



GI

Anatomy

LEC no .6



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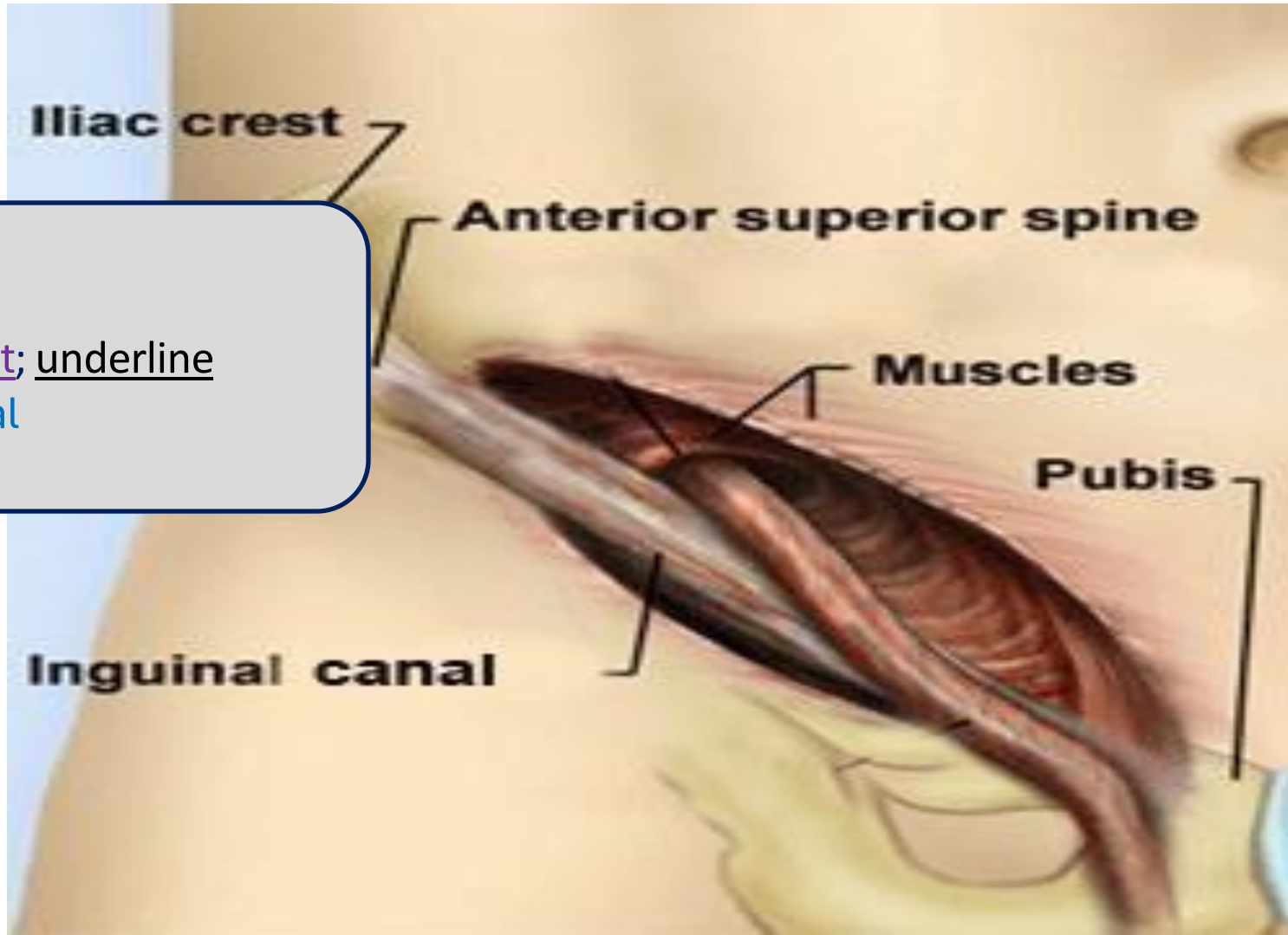
Inguinal canal

Key:

■ Doctor

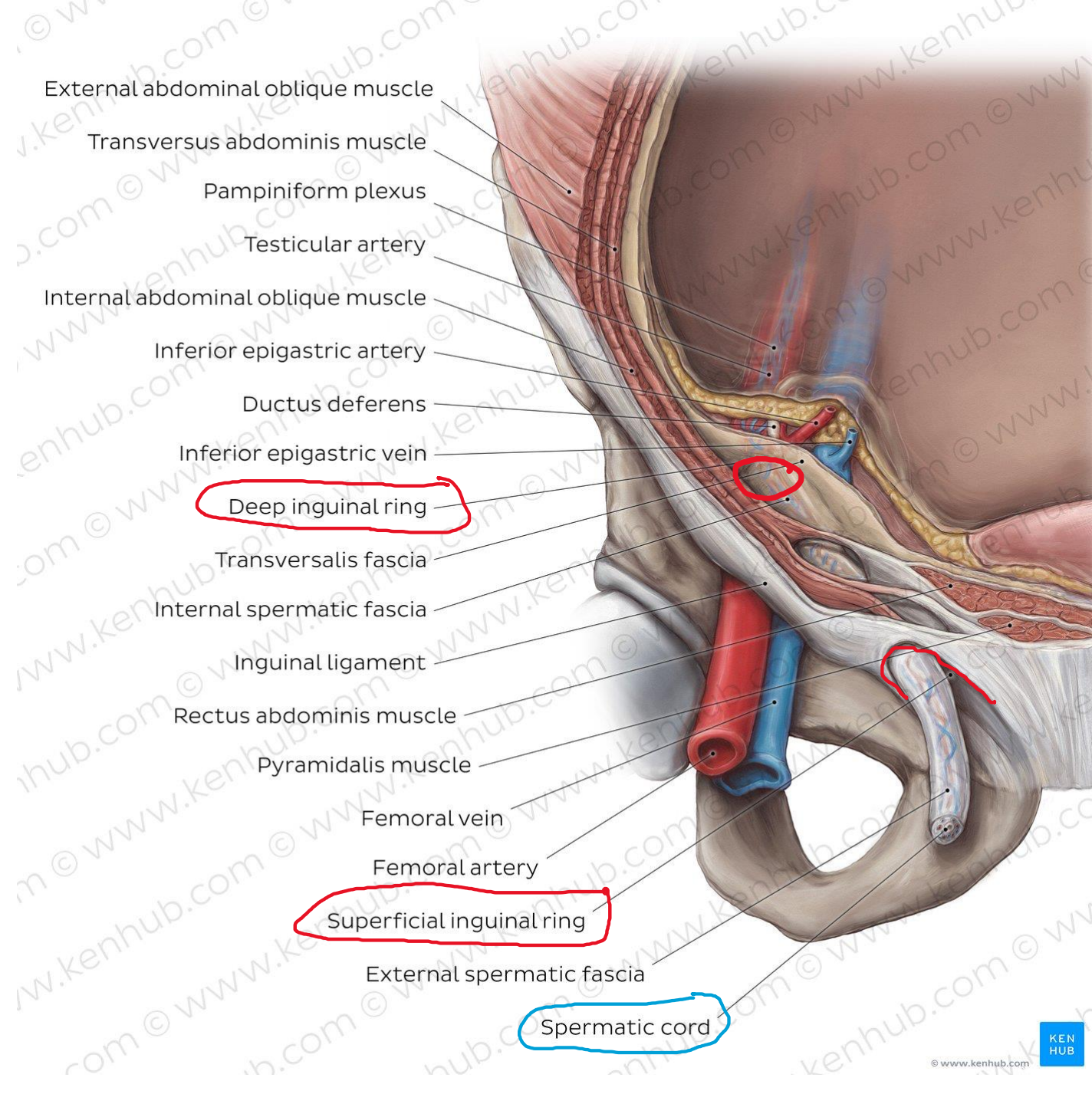
■ Important; underline

■ Additional



Inguinal Canal

- It is an oblique passage through the lower part of the anterior abdominal wall, **and it is superior to the medial part of the inguinal ligament and extend from deep ring to superficial**
- 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

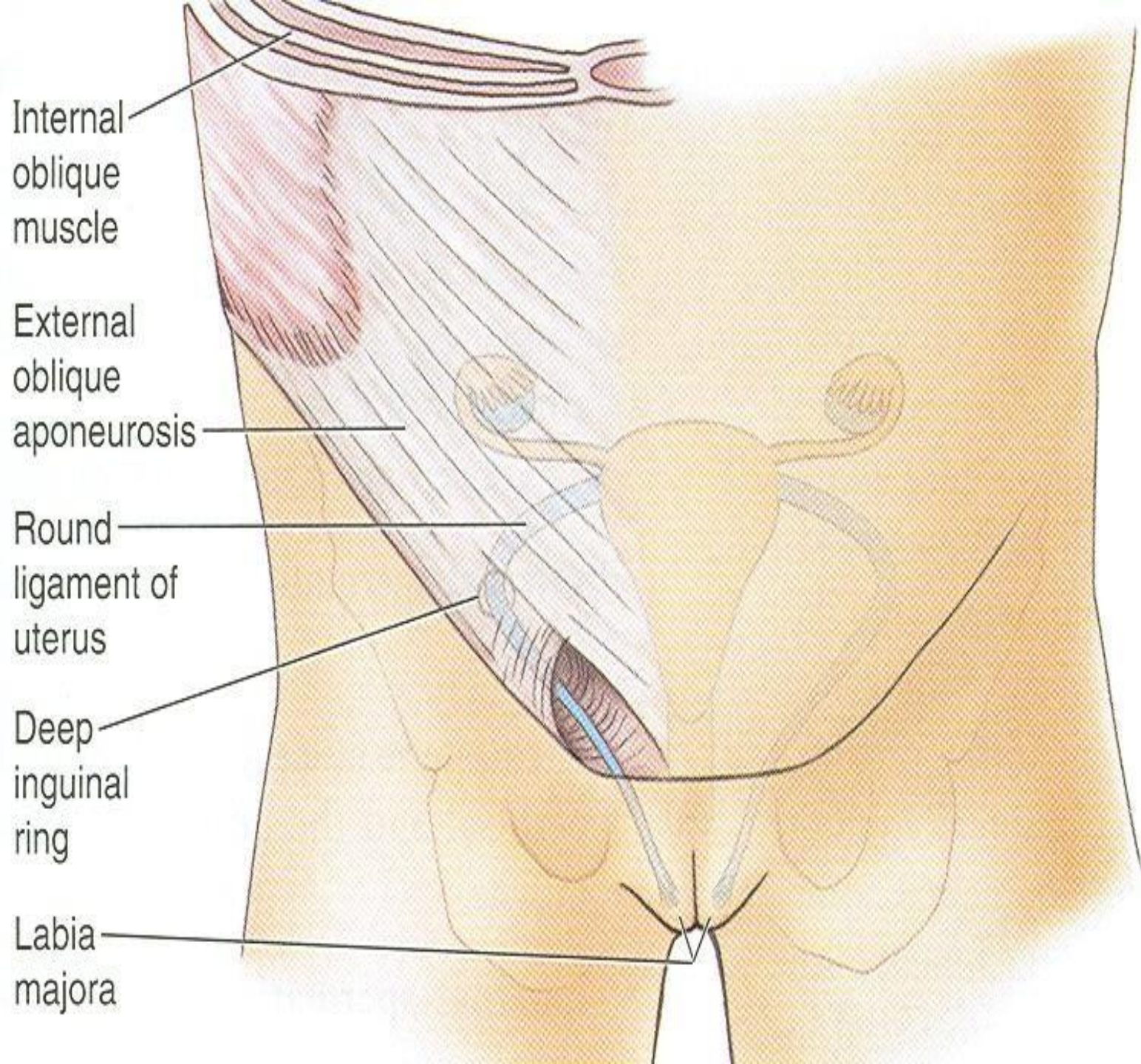


The inguinal ring :

In **males** it makes the spermatic cord, which connects vas deferens and some blood vessels to the testis, and genital branch of genitofemoral nerve to innervate the cremasteric muscle of the scrotum.

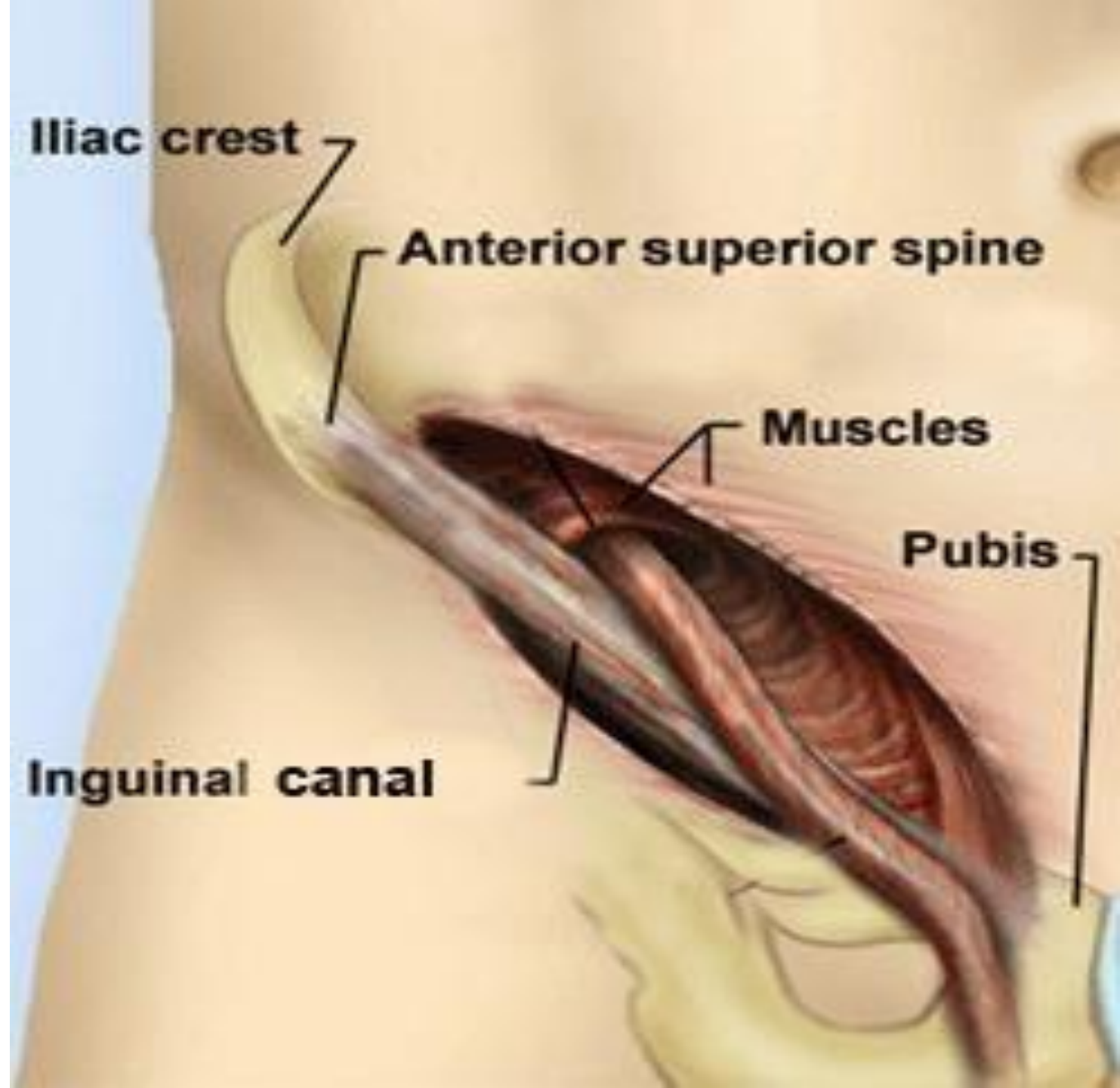
In **females** it makes the round ligament which connects the uterus to labia majora (labium majus).

In **both sexes** it contains genital branch of genitofemoral nerve, and ilioinguinal nerve which **does not go through the deep inguinal ring**, but it pierces the posterior surface of the inguinal canal.



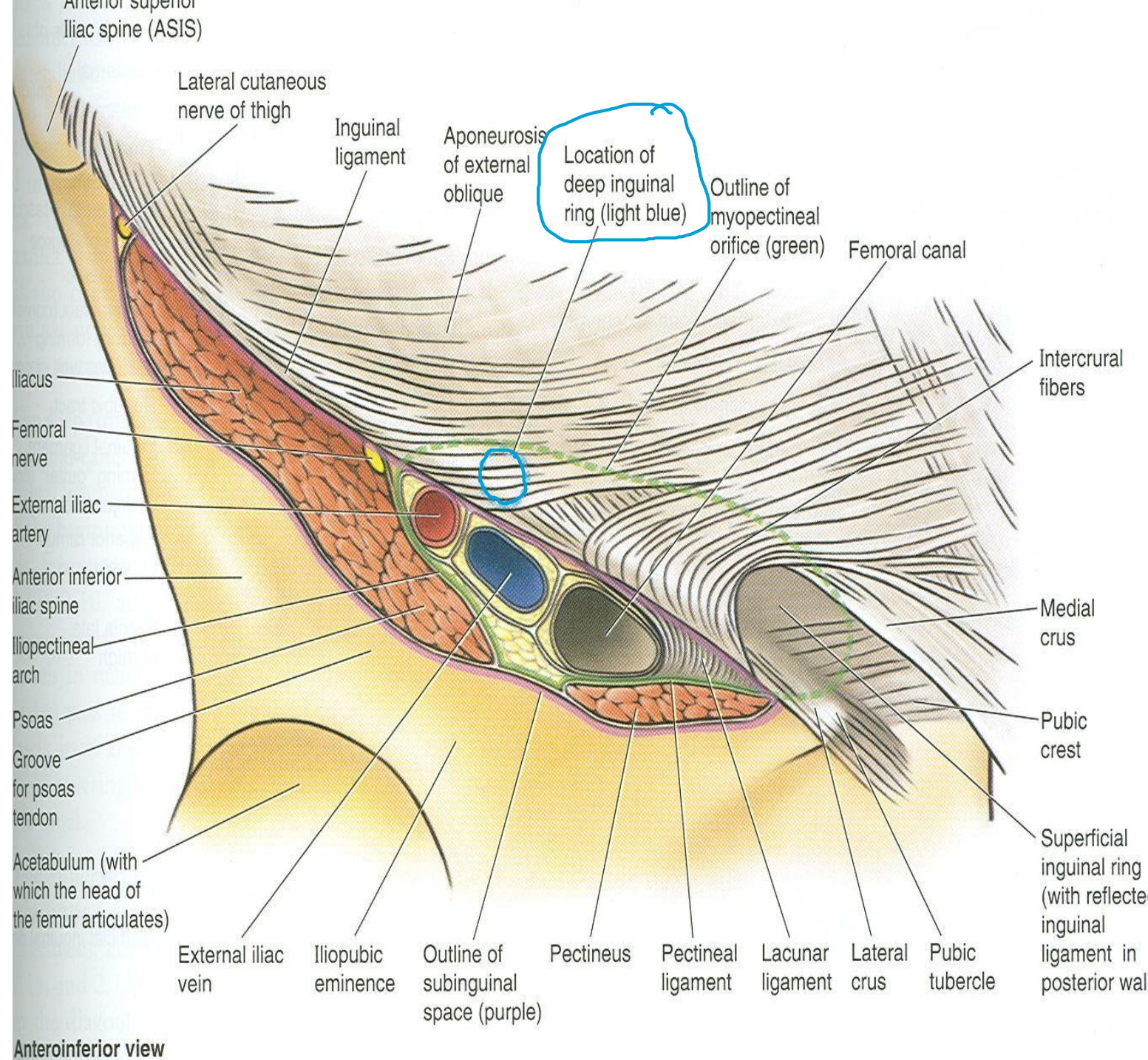
Inguinal Canal

- It is about 1 ½ inches or 4cm long in the adults
- Extends from the deep inguinal ring downward and medially to the superficial inguinal ring
- Lies parallel to and immediately above the inguinal ligament
- In the newborn child, the deep ring lies almost directly posterior to the superficial ring, **because the inguinal canal is too short in newborn children.**

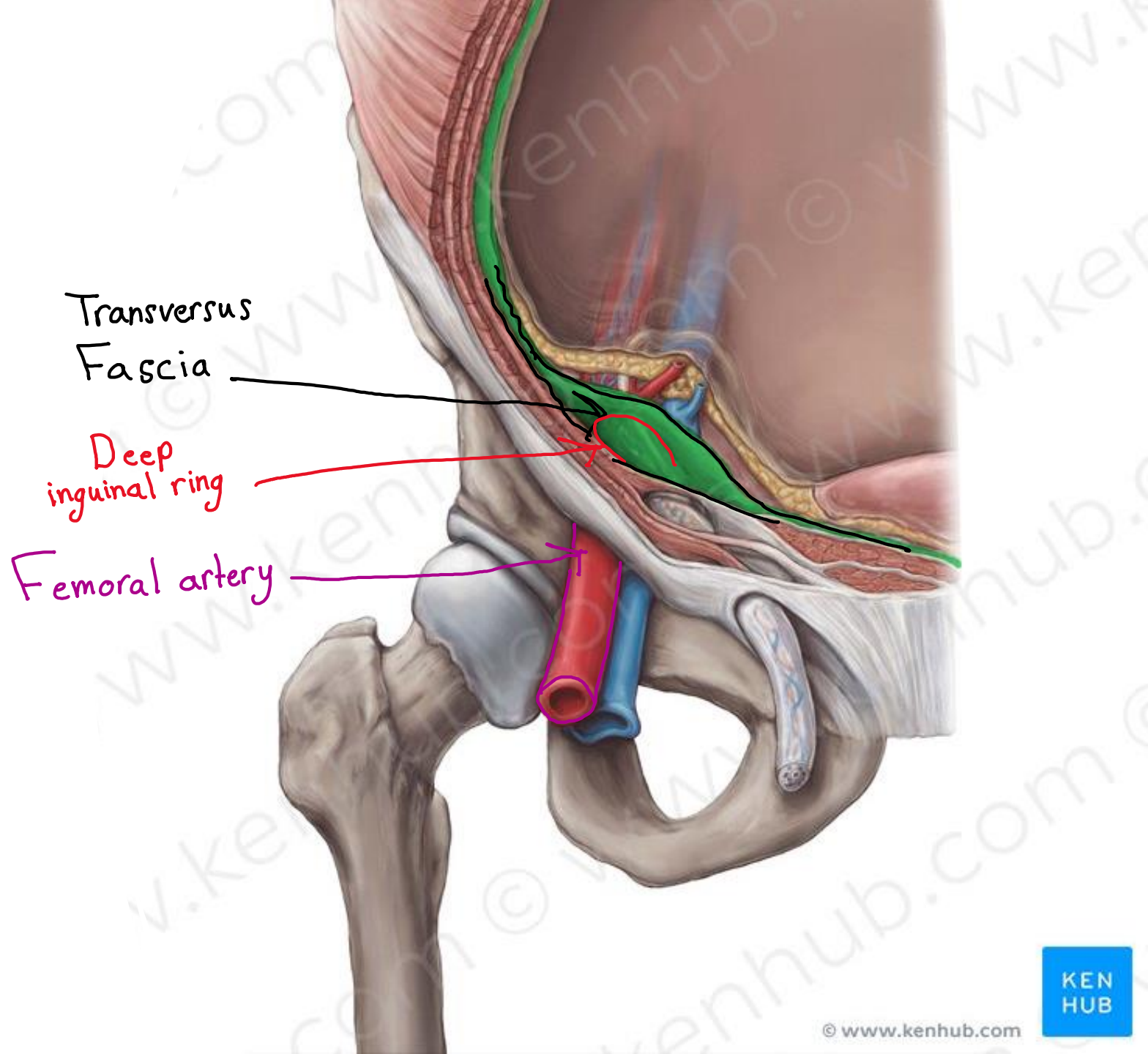


Deep Inguinal Ring

- 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

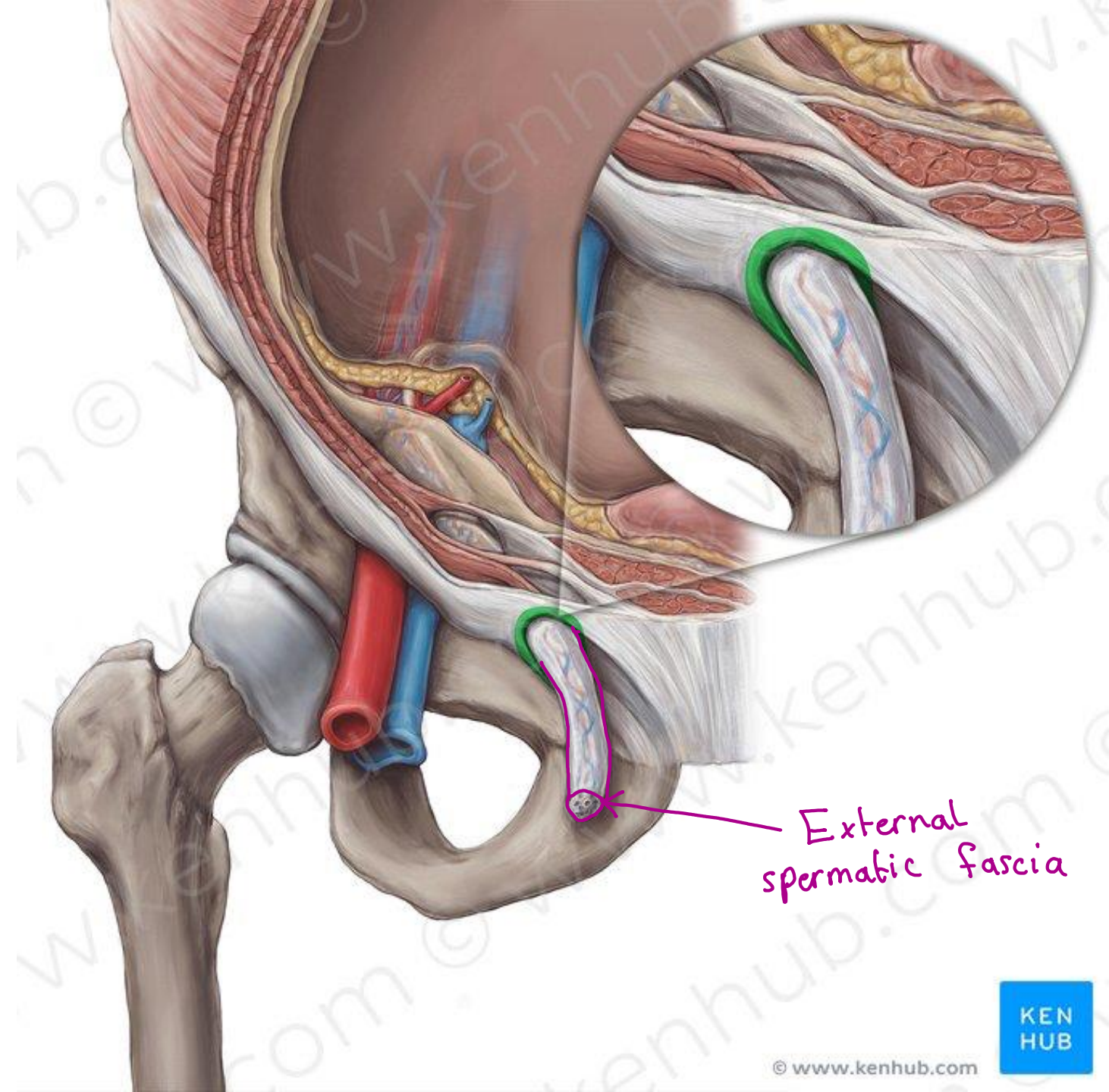


The deep inguinal ring can be found in relation to the femoral artery, by feeling the palpitation of the femoral artery first (on the inguinal ligament) then going 1.3cm upward.

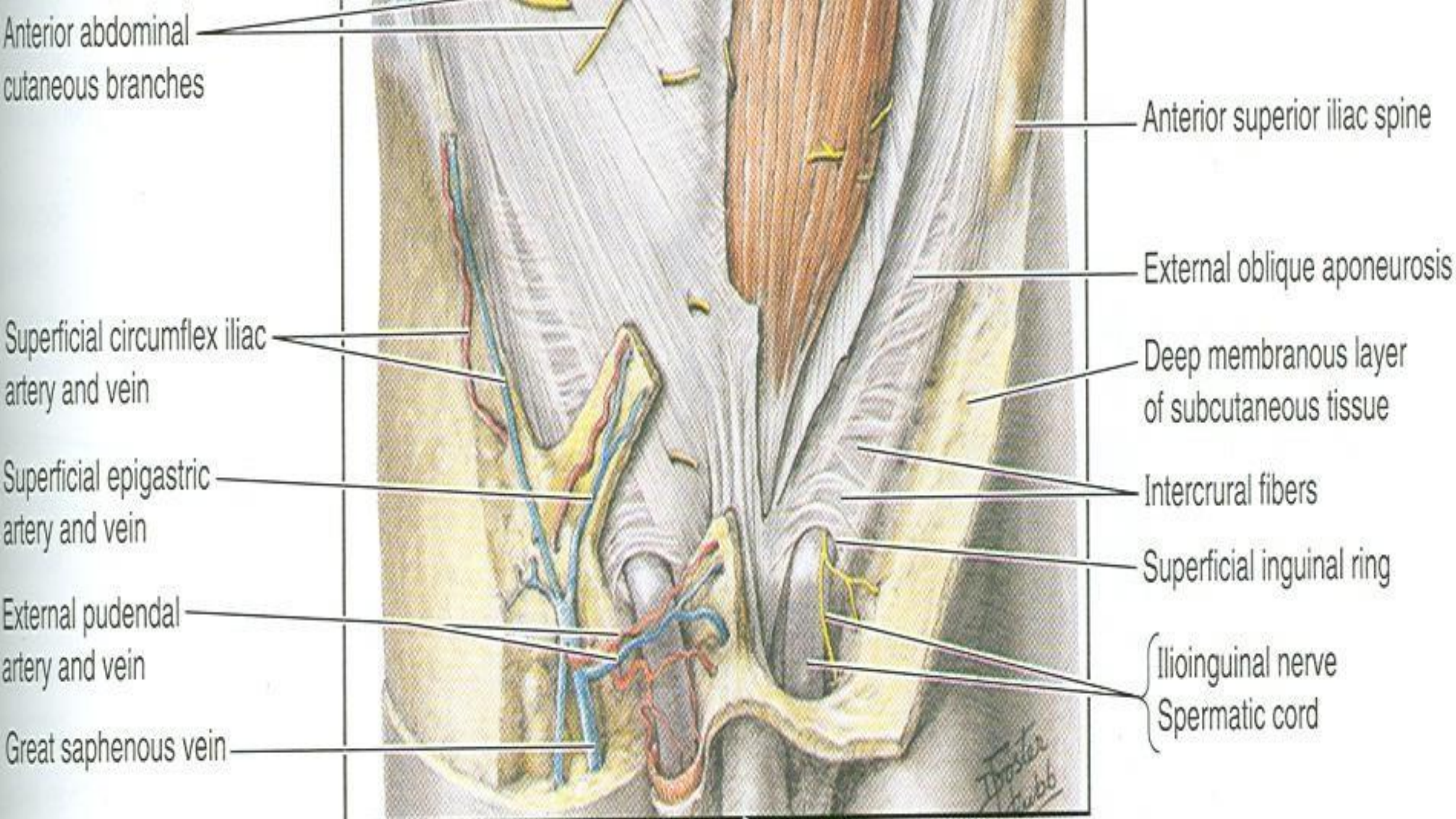


Superficial Inguinal Ring

- Triangular in shape
- Defect in the aponeurosis of the external oblique muscle
- Lies immediately above and medial to the pubic tubercle
- Its margins some times called crura (Med & lat crus), give attachment to the external spermatic fascia



External spermatic fascia



Anterior abdominal cutaneous branches

Superficial circumflex iliac artery and vein

Superficial epigastric artery and vein

External pudendal artery and vein

Great saphenous vein

Anterior superior iliac spine

External oblique aponeurosis

Deep membranous layer of subcutaneous tissue

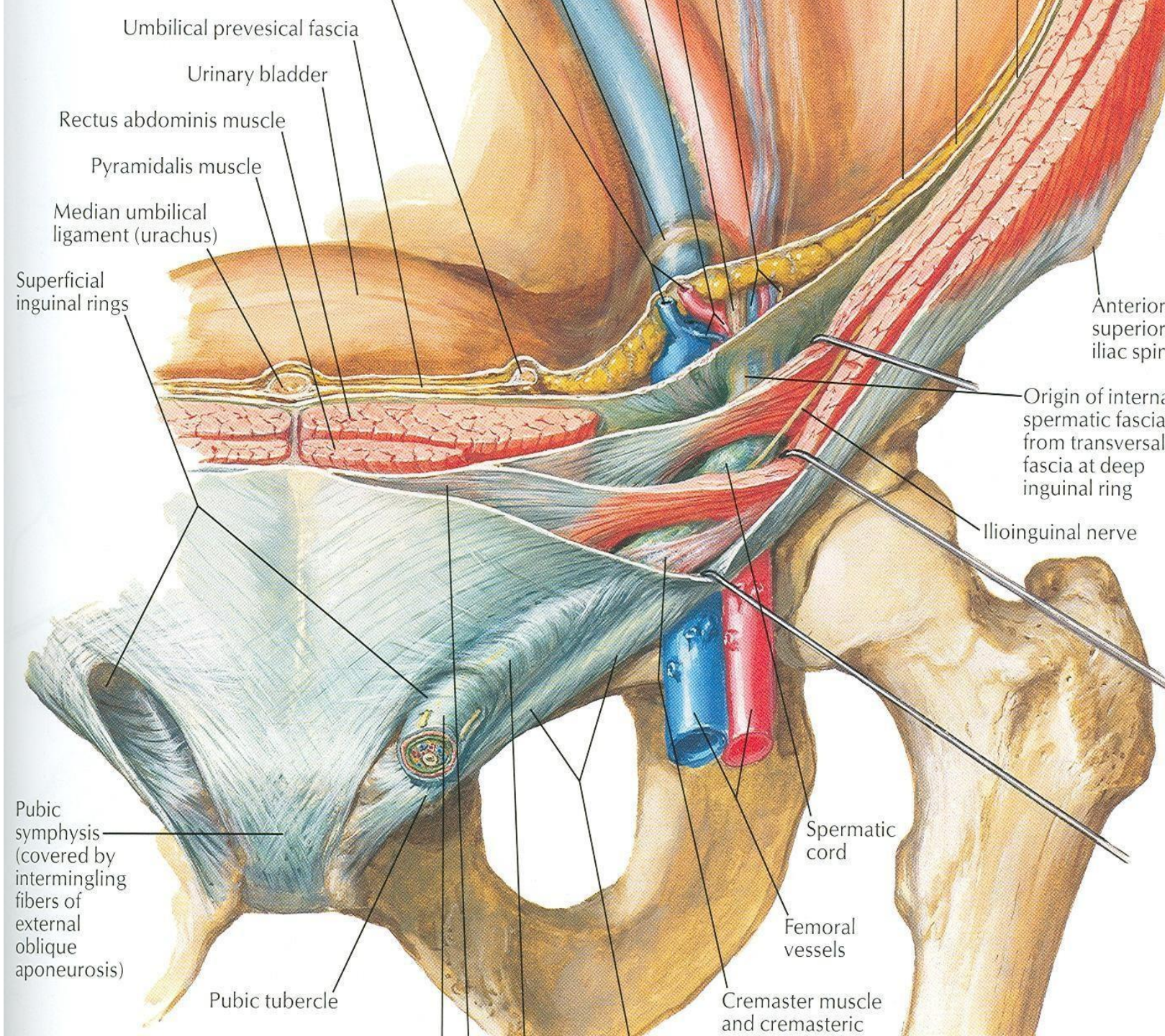
Intercrural fibers

Superficial inguinal ring

Ilioinguinal nerve
Spermatic cord

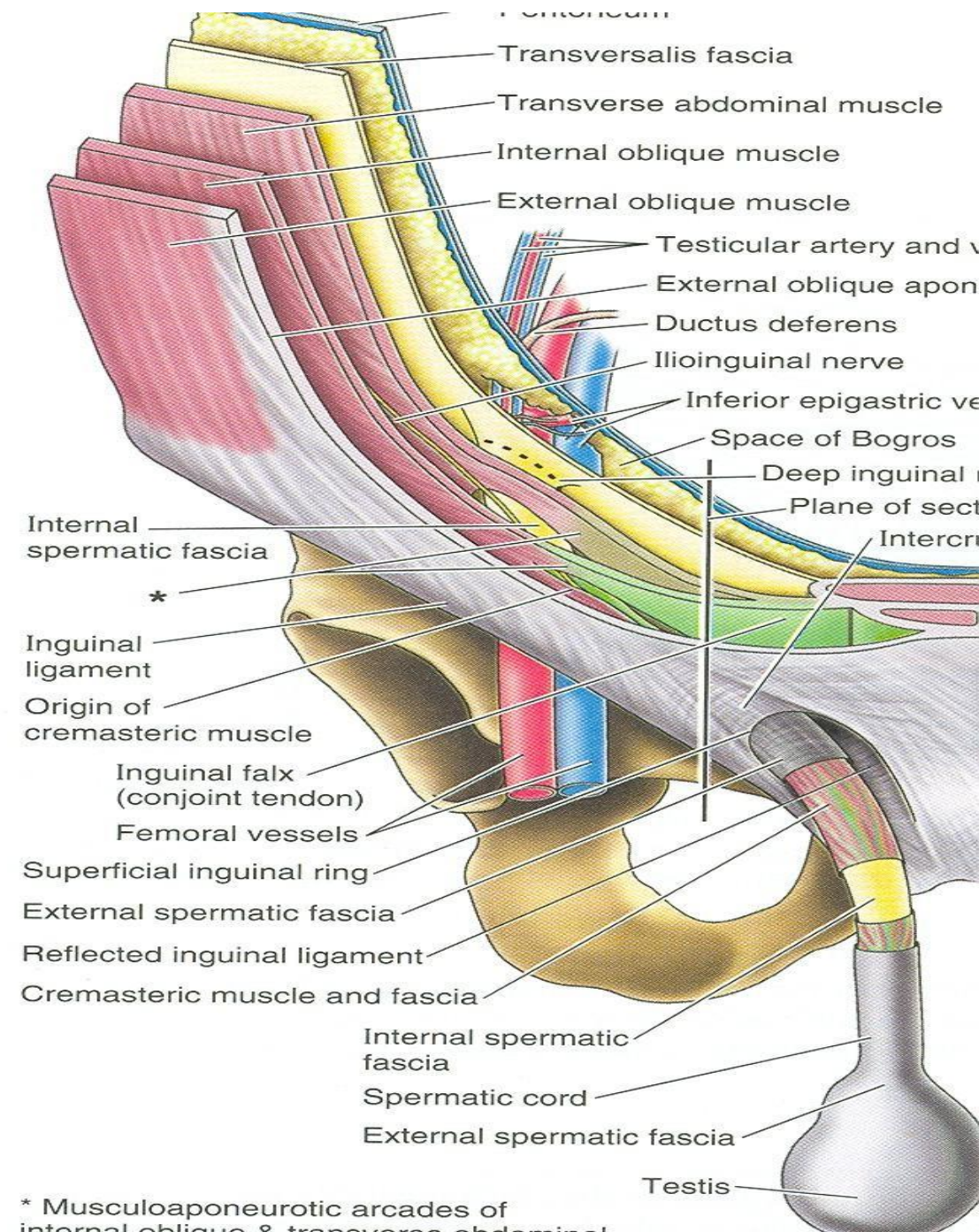
Anterior Wall of Inguinal Canal

- 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



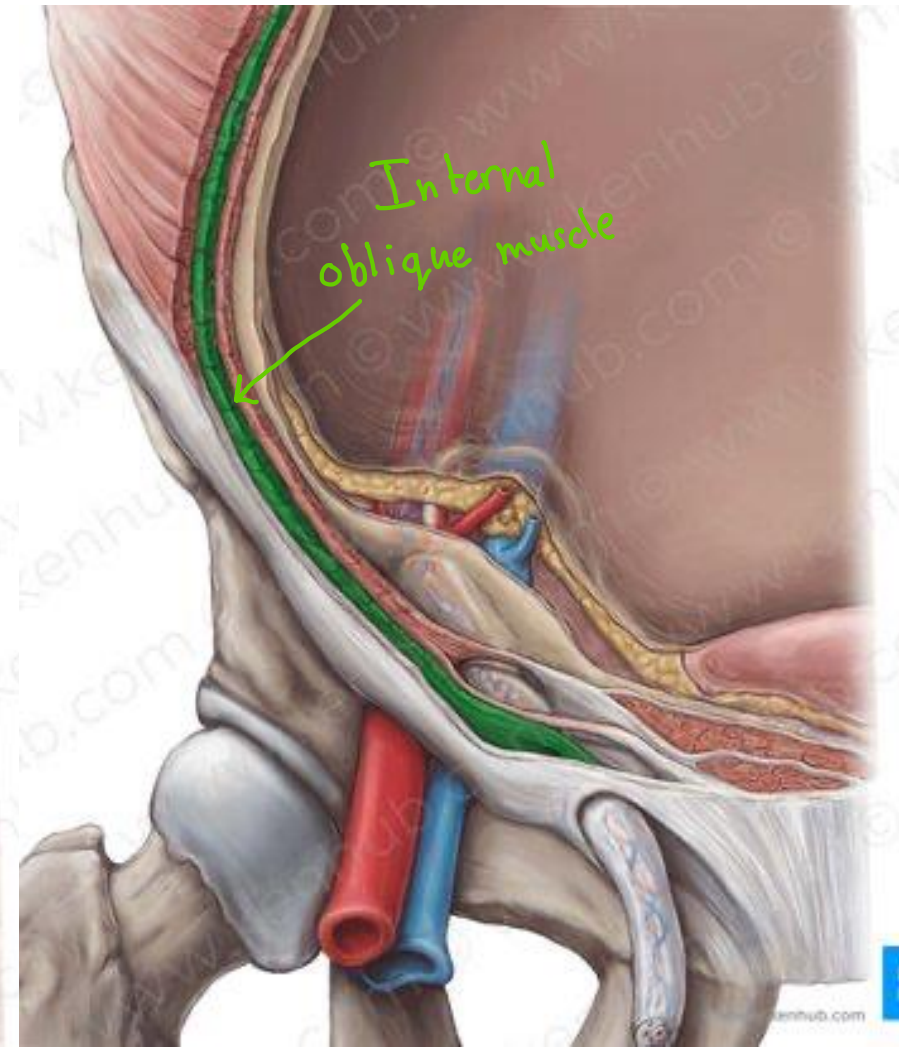
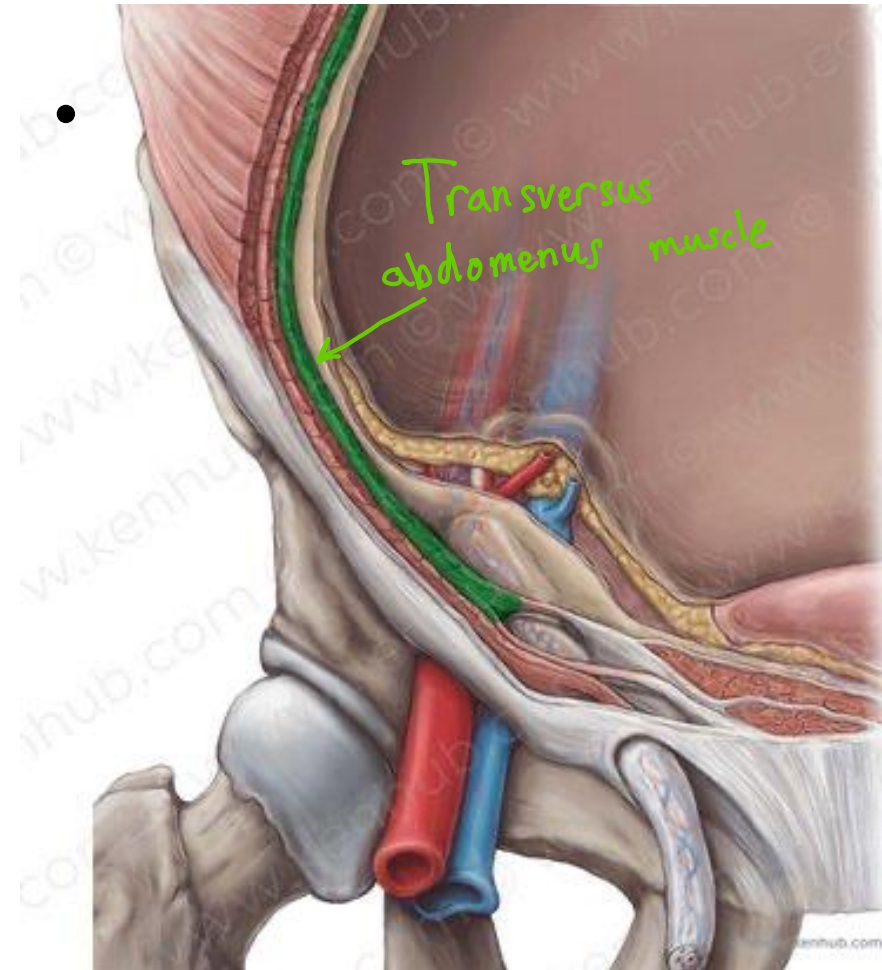
Posterior Wall of Inguinal Canal

- It is formed along its entire length by the fascia transversalis
- It is reinforced (عشان ما يصير **hernia**) 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



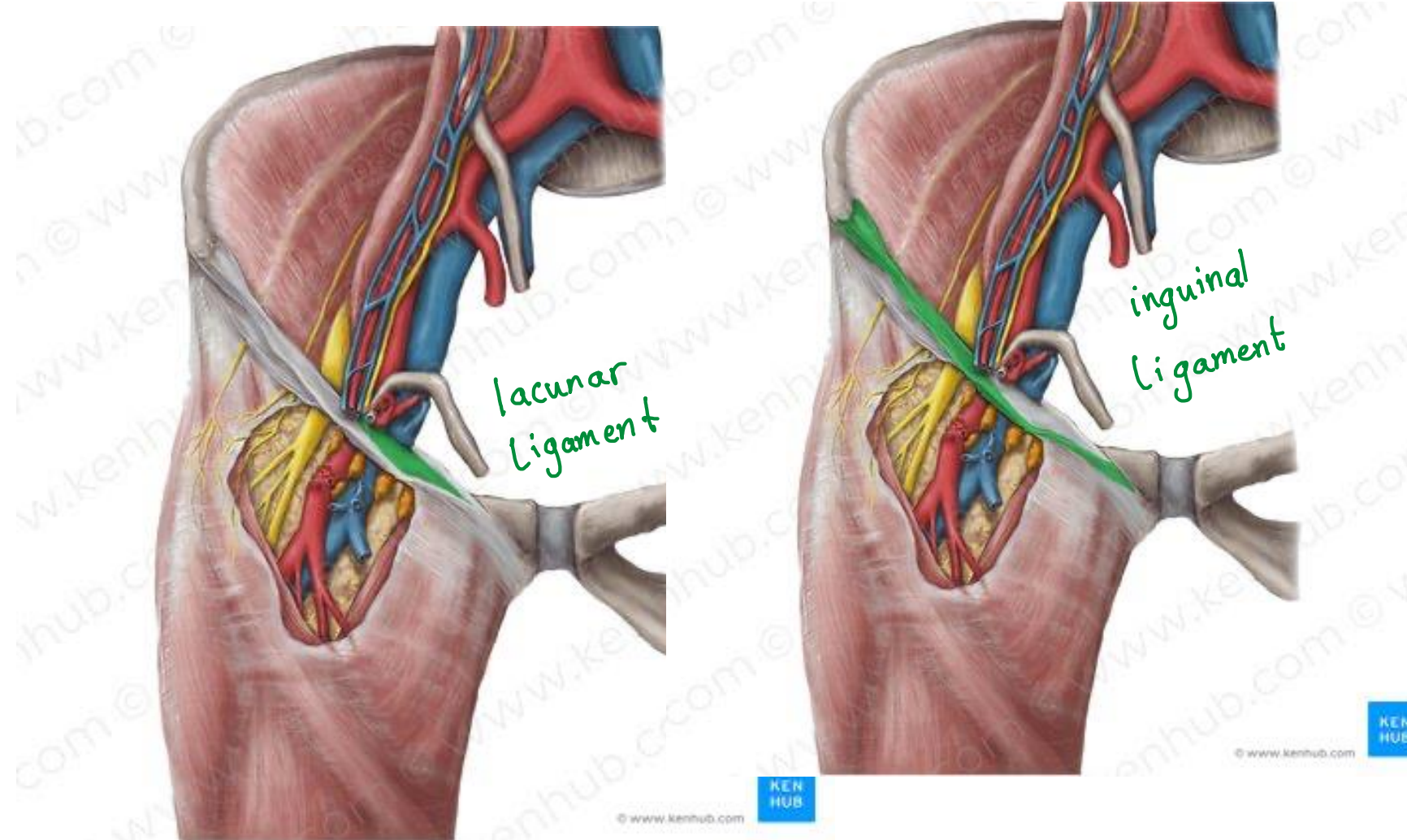
Superior Wall of Inguinal Canal = Roof

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



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

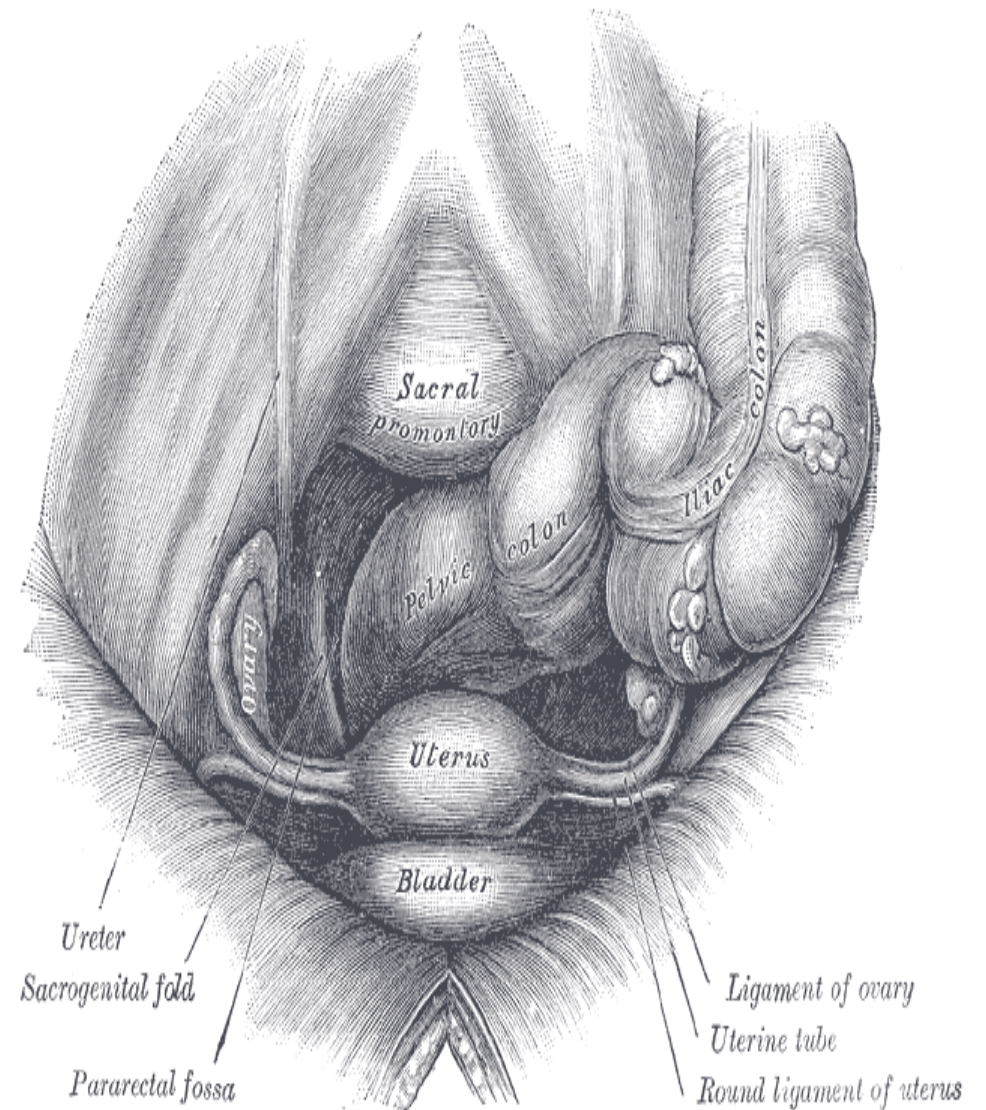


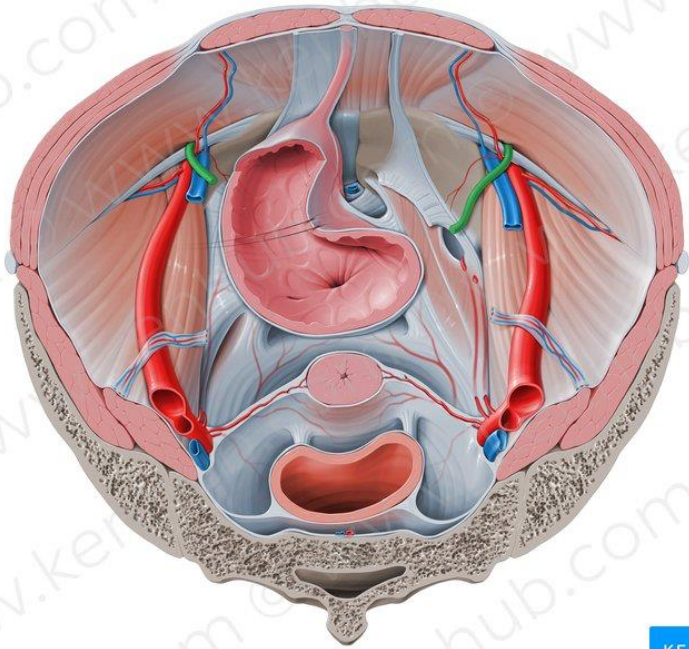
Functions of Inguinal Canal

- 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

Contents of inguinal canal

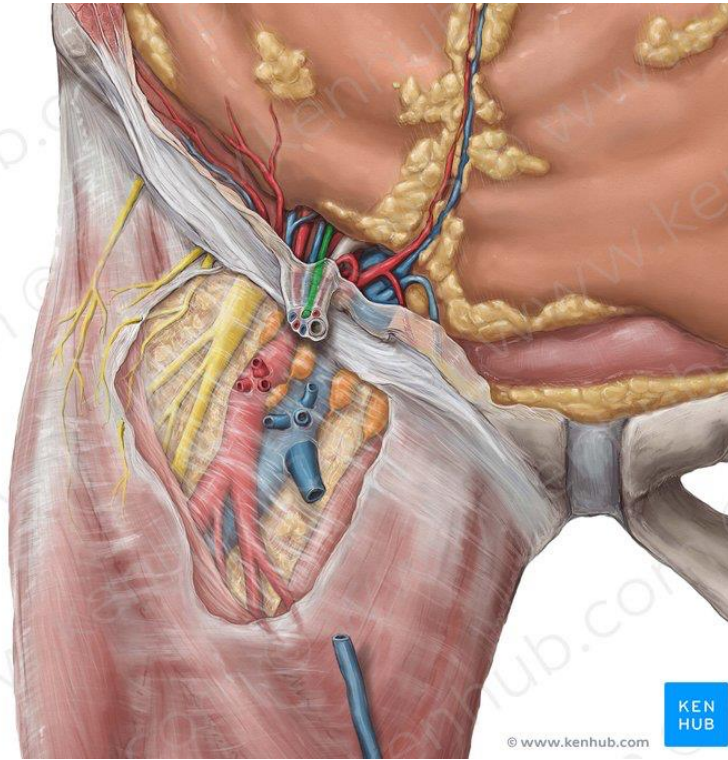
- Spermatic cord & its contents in male
- Round ligament in female
- Genital branch of genitofemoral nerve
- Ilioinguinal nerve: Enter the canal through the posterior wall





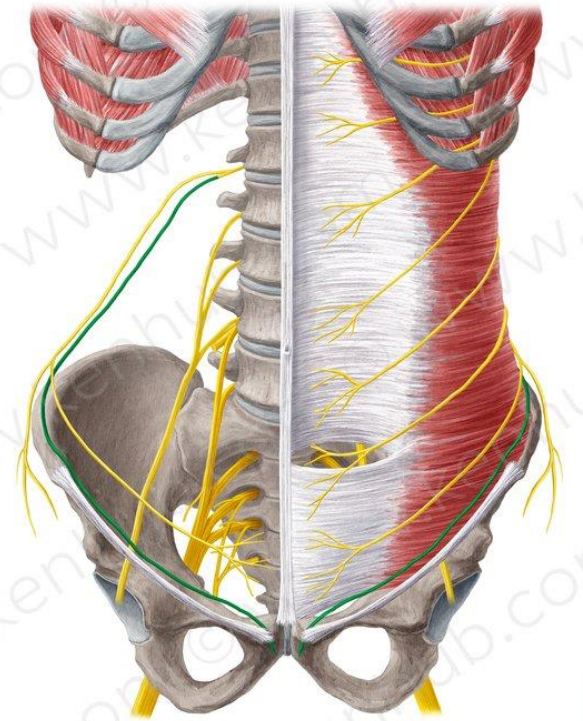
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In females, the round ligament of uterus extends through the inguinal canal to attach to labia majora

In males the inguinal canal contains the spermatic cord with its contents.

In both sexes, genital branch of genitofemoral nerve and ilioinguinal nerve pass through the inguinal canal

Inguinal triangle

- Region of abdominal wall

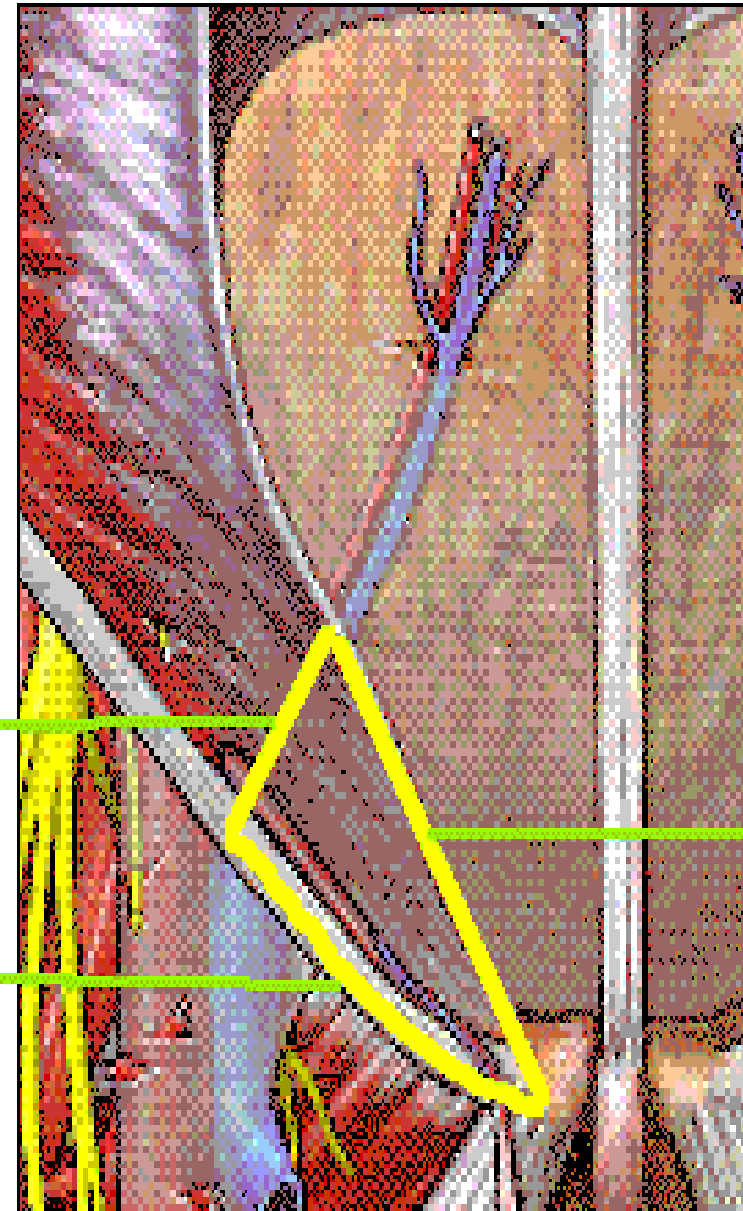
Borders

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

lateral border:
inferior
epigastric vessels

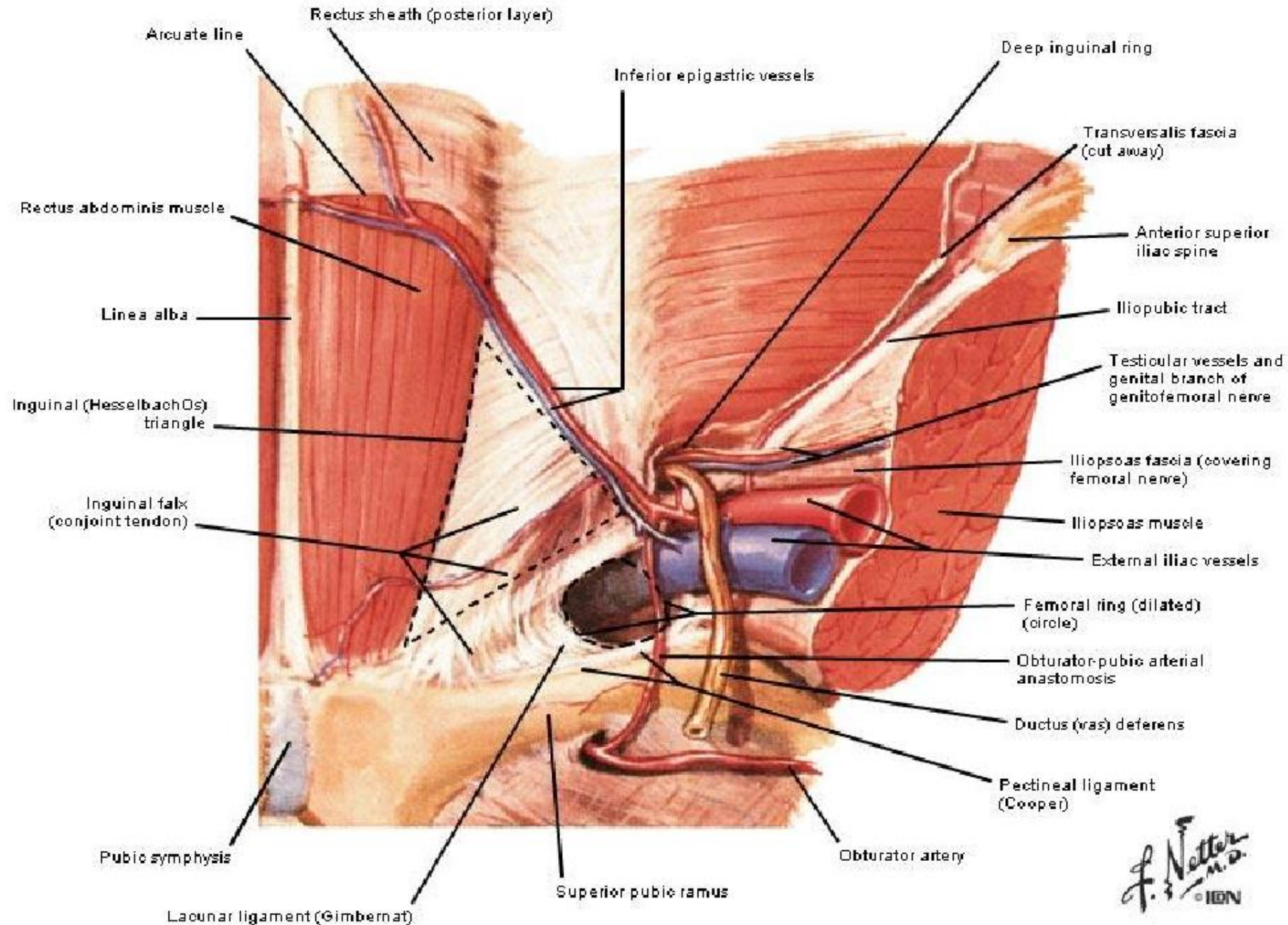
inferior border:
inguinal ligament

medial border:
lateral edge of
rectus abdominis



Inguinal Region

Dissection - Posterior (Internal) View



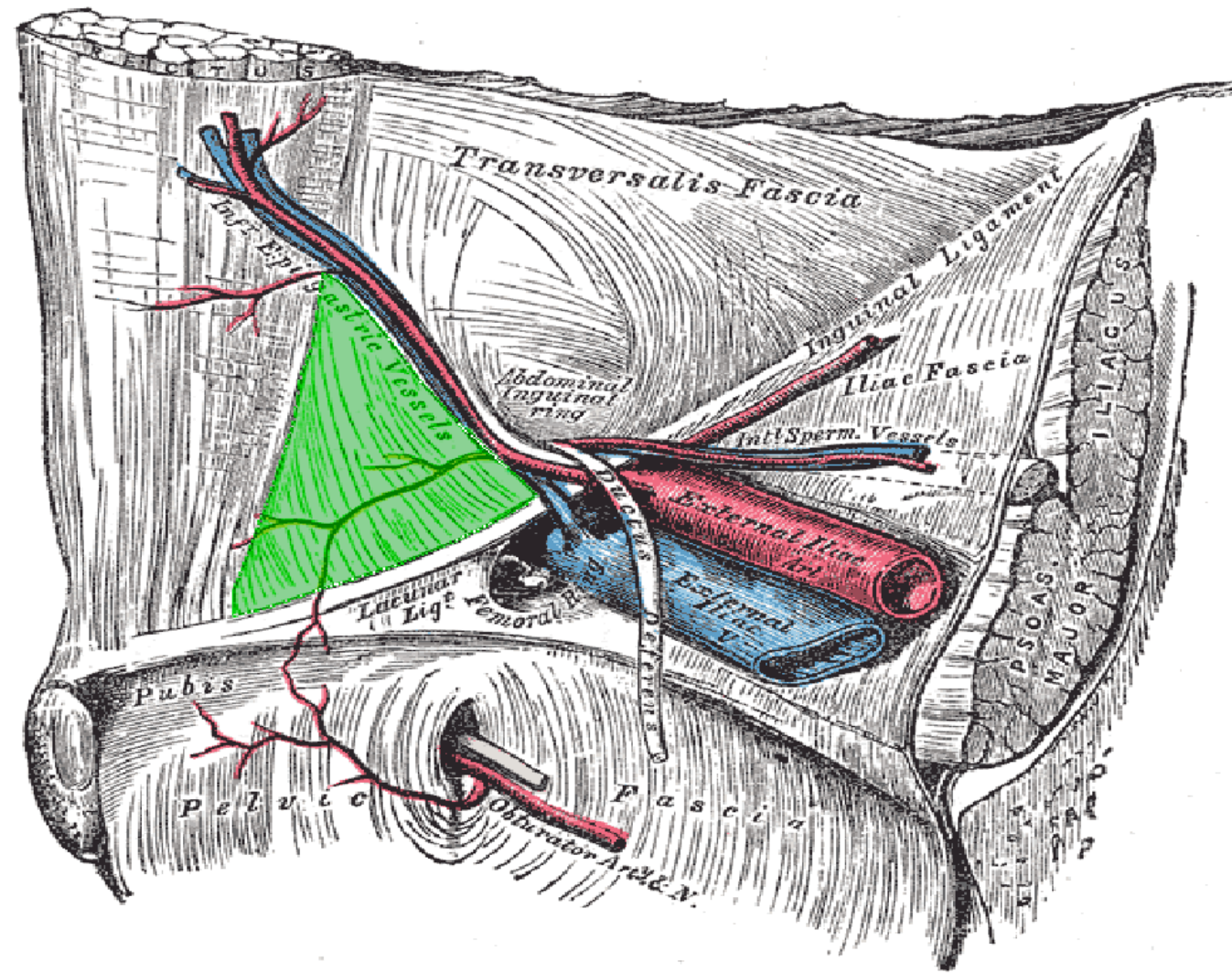
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In old people with chronic cough, an intestinal hernia might bulge through the inguinal triangle because it's a weak point, making a direct inguinal hernia medial to the inferior epigastric artery.

In young people, a hernia in the deep inguinal ring might happen, making an indirect inguinal hernia lateral to the inferior epigastric artery.

So the inferior epigastric artery is an important anatomical landmark to determine the type of inguinal hernia.

More details will be discussed later in this lecture so don't worry.



Spermatic Cord

- 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

Structures of Spermatic Cord

- Vas deferens
- Testicular artery and vein
- Testicular lymph vessels
- Autonomic nerves
- Processus vaginalis
- Cremasteric artery To cremasteric muscle
- Artery of the vas deference
- Genital branch of genitofemoral nerve To cremasteric muscle

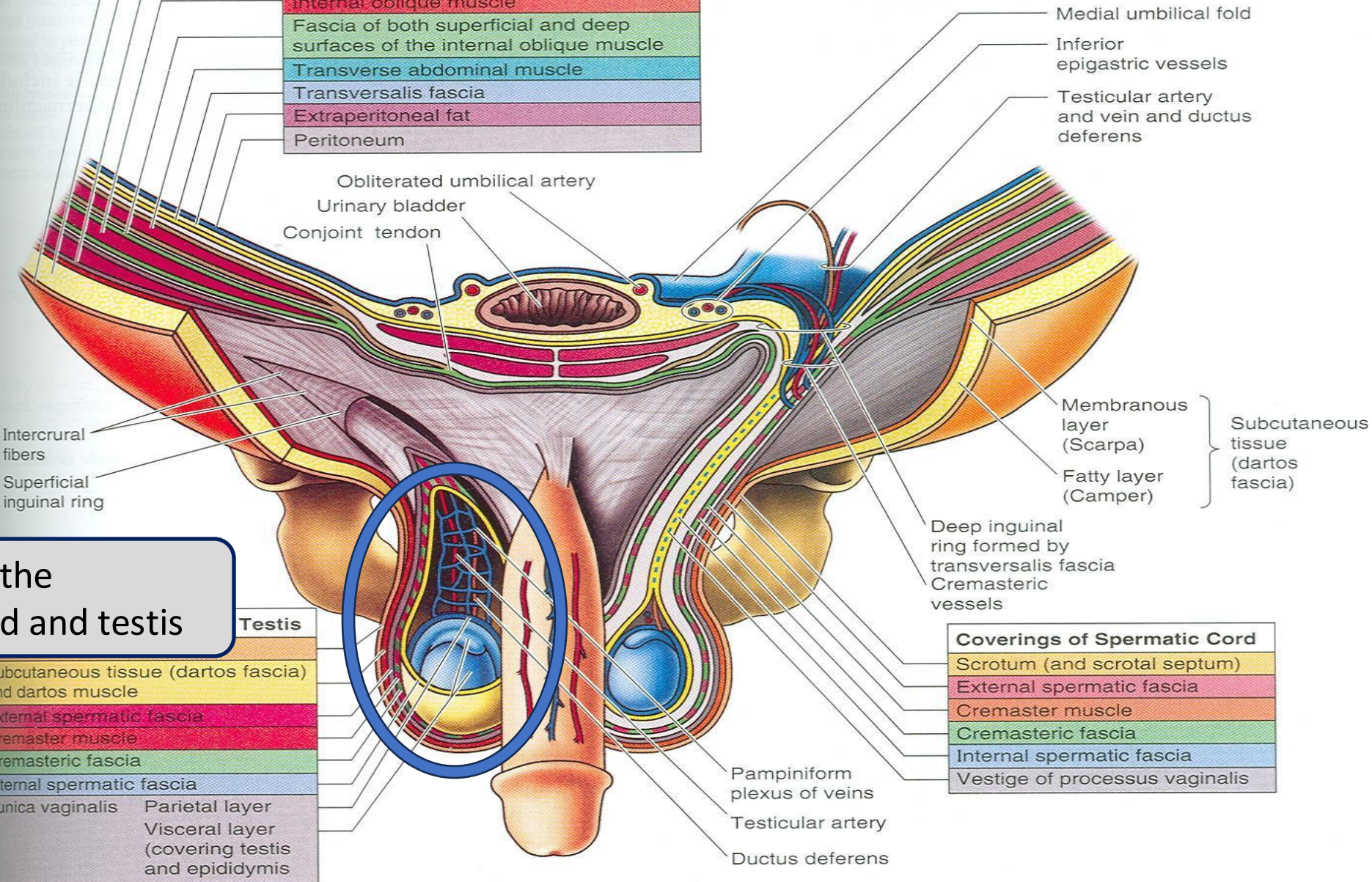
Covering of the Spermatic Cord

- 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

Surrounding the the spermatic cord and testis

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	



Surrounding the spermatic cord and testis

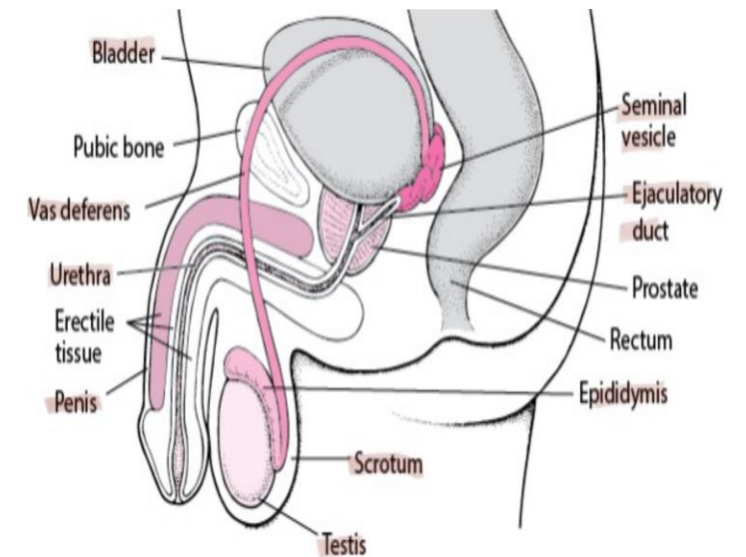
Testis	
Subcutaneous tissue (dartos fascia) and dartos muscle	
External spermatic fascia	
Cremaster muscle	
Cremasteric fascia	
Internal spermatic fascia	
Tunica vaginalis	
Parietal layer	
Visceral layer (covering testis and epididymis)	

Coverings of Spermatic Cord	
Scrotum (and scrotal septum)	
External spermatic fascia	
Cremaster muscle	
Cremasteric fascia	
Internal spermatic fascia	
Vestige of processus vaginalis	

Vas Deferens

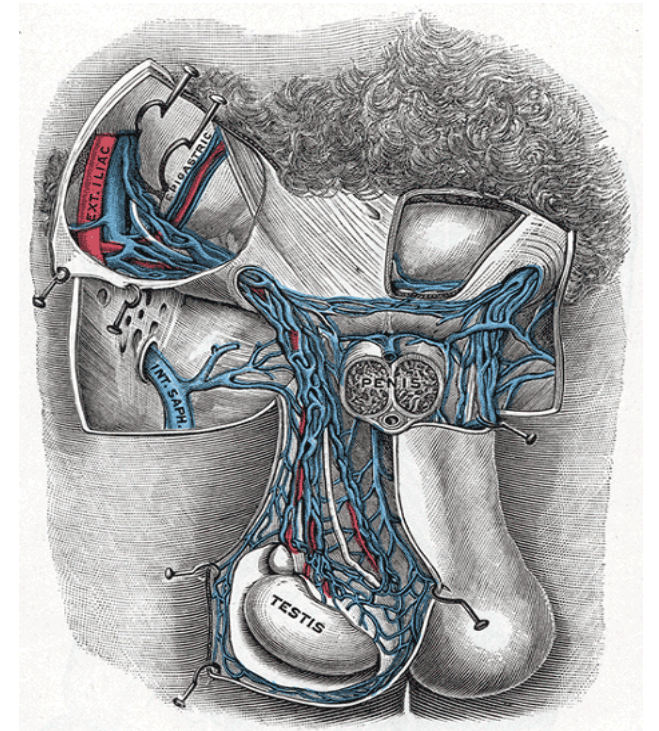
- It is a cord like structure
- Can be palpated between finger and thumb in the upper part of the scrotum
- It is a thick walled muscular duct that transport spermatozoa from the epididymis to the prostatic urethra

It is 45 cm long ,starts from the testis as a continuation of epididymis , ending in the seminal vesicles behind the urinary bladder



Testicular Artery

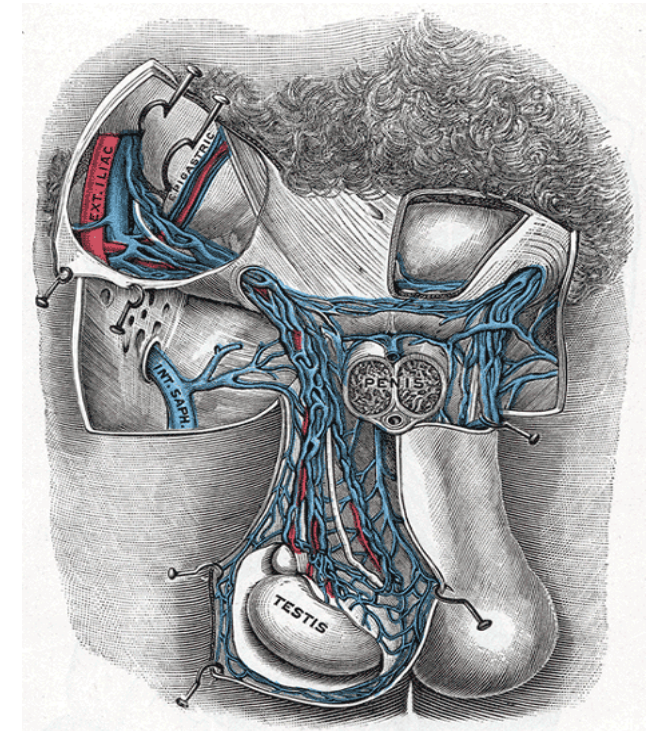
- It is a branch of abdominal aorta at level of L2
- It is long and slender
- Descends on the posterior abdominal wall
- It traverses the inguinal canal and supplies the testis and the epididymis



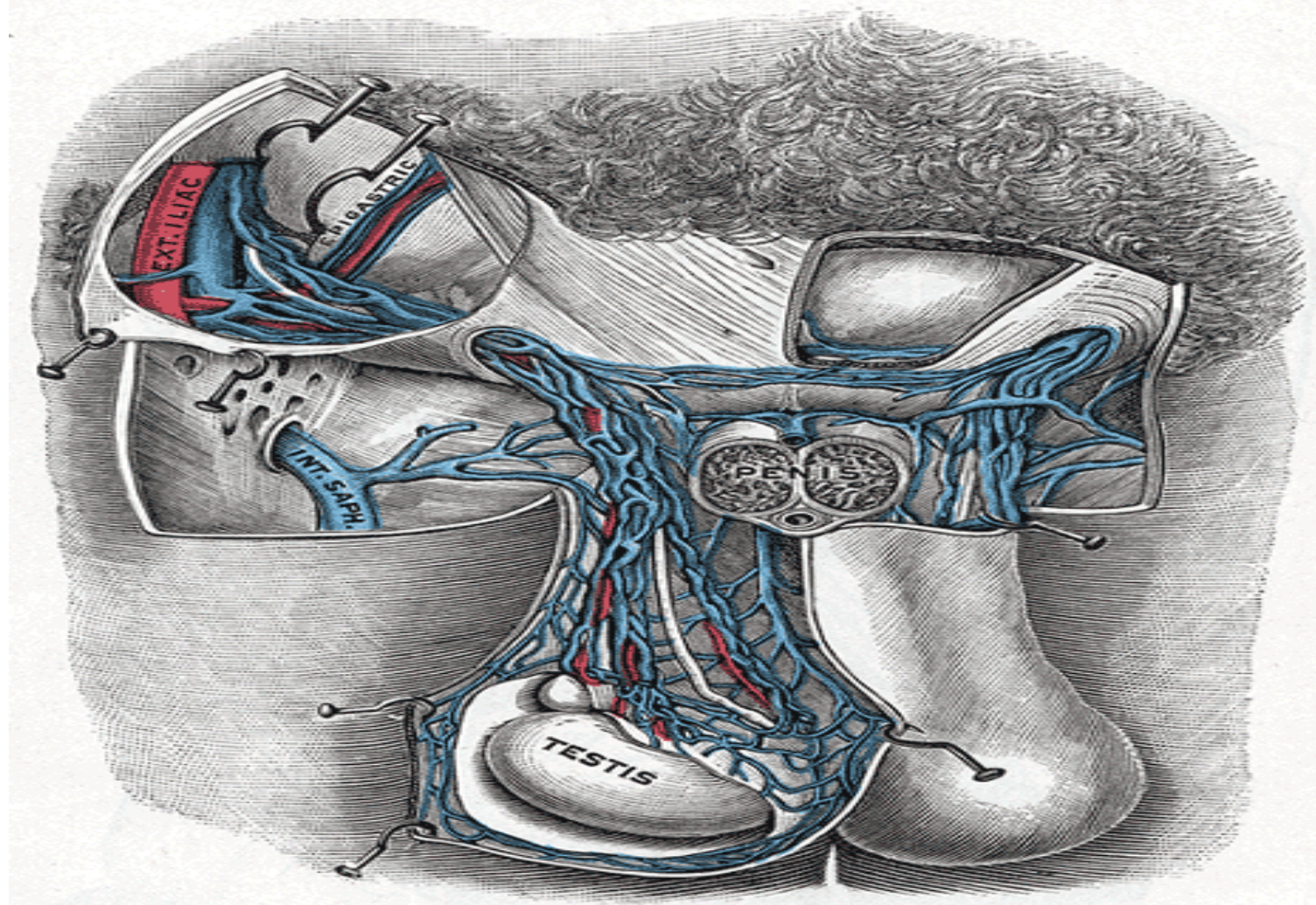
Testicular Veins

- These are the extensive venous plexus, the pampiniform plexus
- Leaves the posterior border of the testis
- As the plexus ascends, it becomes reduced in size so that at about the level of deep inguinal ring, a single testicular vein is formed,
- Drains into left renal vein on left side
- and inferior vena cava on right side

It is formed in the deep ring
In which varicocele (دوالي الخصيه) of the testis
is formed
Slide 47



Testicular artery & vein



Autonomic nerve & Genitofemoral nerve

Sympathetic and parasympathetic

- Autonomic nerves
 - Sympathetic fibers run with testicular artery from renal or aortic sympathetic plexuses
 - Afferent sensory nerve
- Genital branch of the genitofemoral nerve
 - Its root L1& L2
 - Supply the cremastic muscle

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

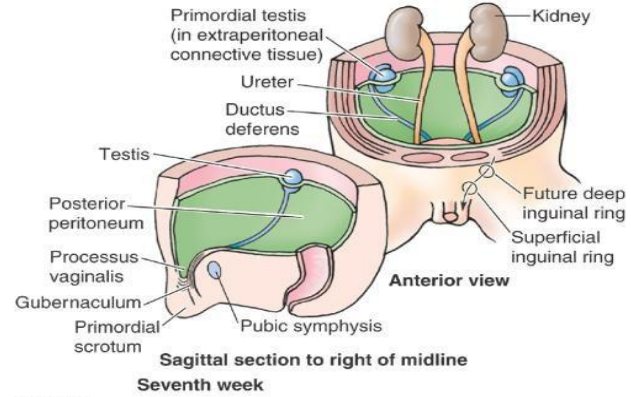
Processus vaginalis

- An out pouching of peritoneum that in the fetus is responsible for the formation of the inguinal canal
- The remains of the processus vaginalis causes the congenital indirect hernia (if it remains opened)

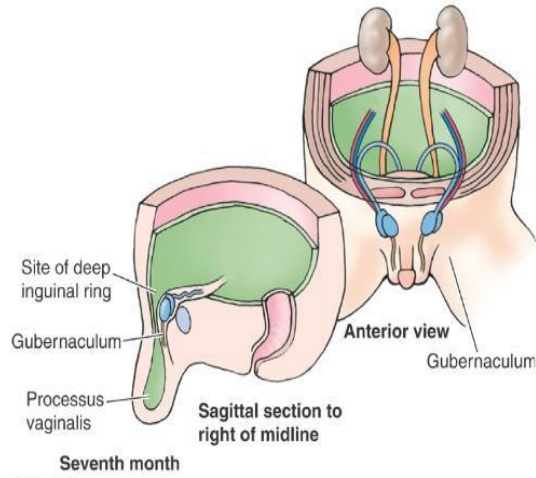
embryology:

Testis and ovaries originally develop in the posterior abdominal wall at the level of L1 in the back. In the 7th month of pregnancy, processus vaginalis along with the gubernaculum are responsible to: pull the testis downwards from L1 in the abdomen to → the deep ring → inguinal canal → superficial ring → Scrotum.

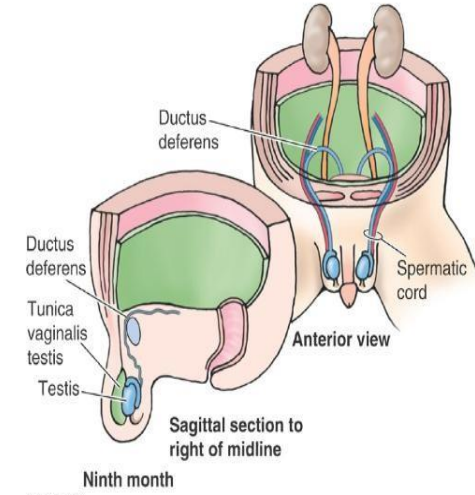
Developing of process vaginalis



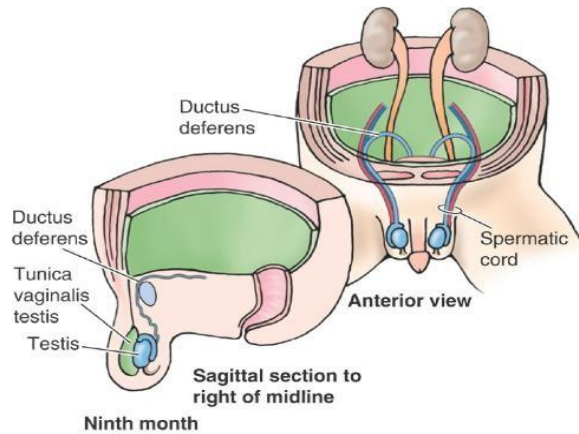
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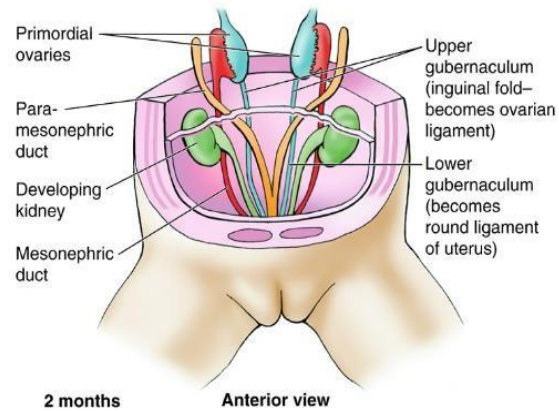
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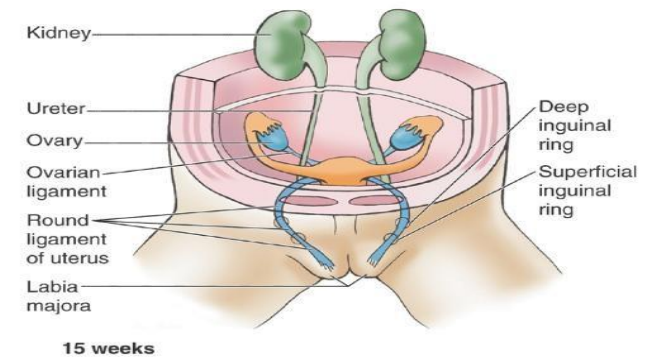
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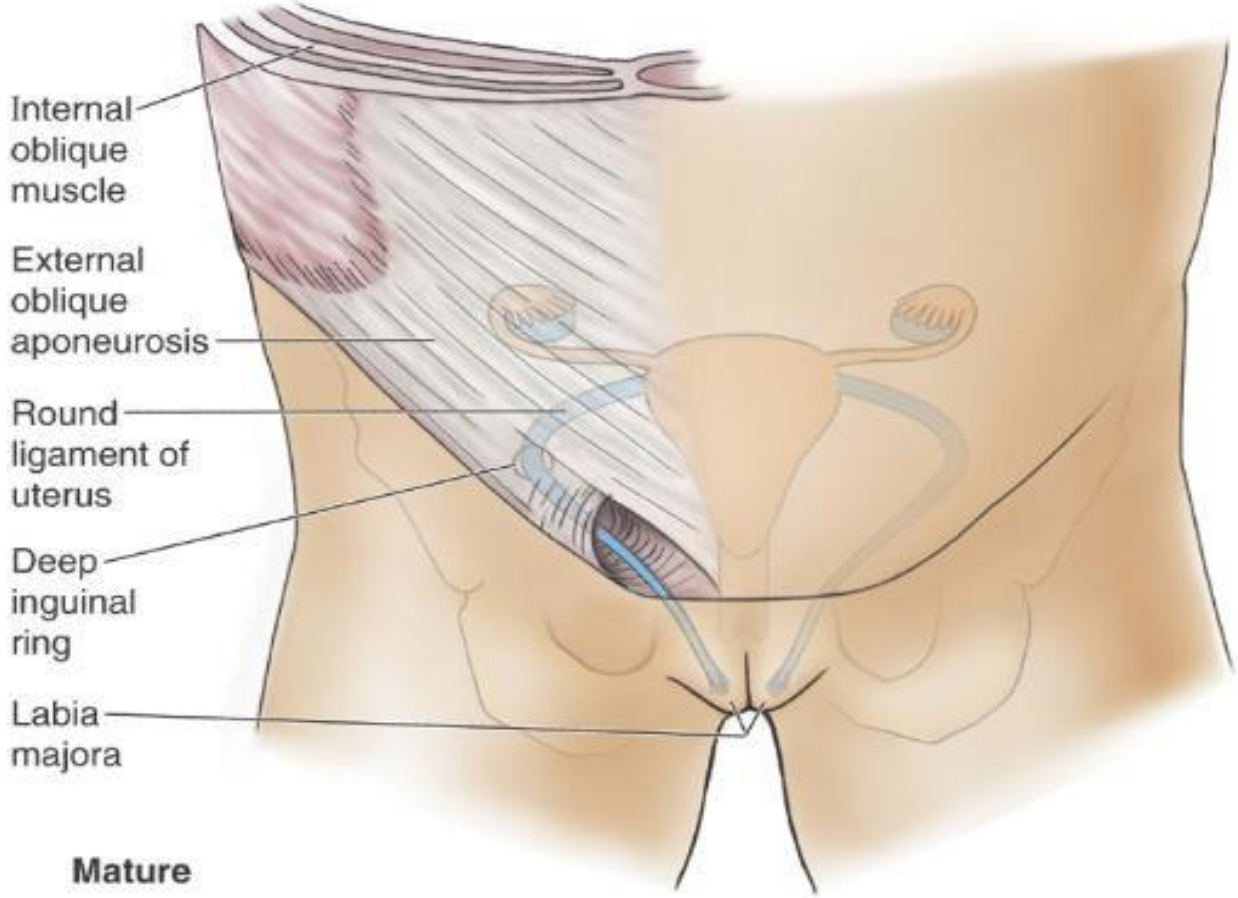


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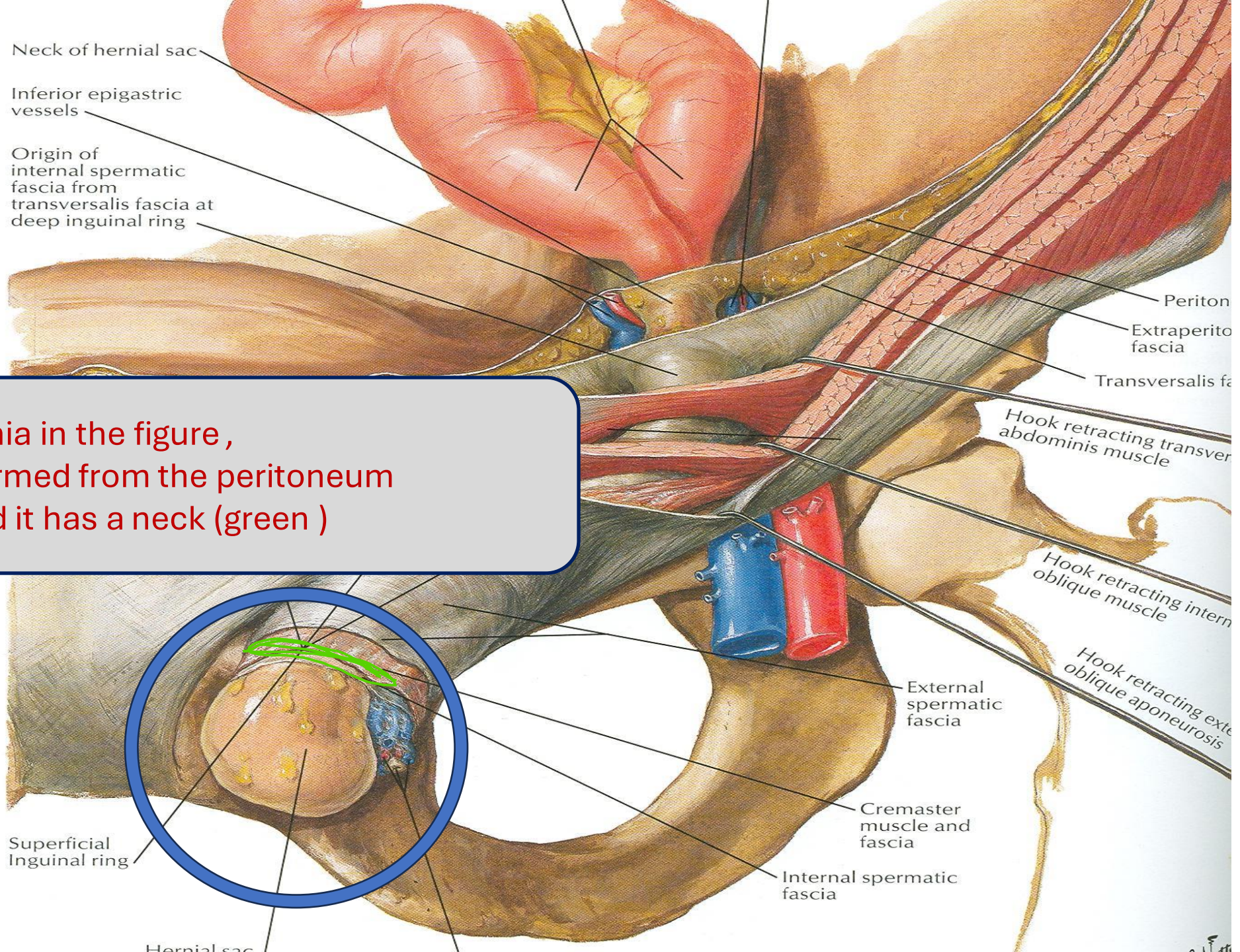
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Developing of process vaginalis.....cont



Inguinal Hernia

- A hernia is the protrusion of part of the abdominal contents beyond the normal confines of the abdominal wall
- 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

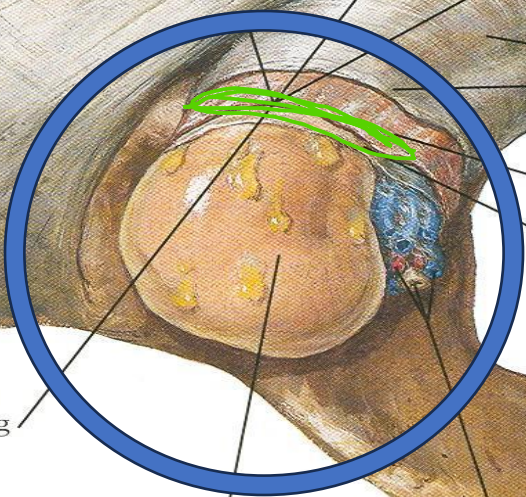


Neck of hernial sac
Inferior epigastric vessels
Origin of internal spermatic fascia from transversalis fascia at deep inguinal ring

Periton
Extraperito
fascia
Transversalis fa
Hook retracting transver
abdominis muscle
Hook retracting intern
oblique muscle
Hook retracting exte
oblique aponeurosis

External spermatic fascia
Cremaster muscle and fascia
Internal spermatic fascia

Superficial Inguinal ring



Hernial sac

Check the hernia in the figure,
It has a sac formed from the peritoneum
membrane And it has a neck (green)

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) No obliteration(
- 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

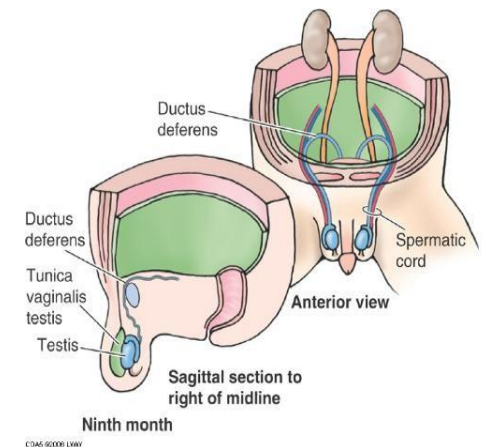
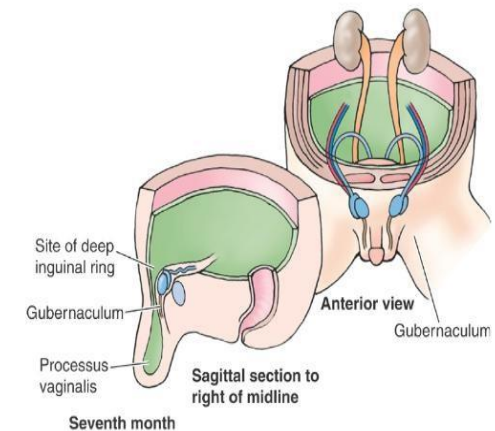
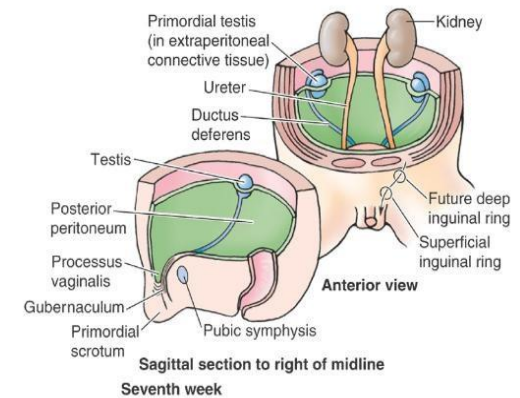
RECALL Processus vaginalis:

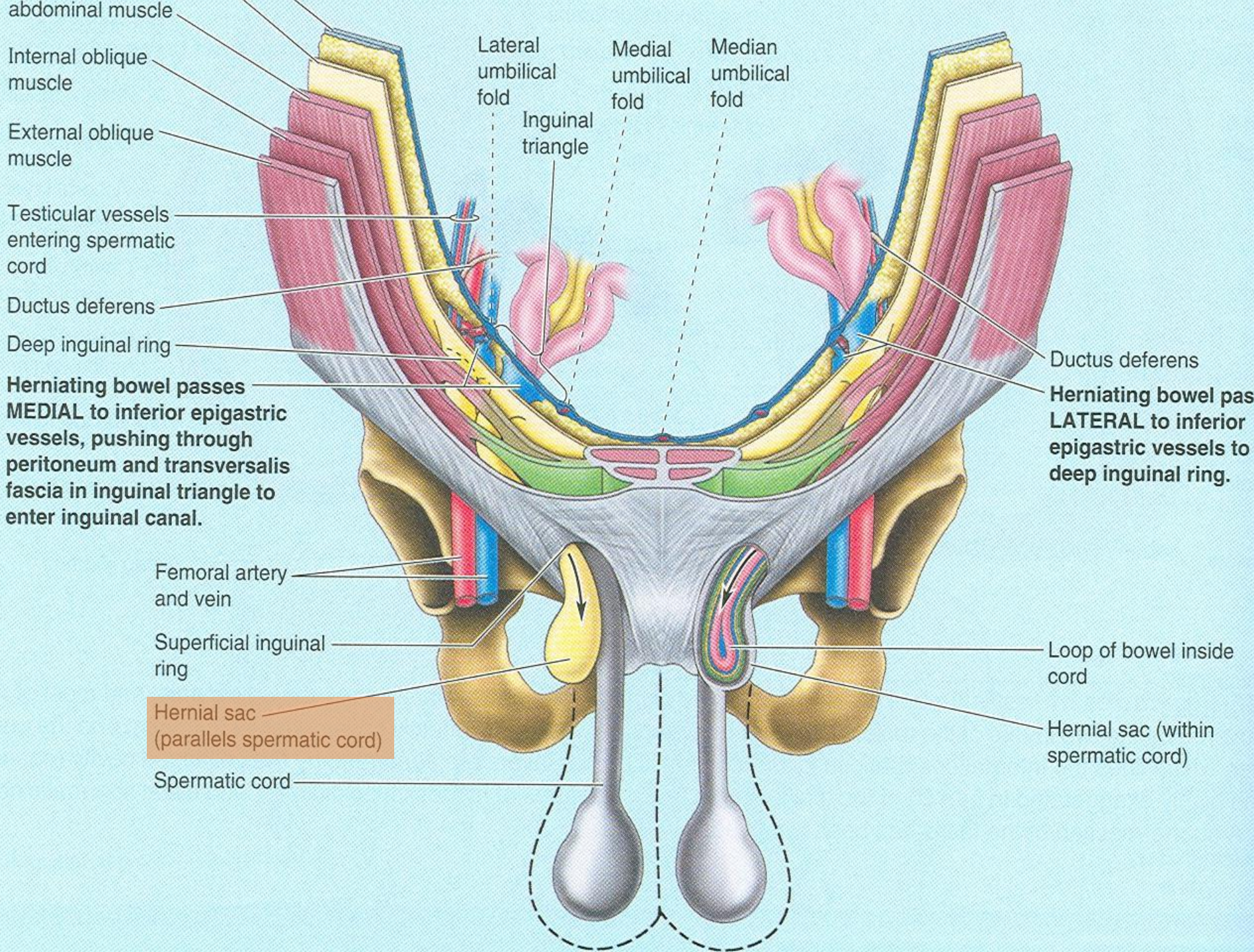
The processus takes the form of canal, after the birth it gets "obliteration" which includes closure of the deep ring and processus fibrosis.,

If deep ring fails to close after birth it causes congenital indirect hernia .

When the abdominal pressure increased due to coughing or constipation the deep ring opens causing indirect hernia of small intestine or greater omentum which enters the deep ring --> along the canal --< through superficial inguinal ring --> reaching the scrotum

Treated surgically replacing the hernia and closing the deep ring .





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

It is NOT related to the inguinal canal
However it is related to the inguinal triangle
- 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
<u>Superficial</u> inguinal ring <u>test</u>	Feel impulse on the side finger	Feel an impulse on the tip of the finger
<u>Deep</u> ring <u>test</u> 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, superficial fascia, Ex.sp.fascia, cremastic muscle & fascia, Int.spermatic fascia,

Reduction = How to get the hernia back to the abdomen

DEEP RING TEST

If the hernia occurred again by coughing → this indicates that hernia originates from another opening and the pressure you exerted on Deep ring is useless → Direct hernia.

∅ If patient coughs and Hernia doesn't appear → Indirect hernia.

SUPERFICIAL RING TEST

It depends on the direction of the reduction

you reduce the Direct hernia backward toward the superficial inguinal ring you will feel the pulse of the inferior epigastric artery at the lateral side of your index.

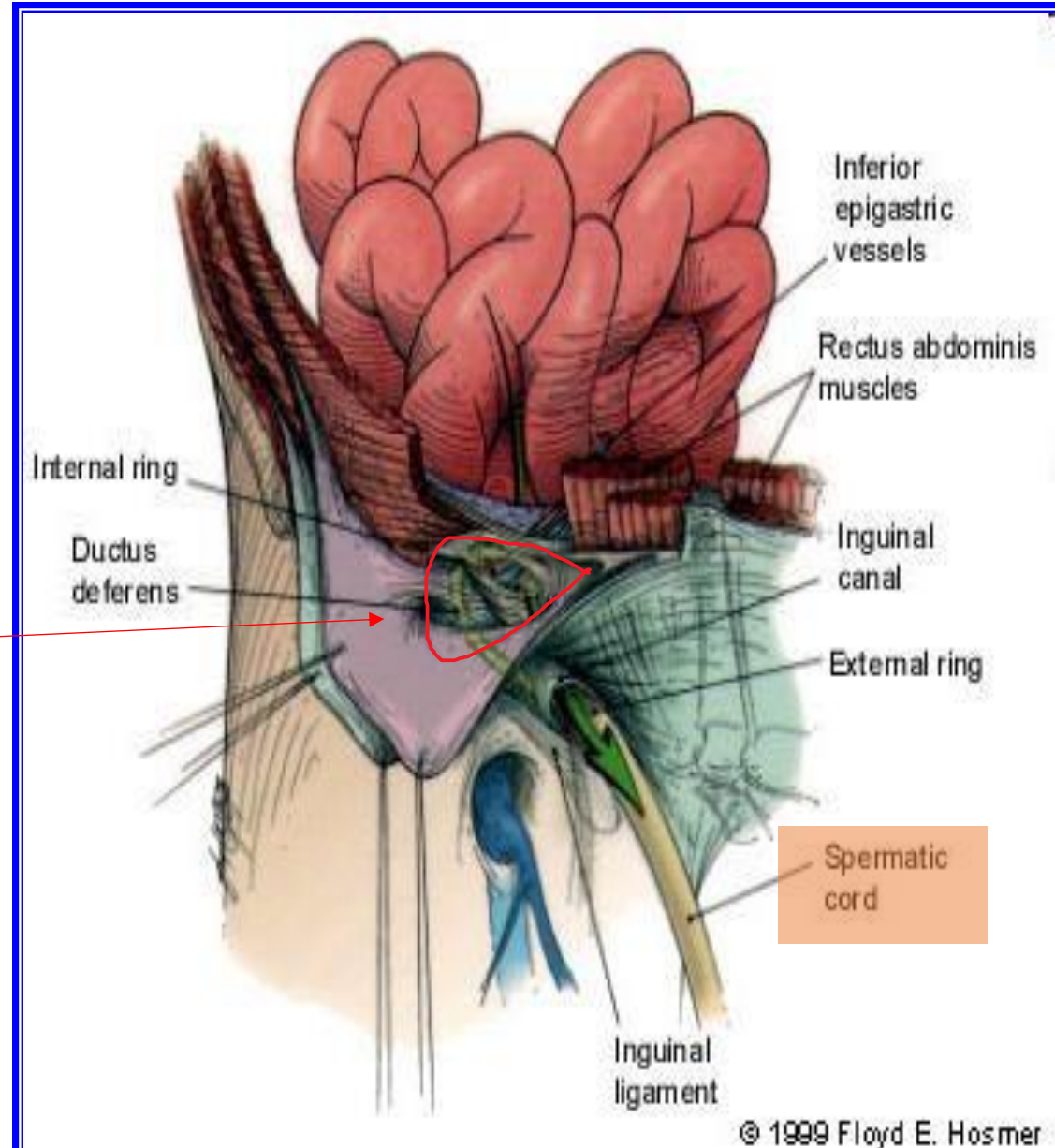
But when you reduce the Indirect hernia upwards and laterally you will feel the pulse at the tip of your index..

Direct Hernia Route

Note:

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

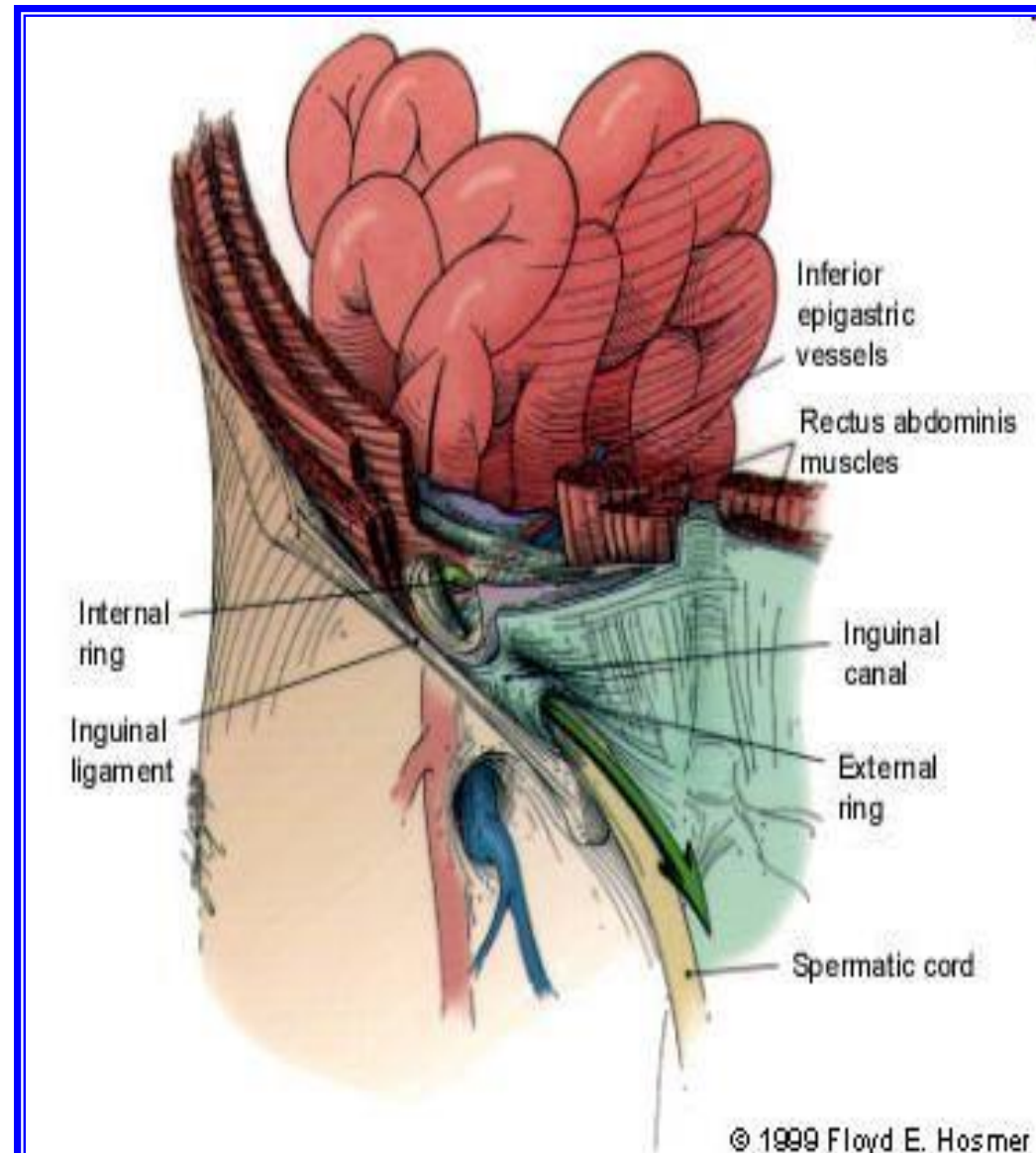
Inguinal triangle



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.

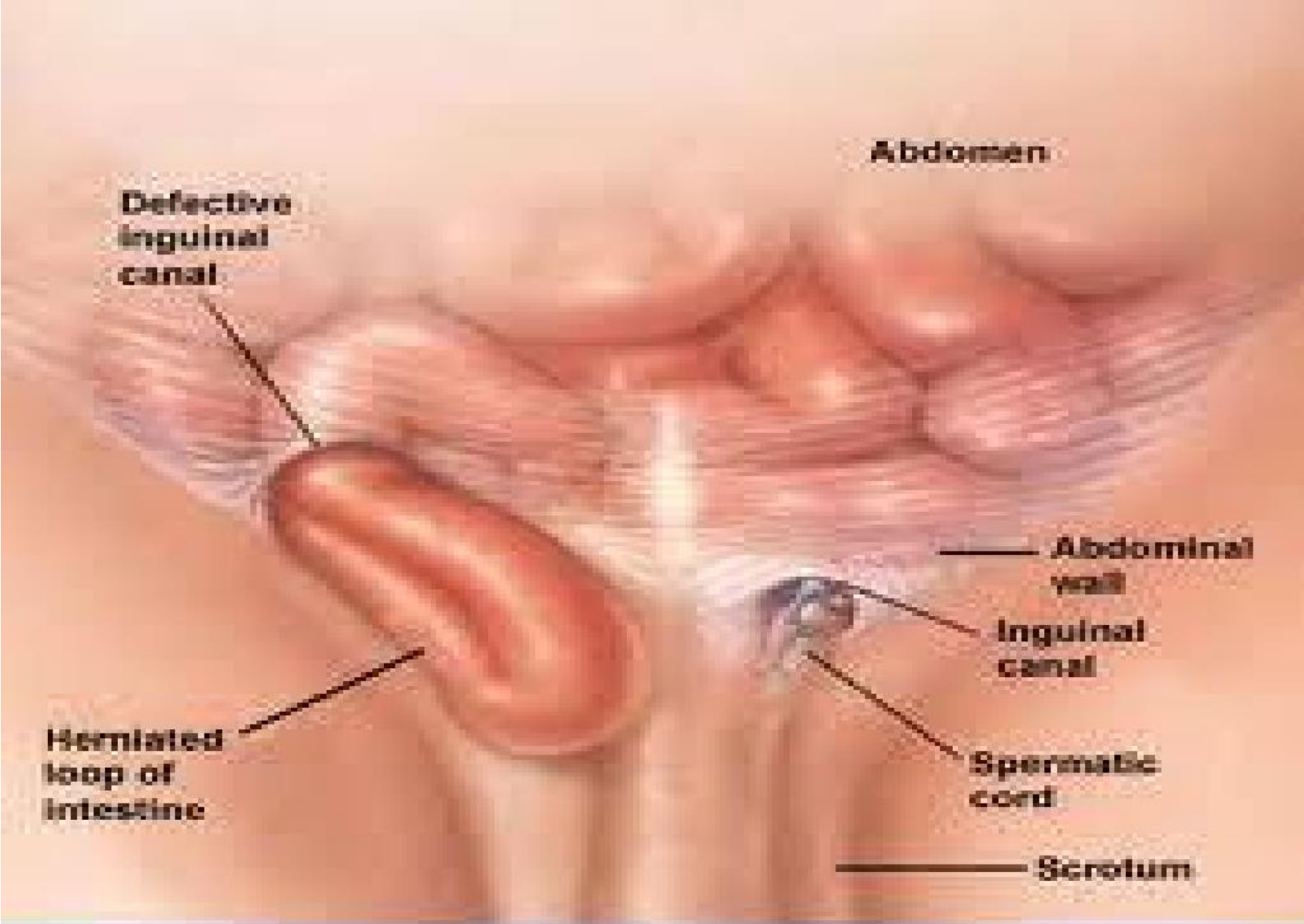


Indirect hernia

Where the reaches the scrotum

As you can see the scrotum expanded





Clinical Notes

***Clinical conditions involving the scrotum
and testes***

Varicocele:

-The veins of the pampiniform plexus elongated & dilated

- Lt side more common → venous pressure is higher
- Common in young & adult

- Vasectomy → Infertility

- Processus vaginalis

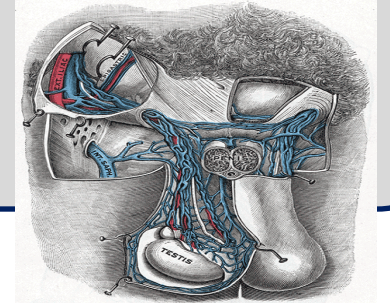
Upper part → obliterated just before birth

Lower part → Tunica vaginalis

Congenital anomalies of processus vaginalis

- 1 persist → indirect inguinal hernia
- 2 Narrowed → congenital hydrocele
- 3 Obliterated upper & lower part → encysted hydrocele of the cord

Varicocele causes infertility because the blood ingestion raises the temp killing the sperms this can be treated by surgery and things go back to normal



Vasectomy = ligation of vas deferens by surgery in which sperm doesn't pass through the vas

Processus vaginalis = fibrous tissue around testis Where hydrocele could happen around it

Abnormality in testis & scrotum.....cont

Hydrocele

- Accumulation of fluid within the tunica vaginalis of the testis

- **Causes**

1 Inflammatory

2 idiopathic

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

Congenital anomalies of the testes

What is the difference between cryptorchidism and maldescent ?

Cryptorchidism

- Incomplete descent of testis although traveling down *normal pathway*
- It may be found in
 - 1 Abdominal cavity
 - 2 In inguinal canal
 - 3 At superficial inguinal ring
 - 4 In upper part of scrotum

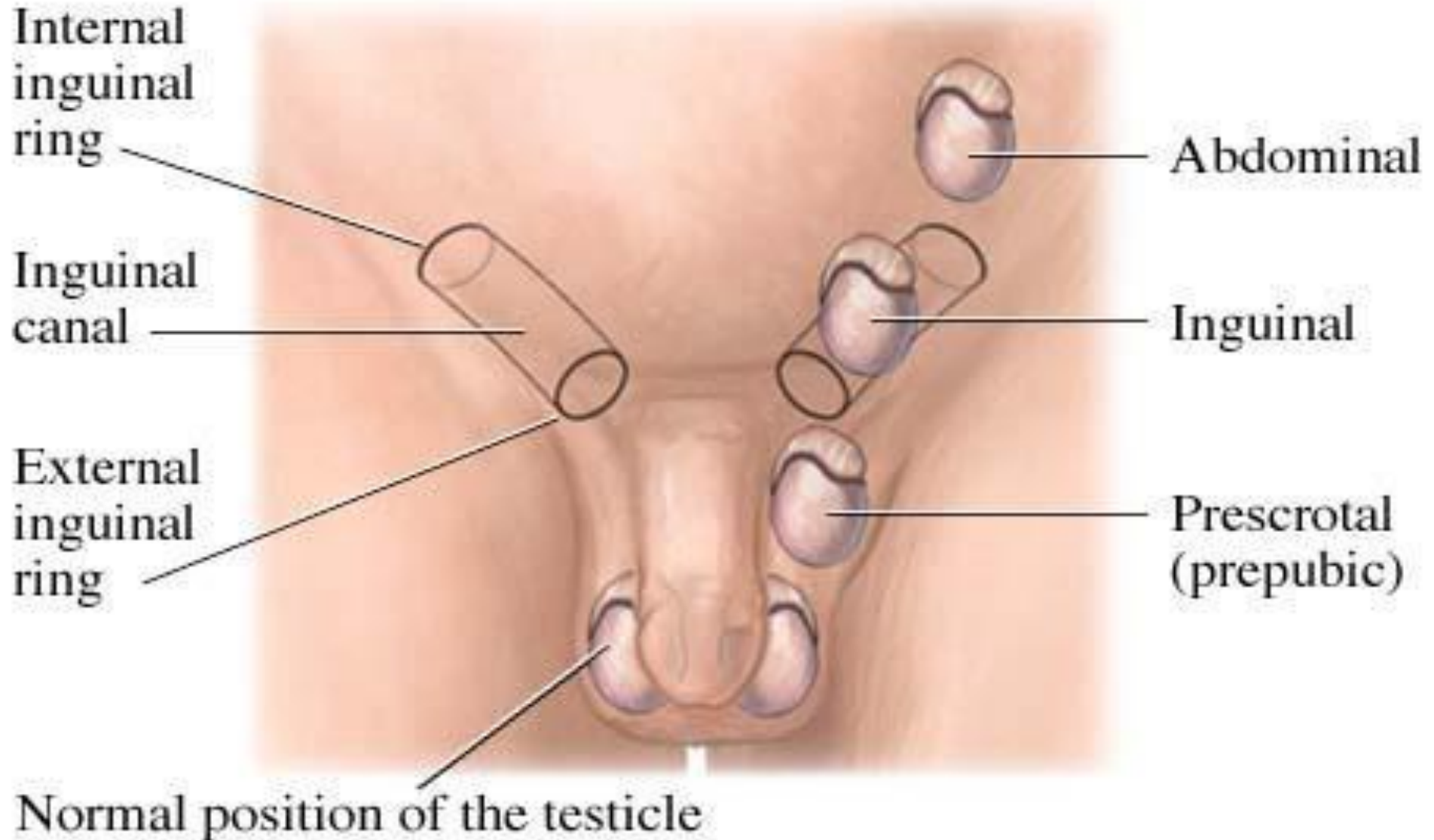
Maldescent

- Testes travel down an *abnormal pathway*
 - 1 Superficial fascia
 - 2 Root of penis
 - 3 Perineum
 - 4 In the thigh

In both of them the patient / child should be treated as soon as possible; If the testis remains in an abnormal position beyond 6 years, this will impair the production of testosterone and sperm.

If testis remain in the abnormal site , they could transform into malignant tumour or dead tissue

Cryptorchidism



PAST PAPERS:

Wrong about indirect hernia:

- a. sac from superficial inguinal ring will be below and lateral to pubic tubercle.
- b. It is 20 times more common in young males than females.

Wrong about spermatic cord:

- a. inner spermatic fascia is from internal oblique.
- b. External Spermatic fascia is derived from the external oblique aponeurosis.

Wrong about direct hernia:

- a. bulges from superficial inguinal ring.
- b. medial to inferior epigastric artery.

What is the type of hernia that exits from this triangle (inguinal triangle):

- a. indirect inguinal hernia.
- b. direct inguinal hernia
- c. hiatal hernia.

Direct inguinal hernia, all are correct except:

- a. hernial sac lies medial to the inferior epigastric artery.
- b. common in the old.
- c. usually bilateral.
- d. the hernial sac never reaches the scrotum.
- e. in superficial inguinal ring test, you feel impulse on the tip of your index.

About indirect inguinal hernia , which is wrong :

- a. Commonly unilateral.
- b. Common in young.
- c. Hernial sac is found lateral to inferior epigastric artery.
- d. Caused by injury to ilioinguinal nerve.

An injury to the ilio-inguinal nerve, might be associated with one of these types of hernia:

- a. direct hernia.
- b. indirect hernia.
- c. lumbar hernia.
- d. internal hernia.
- e. incisional hernia.

A,A,A,B,E,D,B

Thank you