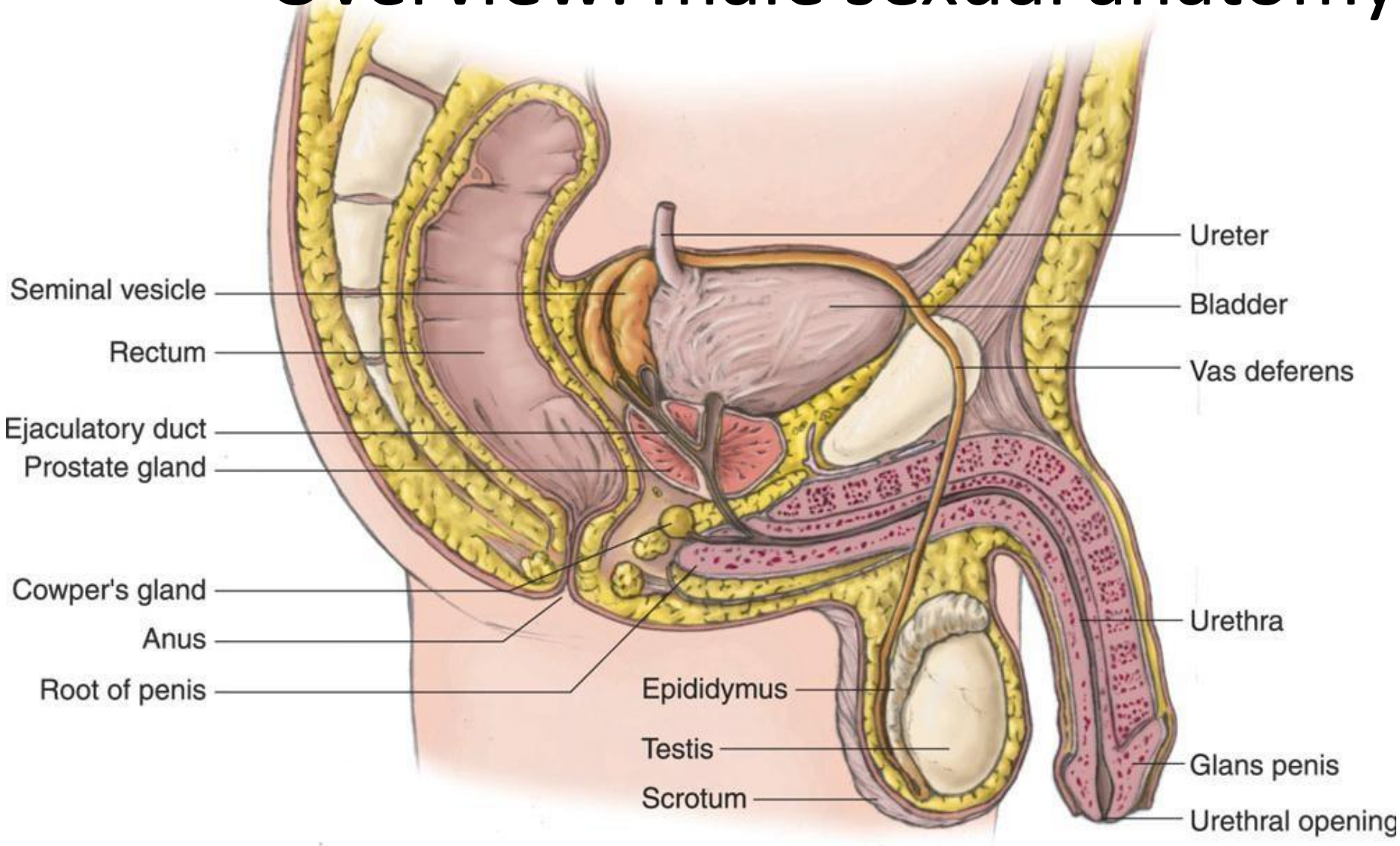
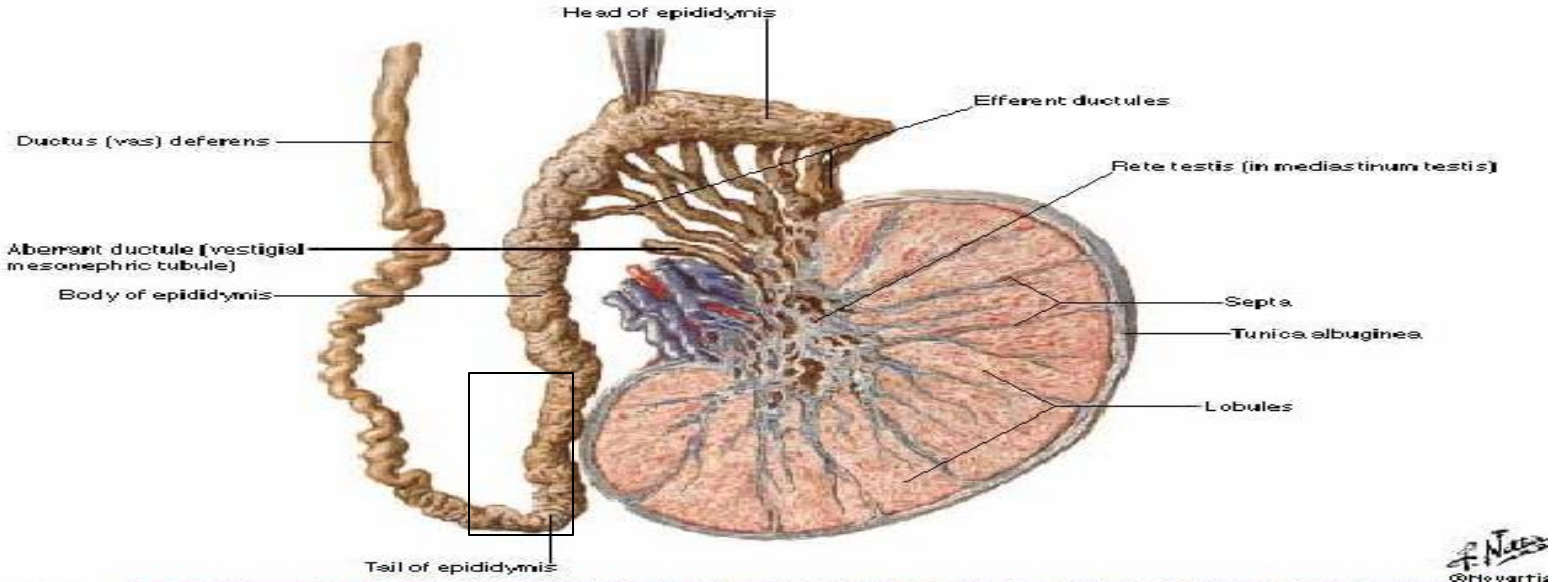
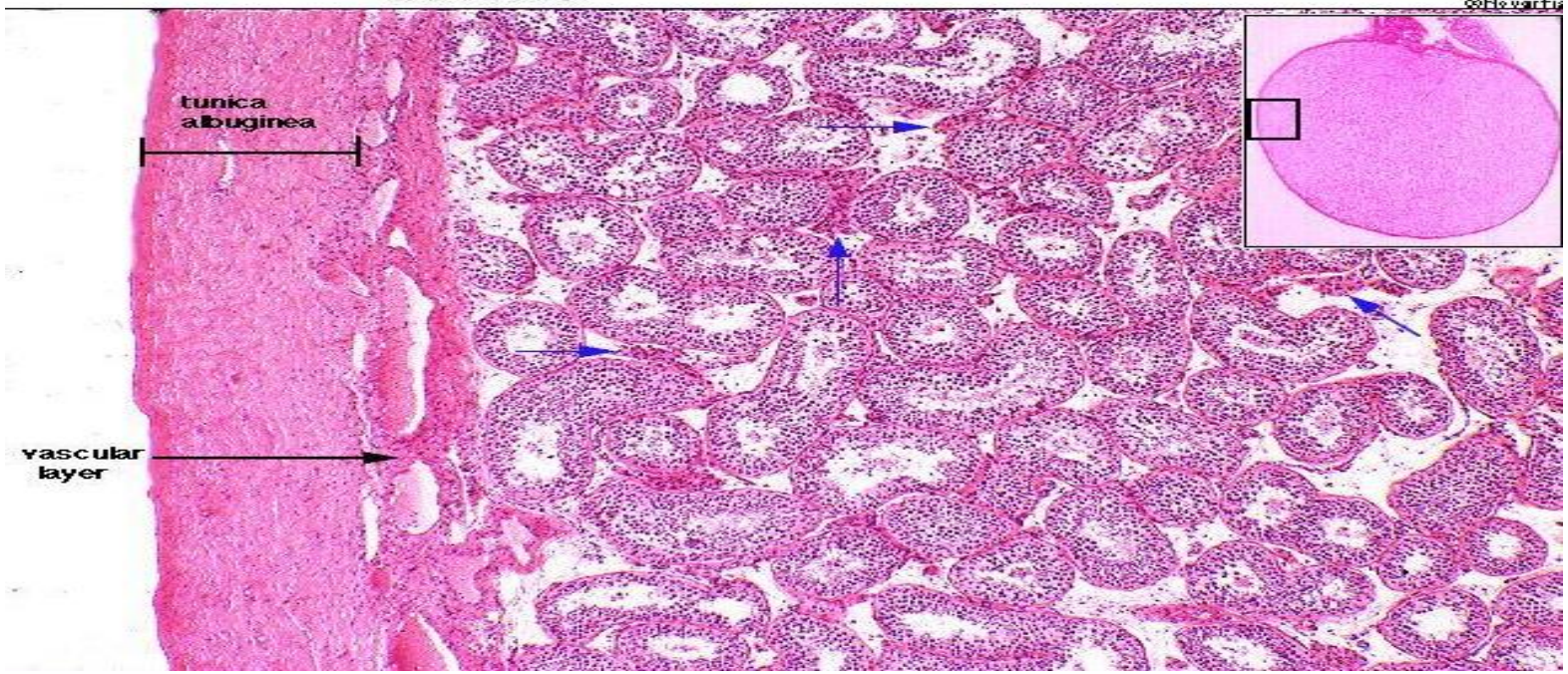


Fig : Male sexual anatomy: A cross-section side view of male reproductive organs.

Testis, Epididymis and Ductus Deferens

Frontal Section





Blood supply of testes

Artery

- Testicular arteries→ Abdominal aorta at level L2

Vein

- Pampiniform plexus → reduced to a single vein → ascend through inguinal canal → Rt. testicular vein drains into I.V.C & Lt. testicular vein drains into Lt.renal vein

Lymphatic drainage of testes

- Ascend in the spermatic cord
- End in the lymph nodes on the side of aorta(Lumber or Para- aortic) nodes at level L1
- Scrotum+ skin→ inguinal canal lymphatic nodes

Nerve supply to testes

- Autonomic nerves
  - Sympathetic fibers run with testicular artery from renal or aortic sympathetic plexuses
  - Afferent sensory nerve
- Genital branch of the genitofemoral nerve
  - Supply the cremastric muscle
- Scrotum → By the above nerves + ilioinguinal nerve

Clinical Notes

Clinical conditions involving the scrotum and testes

Varicocele:

- The veins of the pampiniform plexus elongated & dilated
- **Lt side more common** because the left testis often hangs lower and the vein is perpendicular (going to Lt renal) → venous pressure is higher
- Common in young & adult

□ Treatment:

• Ligation or embolization of the dilated veins to redirect blood flow and reduce scrotal temperature.

•The goal is to improve fertility and reduce testicular discomfort or atrophy.

Vasectomy → Infertility

· In our countries, **women** commonly undergo **bilateral tubal ligation** as a method of permanent **contraception**. This involves the surgical tying or sealing of **both fallopian tubes**, leading to **fibrosis** at the site of ligation. Ovulation discontinues, thus preventing fertilization and pregnancy.

· In contrast, in many Western countries, men more commonly undergo vasectomy as a form of permanent **male** contraception. This procedure involves the **bilateral ligation of the vas deferens**, which **blocks** the pathway for sperm transport. As a result, sperm are still produced but are **reabsorbed** by the body, and the ejaculate no longer contains sperm, thereby preventing fertilization.

Processus vaginalis

Upper part → obliterated just before birth
Lower part → Tunica vaginalis

Congenital anomalies of processus vaginalis:

1. persist→ indirect inguinal hernia
2. Narrowed →congenital hydrocele
3. Obliterated upper & lower part (except at the middle where it forms a cyst) → encysted hydrocele of the cord

· Remember, if the processus vaginalis is not obliterated then it will cause congenital anomalies.

Abnormality in testis & scrotum…….cont

Hydrocele

- Accumulation of fluid within the tunica vaginalis of the testis. **(Remember that at the end of the processus, tunica vaginalis forms around the testis).**

Causes

1 Inflammatory

2 Idiopathic

- Tapping ahydrocele → structures (all layers covering the testis, skin→ tunica vaginalis) traversed by the cannula

Congenital anomalies of the testes

Cryptorchidism

- Incomplete descent of testis although traveling down normal pathway.
  Normal passage is from abdomen -> deep ring -> inguinal canal -> superficial ring -> scrotum.

- It may be found in:

1 Abdominal cavity
2 In inguinal canal
3 At superficial inguinal ring
4 In upper part of scrotum

Maldescent

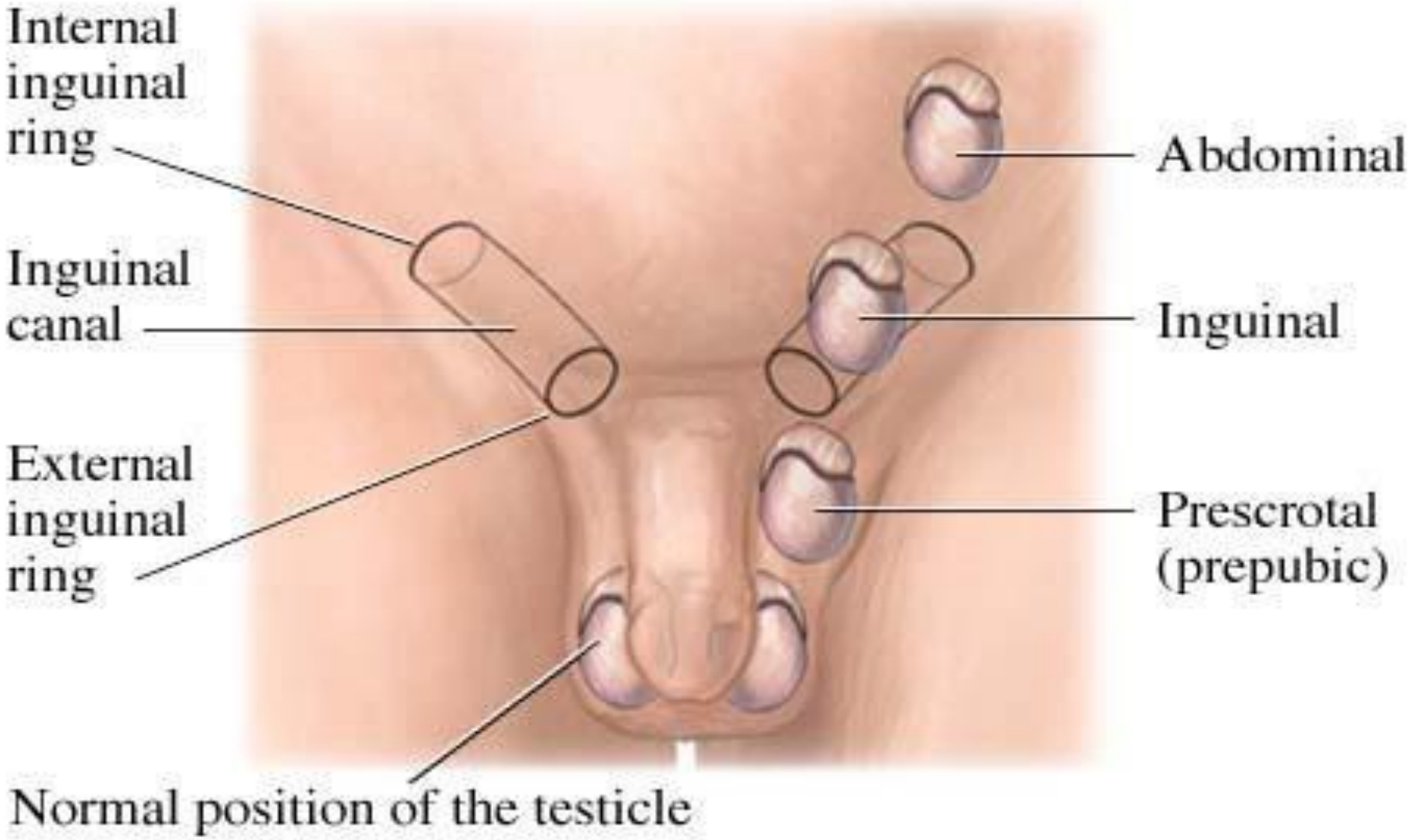
- Testes travel down an abnormal pathway

1 Superficial fascia
2 Root of penis
3 Perineum
4 In the thigh

- Previously, if a child was born with an undescended testis (**cryptorchidism**), **surgical** correction was typically performed **around the age of six**, based on the belief that this coincided with the onset of **testosterone secretion.**
  - However, delaying treatment beyond this age increased the risk of testicular atrophy, loss of function, and **potential malignant transformation.**

- currently, the recommended approach is to perform **surgical intervention** as early as possible.

Cryptorchidism



Thank you

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الدعاء نعمة كبرى، ومنحة عظمى، تفضل الله بها على عباده، وجاد بها عليهم حين أمرهم به وحثهم عليه، ووالى إحسانه فوعدهم عليه الإجابة، وعلَّقها به، وسيَّرها في ركابه؛ فمتى وُجِد الدعاء فالإجابة معه، كذلكم قال الله وقضى في كتابه العزيز: {وإذا سألك عبادي عني فإني قريب}

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			

رسالة من الفريق العلمي:

يقول ﷺ: أنا زعيمٌ ببيتٍ في ربض الجنة لمن ترك المراءَ وإن كان مُحقًّا، وأنا زعيمٌ ببيتٍ في وسط الجنة لمن ترك الكذبَ وإن كان مازحًا، وأنا زعيمٌ ببيتٍ في أعلى الجنَّة لمن حَسُن خلقه.
أخبرنا النبي صلى الله عليه وسلم فقال: دعوة المرء المسلم لأخيه بظهر الغيب مستجابة .. 🌸

أيا ربِّ عبدٌ ضعيفٌ أتاك
ويرجو رِضاكَ ويرجو هُداكْ
أيا ربِّ يدعوكَ أسمى أمانيهِ
جنَّةُ عَدنٍ وفيها يرَاكْ
أُناجيكَ خَوفاً أُناجِيك ضَعفاً
وحاشاكَ تَرفضُ عبداً أتاكْ
أعنِّي عليَّ فإنّي عدُوّي
وإن لم تُعنِّي فمن لي سواكْ !
القسّامي الشهيد _ بإذن الله _ محمّد عبد الرحيم صالح

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